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Mills of Grain in Ptolemaic and Roman Egypt

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Abstract

For the Egyptians, bread was and still one of the most important foods. It is consumed daily. As a result, the ancient Egyptians in later periods were preoccupied with producing bread through a number of processes. One of these steps is the grinding, in order to turn grain into flour needed to make bread. Grain grinding, or milling, was a significant task that was done in almost every ancient Egyptian home. The grinding of grain was done through mills or millstones that evolved from era to era. Hence, this paper sheds light on mills used in grinding grains in Ptolemaic and Roman Egypt. It includes various mill kinds and who owns them. It also takes into account the kinds of grains that mills grind as well as mill leases. After that, it looks at the archeological evidence for mills in Ptolemaic and Roman Egypt. The researchers will depend on literary and non-literary texts in addition to archaeological evidence in Egypt during the Ptolemaic and Roman Period. Historical and analytical study will be used to examine documents in addition to descriptive study for the archaeological evidences of mills. The results reveal that mills of grain played an important role in the daily life of Graeco-Roman Egypt; they were used for producing flour. Different types of mills especially the Theban mills were used. Ownership of mills varied from individual households to temples and government-affiliated mills in cities.

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1. Introduction

Bread was and still one of the most important foods for the Egyptians. It is eaten every day. Thus, the ancient Egyptians, in successive eras, were concerned with providing bread through several steps. One of these steps is the grinding, in order to turn grain into flour needed to make bread. Grain grinding, or milling, was a significant task that was done in almost every ancient Egyptian home. The grinding of grain was done through mills or millstones that evolved from era to era. Hence, the main aim of this paper is highlighting milling and mills of grain in Ptolemaic and Roman Egypt. It sheds light on various mill kinds and who owns them. It explains the evolution of mills from ancient Egypt till the Roman Period. It also takes into account the kinds of grains that mills grind as well as mill leases. After that, it explores the archeological evidence for mills in Ptolemaic and Roman Egypt.

Some scholars have dealt with the topic of milling and mills in different eras either in Egypt or outside of Egypt. Moritz¹ discussed generally different types of mills of grains in classical antiquity. Stones used in manufacturing mills were discussed by Harrell.² In his thesis, Gendy³ discussed the economic aspects of homes in the Roman period in Egypt and referred in his study to a type of mill that was present in homes as one of the economic components that were found in homes in the Roman Egypt.

This study depends on papyri and Ostracas date back to the period of study. It also depends on some archaeological remains and pictorial sources. To achieve the objectives of the study, the researcher will use historical and analytical mythology to examine documents in addition to descriptive study for the archaeological evidences of mills.

Since ancient times, Egypt has been well-known for producing an abundance of barley, corn and wheat. These grains were utilized by the Egyptians to make flour and bread. Making bread was without a doubt the most essential human need. Therefore, in order to create bread, bakeries and mills had to be present.⁴

The Roman historian Pliny (1st century AD) mentioned the types of grains cultivated in Egypt. He stated that the constant temperature and established agricultural habits are among the conditions that help in the abundance of wheat production in Egypt, and that the plains of Egypt produce a hundred times the amount of seeds grown in cultivated land. He stated that a measure of white wheat of Alexandria produces twenty pounds of bread, and if mixed with wheat of Cyprus, it produces twenty-five pounds. In addition, the wheat in Egypt is used to produce a type of soft food for children and the sick. Wheat was also mentioned alongside with corn.⁵

Additionally, he talked about barley, stating that Egyptian barley is ranked third globally. The Egyptians succeeded in boiling it to extract a medication they named athera, which is excellent for babies and can also be used as a liniment by adults.⁶

Furthermore, given that barley is a third kind of wheat, it was said that the barley flour produced in Egypt was known as (*it*) ancient Egyptian language and "olyra" in the ancient sources. It was also mentioned that the second most common

¹ Moritz 1958.

² Harrell 2012

³ Gendy 1990

⁴ Samuel 1997, 579.

⁵ Pliny, Natural History XVII. 15, 31; XVIII. 67-68, 76, 81, 95, 170.

⁶ Pliny, NH, XVIII. 81, 63; XXII. 121

variety in Egypt is starch, or amyllum.⁷ Pliny also mentioned that lotometra was a product of Egyptian shepherds, who kneaded fenugreek primarily with milk or water. It is stated that there is no bread lighter or healthier than this one.⁸

For the Egyptians, bread was one of the most important foods. Every day, the food was simple. As a result, the ancient Egyptians were interested in producing bread that required multiple phases of preparation in later times. Grain grinding, which produces the flour needed to create bread, is one of these processes (fig.1). An important duty carried out in nearly every ancient Egyptian home was grain milling. Grain was ground using mills, sometimes known as millstones, which changed over time.⁹



Fig.1: Steps of sieving and milling the grains, Drawing of the relief from the Tomb of Eurysaces¹⁰ (After, Cardon, 2022, 107).

A large group of craftsmen worked in grinding grains and making bread. These included the miller who was known in ancient Egyptian Language as *ndy* or *nd*¹¹ and in the Greek Language as *μυλωνικου* (*molwnikon*). The millers grind various grains in the mill.¹² The yeast maker who makes the yeast needed for the bread; bakers, and there were different groups of them, including the baker of fine bread, and the baker of cakes. This paper will deal with the mills used in grinding grains during the Ptolemaic and Roman Period.

⁷ Pliny, *NH*, XVIII. 62, 77.

⁸ Pliny, *NH*, XVII. 56.

⁹ Lang 2016, 279-289.

¹⁰ This tomb belongs to a baker called Marcus Vergilius Eurysaces,. It was built apparently about the end of the republic (approximately 50-20 BC). It is one of best preserved and largest funerary monuments dedicated to a freedman in Rome. For more information look: Petersen, L. H. (2003). The baker, his tomb, his wife, and her breadbasket: the monument of Eurysaces in Rome. *The Art Bulletin*, 85(2), 230-257.

¹¹ *Wb*. II: 370 (14).

¹² *P. Mert.* II, 73.13; *P. Oxy.* XII. 1446, 1.54; *P. Lond.* II. 335.7; *P. Mich.* XI. 620. IV, Recto 85-6.

2. Mills of Grain

Any grinding stone used in a hand, animal, or water-driven mill is referred to as a "millstone." The term "quern" describes a small, manually operated mill with a diameter of less than 45 cm that is typically cylindrical in shape. While the quern is used for smaller amounts of grain, the millstones are utilized for bigger amounts.¹³ The grinding mills found within the homes were referred to by the excavators using a variety of colloquial titles, including grindstone, lower grindstone, stone grinder, grinding stone, and grinding mill. Excavators in Ptolemaic and Roman Egypt spoke about four or five different kinds of grindstone that were ground by hand. Among these were mills, saddle-querns (upper and lower stones), pestles and mortars.¹⁴

3. Mill Types and their Evolution

As for the mills that were used in grinding grains (wheat - barley) to produce flour and control the fineness of the processed grain from very fine flour to crushed grain. It is certain that some developments occurred in grinding stones throughout time.

3.1 Mortar and Pestle

Mortars were used for grinding the grains from the dynastic period till the Graeco-Roman period. The millers used the mortar to grind small quantities. It was called in ancient Egyptian language *bnwt*. During the Ptolemaic period, it was called in Greek language as ὄλμος and ὄλμος¹⁵ while in Roman period was called *κοπτούρα*.¹⁶ Mortars were described as stones found on the floor with holes inside them. As for the wooden pestle that was attached to the mortar, it was a heavy tool with a rounded end used to grind grain usually in a mortar (figs. 2, 3, 4, 5). It was used manually, and its length ranged from half a meter and a meter.¹⁷ It was made of tree wood, so it was heavy. It was called Πέρος and Κόπανος in Ptolemaic and Roman sources.¹⁸ This mill or mortar was often ineffective in larger quantities.¹⁹

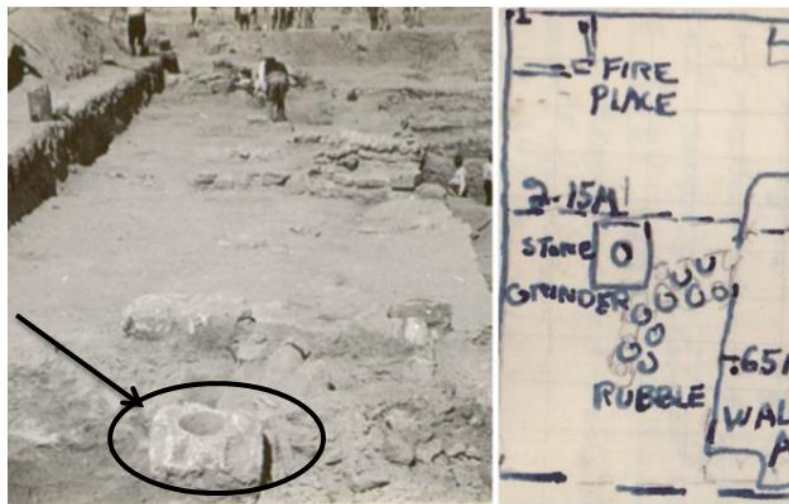


Fig.2: Mortar on with hole in the middle paced on the floor, village of Gordion, Hellenistic Period, approximately 189 BC (after Wells, 2012, fig. 132, p. 224)

¹³ Williams-Thorpe, 1988, 15, 255.

¹⁴ Wells 2012, 222, 223.

¹⁵ Liddell&Scott, SV. "ὄλμος

¹⁶ SB. XVI,12375 (=CPS.II,130); P. Mich. X, 586; P.Ryl. II.167; P.Mich. V.230; P.Mich. IX.554; P.Oxy. III. 502; BGU.IV,1067 ; SB. I,5238.

¹⁷ Smith 1857, 768.

¹⁸ P.COL. IV,100; P.Ryl. II.167; O.Stras. I,790; SB. XXII.15816.

¹⁹ المهدي 1990 م، 14 .



Fig.3: Mortar from granite, Roman Period, Eastern Desert, The Bokari granodiorite quarry (after, Harrell 2012, 11)



Fig.4: Mortar with a pestle discovered in Karanis, House C51, 39 BC (after: Husselman 1979, pl. 87a, courtesy of the Kesley Museum)



Fig.5: Mortar made out limestone, from workmen village at Tell Amarna, Gate Street 9 (After, Samue 1989, 260, fig. 12.2)

3.2 Saddle quern

In the literature, this kind is also referred to as a saddle hand mill. The ancient Egyptians employed saddle querns to grind different grains into flour throughout the dynasty period (fig.7). This kind was in use up until the Ptolemaic and Roman Eras. During the Ptolemaic Period, this type of hand mill was also utilized, albeit less frequently and for smaller amounts of grain. These particular mills had two stones: an oval, elongated stone at the bottom and a little, hand-held stone at the top known as a "rubber" or "rider."²⁰

The clean grain is placed on the lower stone, and both hands are gripping upper grindstone, moving the upper stone forwards and backwards. Grain and flour are milled in a straight line, or occasionally diagonally across the stone, down towards the end where the flour falls into the bowl.²¹ From the Old Kingdom to the First Intermediate Period, as shown in (fig. 6.A), workers would grind on the ground while kneeling. From the Middle Kingdom onward, however, wooden or mud brick or stone emplacements for grinding with saddles began to appear, which could raise the quern off the ground as shown in figure 6.B.²² The Saddle quern underwent various modifications from the dynastic period till the Graeco-Roman period.²³ Saddle querns were made out of different materials like basalt, granite and sandstone as shown in (figs. 8, 9).²⁴

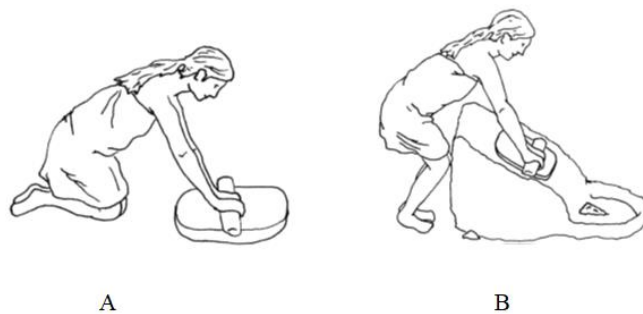


Fig.6: A. The process of grinding on the floor using saddle quern in ancient Egypt
 Fig. 6: B. grinding process using a quern emplacement
 (After, Lang 2016, 282)

²⁰ Harrell 2012, 8.

²¹ Samuel 1994, 99.

²² Lang 2016, 281.

²³ Moritz 1958, 37.

²⁴ Harrell 2012, 7-11.



Fig.7: Terracotta figures depicted milling on a saddle quern. From (left to right): Asyut, Middle kingdom, Egypt ca 2000 BC; and Thebes, ca 525 BC (After Moritz 1958, plates 1-2).

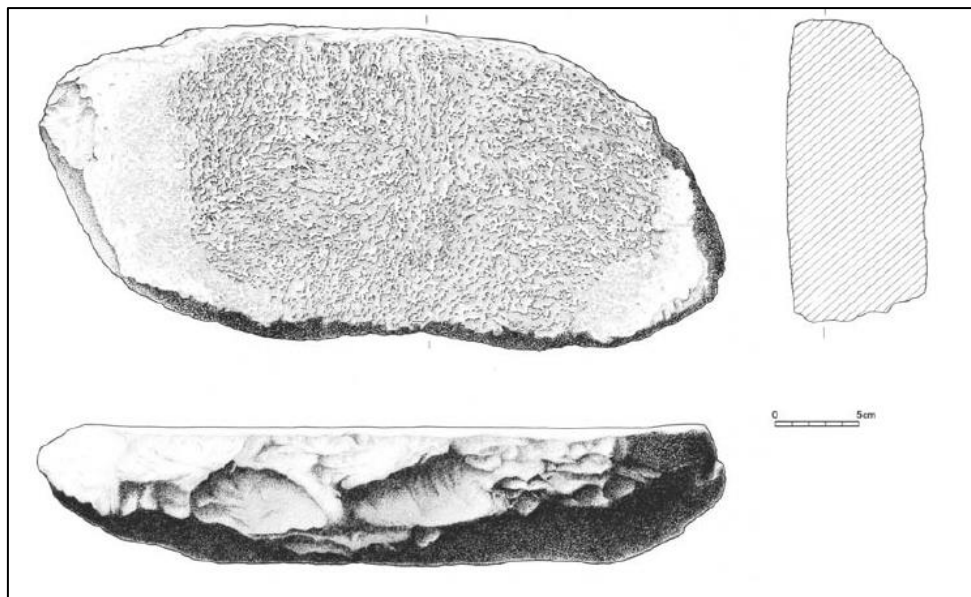


Fig. 8: Illustration of an ancient Egyptian granite saddle quern recovered from the site of Amarna. Note the slightly concave longitudinal surface and the slightly convex width. The centre of the stone is relatively rough while the ends are smoothed. (after, Samuel 1989, 262, fig. 12.4; courtesy EES)

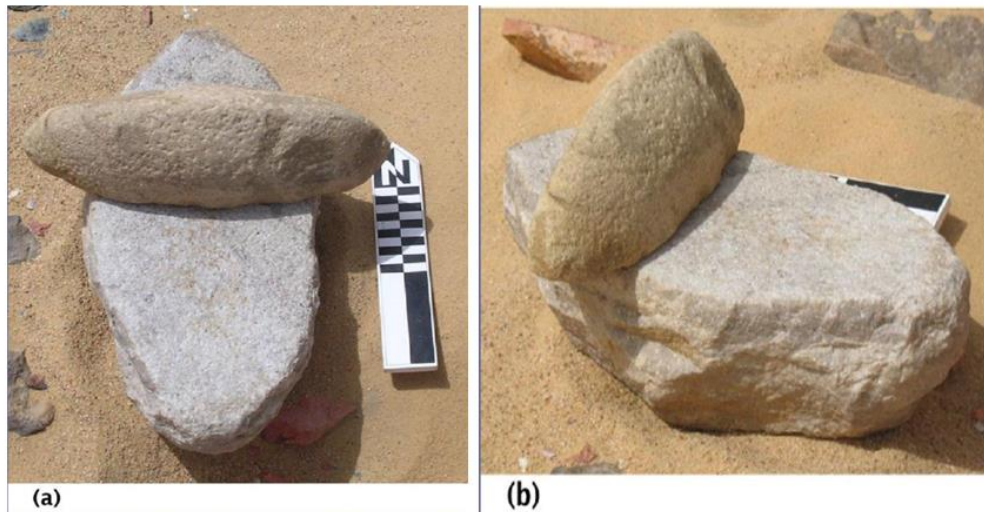


Fig. 9: Saddle hand-mill (a and b) for grains made out of silicified sandstone, Middle Kingdom (Khafra Quarry near Gebel el-Asr in the Nubian desert) (after, Harrell 2012, 10)



Fig.10: “saddle quern” made out of rhyolite porphyry dating back Ptolemaic Period, Wadi Abu Gerida, Eastern Desert (after, Harrell 2012, 11)

3.3 Rotary hand mill (Theban Mill)

This type was introduced to Egypt during the Ptolemaic period. It was still in use during the Roman era, together with manual mills for saddles. It is called *Mola Manuaria* in Latin.²⁵ This kind is referred to in various sources under different names, such as Theban mill or rotating hand mill *μύλος*. It was referred to as hopper-rubber in numerous sources.²⁶ As shown in (fig. 11), the hand mill consisted of two stones stacked on top of each other, the lower stone (*meta*) representing the base with a conical spindle in the center, and a circular upper stone (*catillus*) with an axial hole that fits over the spindle. The miller rotated the upper stone with a wooden handle fitted in a slit carved into one side in a circular motion to grind the grains after the grains were inserted through a central opening in the upper stone and trituated between the two stones (figs. 12, 13, 14).²⁷ The materials used to build the Theban mills were granite, basalt, sandstone, and even limestone.

²⁵ Moritz 1958, 115.

²⁶ Williams-Thorpe, and Richard -Thorpe 1993, 265 - 270 and 270 – 271.

²⁷ Alcock 2005, 112; Harrell 2012, 9; Donahue 2014, 63; Thurmond 2006, 41; Runnels 1990, 147.



Fig. 11: Rotary hand mill made from basalt dates back to the Roman period, discovered in Shenshef, Eastern Desert. A. lower stone, b. upper stone (after, Harrell 2012, 9)



Fig. 12: Milling scene shows how the rotary mill was used for grinding grains. (After Hauken, et al 2015, 41)

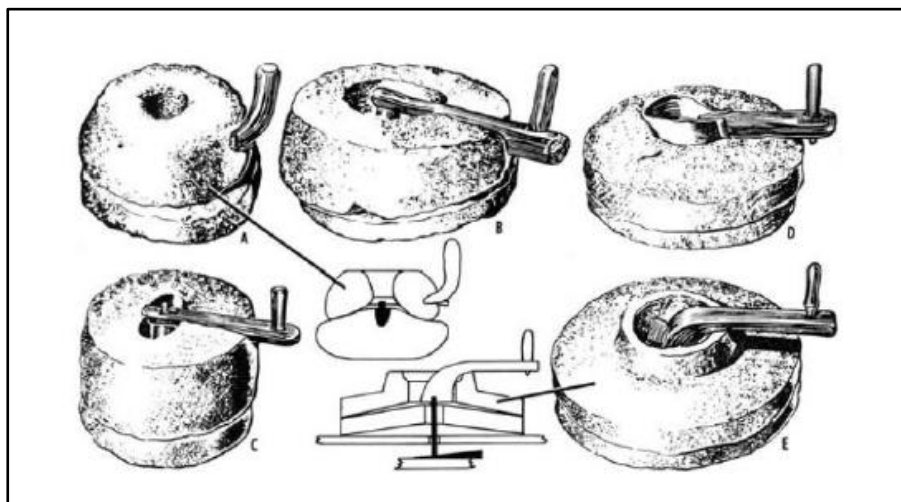


Fig.13: Different shapes of rotary hand mills (after, Brassler, 2013, 34; Thurmond 2006, 41)



Fig.14: Rotary hand mill taken from the Roman fort at Chesters on Hadrian's Wall (after Cardon 2022, 111)

Rotary hand mills were used in homes or by the army. It is mobile, allowing users to exchange it for different locations while still using it for grinding. During the Ptolemaic period, this kind was frequently seen in houses, especially in the Arsinoite nome.²⁸ The round motion of rotary milling turned out to be more efficient than the back-and-forth motion of hand-mill querns. Furthermore, it enabled the creation of larger mills capable of utilizing more powerful energy sources. During the late Roman Period in Egypt, the utilization of "horizontal rotary" (fig.15) and "edge-roller"(fig.16) mills showcased the initial large-scale processing of cereals and other agricultural products. The previous form of the mill was made up of two large circular grinding stones, usually made of rough Aswan granite,²⁹ that were perfectly matched to each other.³⁰

²⁸ *PSI. V.530* (Philadelphia, 275-226 BC); *P.Lond. VII.2059* (Philadelphia, 263-229 BC).

²⁹ There are remnants of round granite stones in some temples such as Dendara, Philae, and also near the site of Kom el-Shagafa, which may have been used as millstones, but we are not sure whether they were used as millstones or column bases, especially since the size of these stones is very large and very similar to the column bases used in those places. These are the links of these images (<https://labitacora.es/los-templos-de-la-isla-de-philae-egipto/>, https://en.wikipedia.org/wiki/Dendera#/media/File:Dendera_Tempelkomplex_06.JPG, <https://traveltoeat.com/catacombs-and-garden-of-kom-el-shoqafa-alexandria-egypt/>

³⁰ Harrell 2012, 9, 10.



Fig.15: horizontal industrial-scale rotary mill used for grinding grains, made out of coarse-grained granite of Aswan; discovered in St. Simeon Monastery near Aswan, Byzantine Period. (After, Harrell 2012, 10)



Fig.16: Limestone edge-roller mill stones from the Roman Period, discovered in Karanis, Fayum. (After, Harrell 2012, 10)

3.4 Large Mechanical Mills (Donkey Mill)

This type was also called Pompeian Donkey Mill (Fig.17).³¹ During the 2nd century AD, mills developed and became large mills powered by animals. This type was operated by animal's power like donkeys, cows and camels or by slaves.³² Sometimes other mills were powered by wind or water. The mill can be operated by one or two donkeys. The mill was driven by a donkey that was tethered to a wooden frame fastened to the mill (figs.18, 19). The miller only had to feed the grain into the mill. The grain was ground between the stones when the donkey rotated the mill. Donkey mills were used in large quantities of grains. Moreover, this innovation led to higher production.³³

³¹ Moritz 1958, 115; Thurmond 2006, 40; Donahue 2014, 64; It is called Pompeian Donkey Mill because it is similar to Pompeian style mills: for more details look: Wefers& Mangartz 2014, 83-96.

³² Evans 2012, 100.

³³ Donahue 2014, 64.



Fig.17: Right of image: four Pompeian-style donkey mills. (After, Cardon 2022, 113)

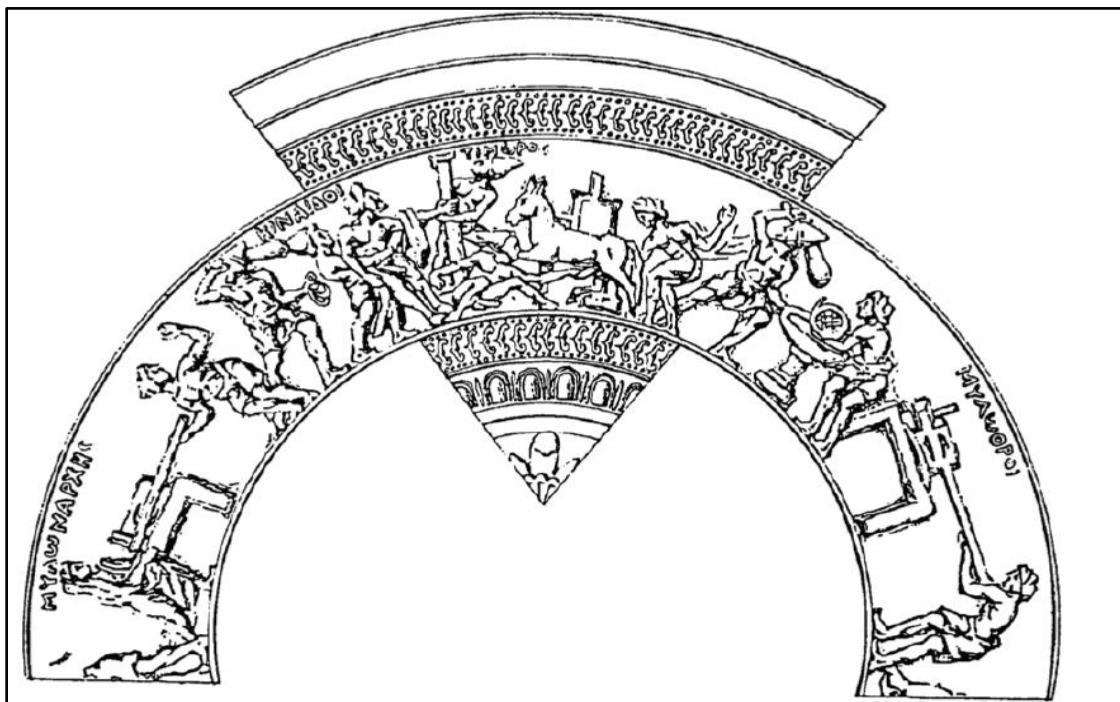


Fig. 18: Relief on Homeric bowl from Thebes, in the center is a mill operated by a donkey, now in the Louvre. (After, Moritz 1958, 13)

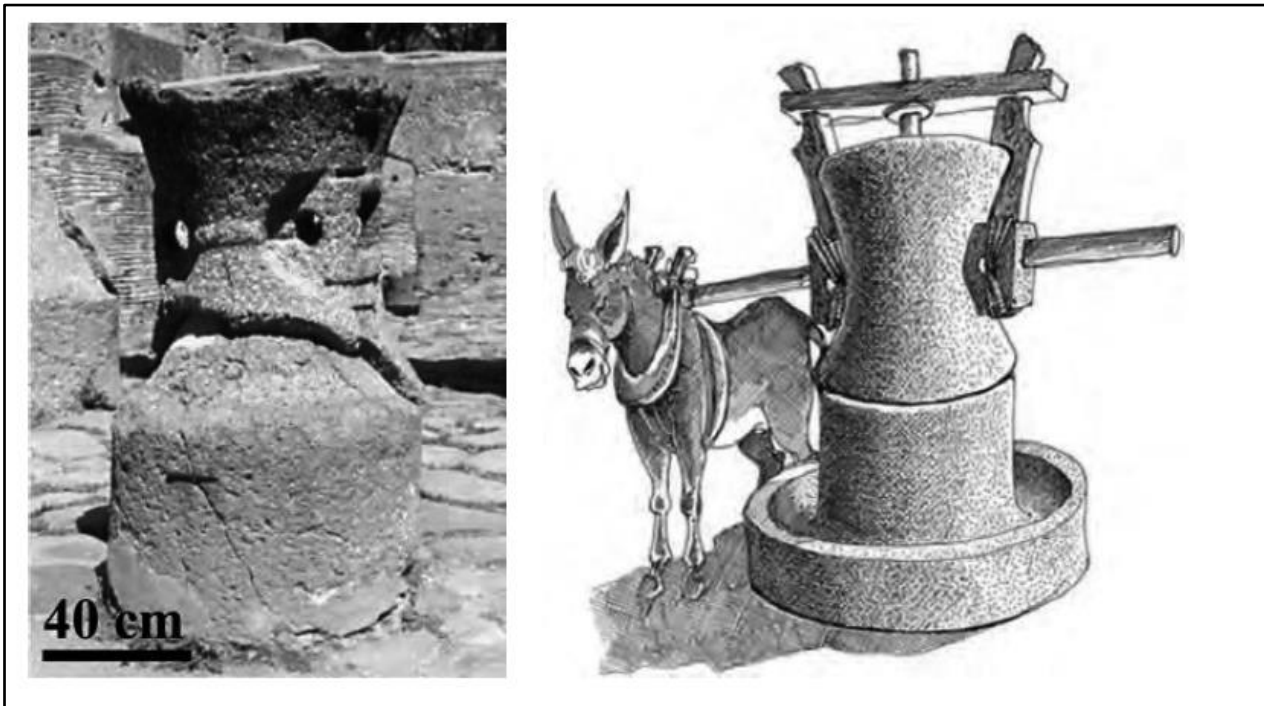


Fig. 19: Pompeian style Donkey mill³⁴ (After, Santi et al 2004, 57-69)

This type of mills is evident in the contracts of leasing mills dating back to the 2nd century AD.³⁵ A document from Tebtunis refers to a mill consisting of two large mechanical mills and a mortar.³⁶ As for the animals needed to operate these mills, there is no reference to these animals in relation to the contract of lease. Hence, it is most likely that the tenant had to provide these animals.³⁷

4. Ownership of Mills

Mills were separated into two primary categories: the first denotes private ownership. It included mills and bakeries built or attached to homes. There were mills whose title to estate or home owners was not specified in the records. The circumstances of the documents, however, suggest that they might have been private property. Public mills, whether state-owned or affixed to temples or estates, were included in the second section.

4.1 Private Sector Mills: which are mills owned by individuals throughout the country during the Ptolemaic and Roman Period.

4.1.1 Mills built inside Homes or Annexed to Homes

Regarding private sector mills, some of them were found inside homes or annexed to parts of homes. Small portable mills were found on the floors of the rooms and courtyards³⁸ as shown in figure 20, while large mills most probably were placed

³⁴ Large mechanical mills or donkey mills were described in the documents of Roman Egypt. They took the shape of this Pompeian style. They were described as consisting of two stones and grain was ground between the stones. They were operated by donkeys and other animals; Donahue 2014, 64.

³⁵ *PSI.Com.VI.12* (129-130 A.D); *PSI.VII.787*; (176-177 AD) Arsinoite; *P.Mil.Vogl. II.53* (= SB. VI,9265) (152-153 AD) Tebtunis; *SB. XX.14197, VI, V4* (253 AD) Theadelphia.

³⁶ *P.Mil.Vogl. II.53* (152-153 AD) Tebtunis; *SB. XX,14197, VI, L.16, V4 L.68* (253 AD) Theadelphia.
المغربي 2007 ، 230 ³⁷

³⁸ Gendy 1990; Husselman 1952, 66.

inside separate rooms as domestic properties or with fully economic or industrial purposes (fig. 21).³⁹ They were also found in the middle of the courtyard.

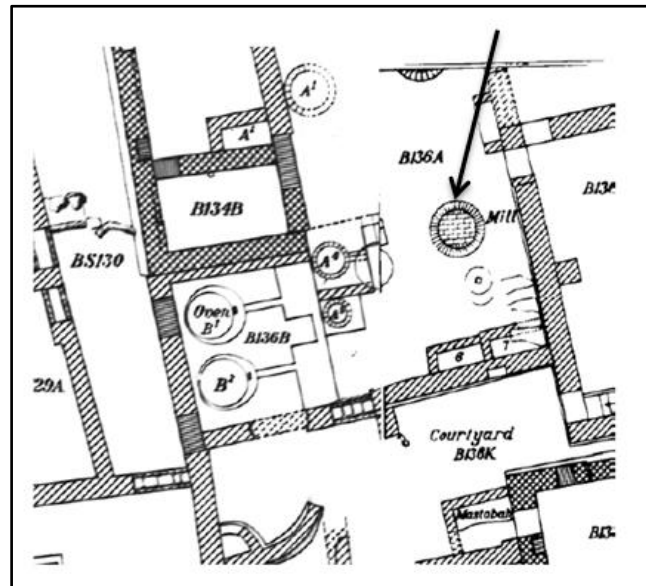


Fig. 20: A plan for a house from Karanis shows a mill in the courtyard of the house, courtesy, the Kelsey Museum Archives (After, Simpson 2014, 210)

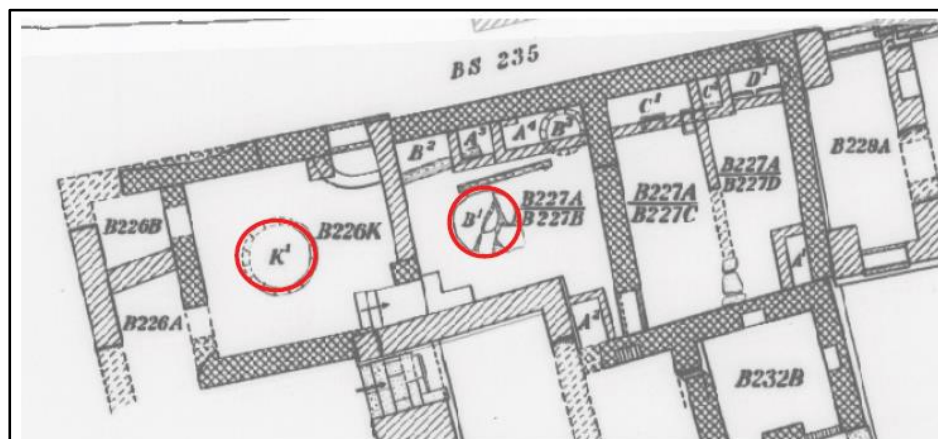


Fig. 21: A plan for a house in Karanis shows large circular bases for millstones in two courtyards of the house, (After, Simpson, 2014, 208)

There are many documents that referred to mills built or annexed to homes, in which flour was made. For example: a document⁴⁰ dates back to 164 AD. It is a correspondence addressed to the nomarch of Arsinoites, from a woman and her cousin (as her guardian), requesting for permission to build a mill, in the house she owns, in the nearby area known as the estate of Metrodorou Epoikion, in the meris of Herakleides. It stated that she will pay annually 18 drachmas for flour tax and additional taxes.

Another document⁴¹ from 287 AD is a guarantee given to Aurelia Thermouthion, daughter of Heraklas, by Aurelius Patermouthis, son of Thoonis, and

³⁹ Simpson2014, 126, 207.

⁴⁰ *P.Rainer Cent.* 60

⁴¹ *P.Wash.Univ.*1.19

Aurelia Helene, daughter of Panechotes, stating that no one would come upon her or her husband regarding the lease she paid for the mill she rents, which is housed in the house they rented. They also acknowledge that they have paid all other expenses and rent for the required year.

Two documents⁴² from 298 AD are copies of a contract for the sale of a tiny house in the Arsinoite settlement of Philadelpheia, which states that the house was formerly a mill.

In addition, a papyrus⁴³ dating back to the 3rd century BC from Philadelpheia, which is a memorandum to Zenon from Artemidorus, son of Theodoros, states that his father entrusted Pantheros with two mills that were in use, and that he used to pay the rent for the room where both mills were placed to Pantheros and Symphythos, who bought the house. However, Pantheros and Semphthos dismantled the two mills. When (Artemidorus) wanted to take them out (two mills), they refused, so he hopes enforcing them to give both mills back to him as they treated him with contempt since his father's absence.

This papyrus explains that there was a certain kind of mill that needed a specific location. As can be seen, Artemidorus tells Zenon that his father gave Pantheros two millstones, which needed to be kept in a room in one of the houses. Pantheros' father was then had to pay rent for the room that held the two millstones. The homeowner took apart the two stone mills, but he won't give them back.

Another papyrus⁴⁴ dating back to the Roman period, dated to 14 AD, from the village of Soknopaïou Nesos. It is a complaint submitted by the priest Satabous, who complained to a fellow priest named Nechtenibis that he came with others at night and assaulted him. Also, they carried away the mortar from the mill that he owned in the village. It is understood from this papyrus that the priest Satabous owned a mill in the village of Soknopaïou Nesos, and another priest named Nechtenibis assaulted him in his house and stole a mortar from a mill that was kept in the house.⁴⁵

Regarding the private ownership of mills driven by animals in homes, this is referenced on a papyrus⁴⁶ from Arsinoe that dates to the third century AD. It documents a mortgage loan that read, "*Marcus Julius Cassianus shall repay the amount with monthly interest to Gaius Valerius Severus without delay, on the security of a small house and an animal-powered mill in the village of Philadelphia in the division of Heraklides of the Arsinoite nome (the loan amount and its interest are missed in the papyrus).*"

During the Roman era, private grain mills within homes were hired; this is documented in an Alexandrian leasing contract⁴⁷ from 13 BC. It demonstrates that the owner would rent to a man called Sarapion, son of Aristius, a house with a mill and workshops in the Delta district, for a term of two years, commencing in Bermuda, in exchange for sixty silver drachmas to be paid at the beginning of each month. The record makes it quite evident that dwellings were meant to be places of residence, but occasionally mills were added to them for industrial and commercial usage.⁴⁸

As for private mills situated in separate places out of houses, there is a request⁴⁹ from Philadelphia (Arsinoe), dating back to the 3rd century AD referring to

⁴² P.Wisc. 58 and 59.

⁴³ P.Mich. I.79.

⁴⁴ SB I.5235.

⁴⁵ Kelly 2011, 2.

⁴⁶ SB XIV.11705.

⁴⁷ BGU. IV.1116.

⁴⁸ المغربي 2007، 227.

⁴⁹ P.Mich. XII.627, 298 AD, Philadelphia; P.Wisc. II.58.

these mills. It is sent by Aurelia Tapais from the village of Philadelphia, Heraclides division, to senator and archivist of the registry of real property of the Arsinoite nome Aurelius Horion,. It states that Aurelia purchased (in accordance with a contract) drawn up here in the Arsinoite nome on the present day a building of one story, formerly a mill, in which there is a dilapidated yard, located in the same village of Philadelphia, at a price of 3000 silver drachmai, from Aurelius Titus Valerius Gaianus, son of Titus Valerius Satrianus. It is clear from this contract that individuals could convert one of the mills into a habitable house, and that the houses themselves were used as mills.⁵⁰

As for the contents of the private mills, they consist of rotary Theban mills with handles, mortars, and animal-powered mills used in industrial purposes which were referred to in some documents related to rent and sale.

4.1.2 Mills with Unspecified Private Ownership

According to the records, another kind of private mills was not specifically affiliated. A few papyri from the Ptolemaic and Roman periods made reference to it; the earliest record⁵¹ goes back to about 30 AD. This lease covers a Tebtunis bakery held by Herakleides, which was leased by Petesouchos and Sochotes, Petesouchos' sons. The bakery included a Theban handmill with nether millstones and a grinding handle, as well as a mortar and an oven. The lease is for two years, or as long as you want to bake, and the annual rent is eighty silver drachmai, paid in four equal payments.

According to the former document, it seems that the mills were producing bread in addition to grinding. It is also indicated that the mills were connected to the process of producing and selling bread as bakeries were attached to the mills.⁵² Thus, they were not limited to the grinding process only. This is evident in the documents for renting the mills that recorded additional payments in kind for the loaves, as well as the obligation to pay taxes. As for the additional taxes, they included determining the number of loaves to be baked, as well as the tenant's grinding and kneading of 11 loaves of wheat per month without taxes, as well as grinding and kneading quantities of flour without pay annually⁵³. Some documents regarding the mills' tax obligations also indicate a quarterly tax on selling bread⁵⁴. Another document also refers to the baking tax that should be paid by the tenant⁵⁵.

Another document⁵⁶ which dates back to 39 AD is a request from Seras, son of Sarapion, to Kastor son of Asclepiades. It stated that he and his wife had the desire to lease "the mill of his father Asclepiades, son of Ptolemaeus in Euhemeria, in full working order, containing 3 Theban mill-stones, with handles and nether-stones, and 2 mortars and the other accessories and the existing pestles, at a total yearly rental of 160 silver drachmae and a half artaba of loaves and a cock as a yearly offering". Kastor will pay the public charges on the mill, but the maintenance charge and the twenty-five per cent on bakers, they will be paid by Seras who will pay the rent in installments at intervals of 4 months, and at the termination of the period he will deliver the mill and its contents, as left by wear and tear.

⁵⁰ Simpson 2014, 207.

⁵¹ *P.Mich.* X.586.

⁵² Gomaa 2020, 194.

⁵³ BGU IV.1067 ll. 11-16 (Euhemeria, 101-102).

⁵⁴ *P.Ryl.* II.167 (Euhemeria, 39 AD).

⁵⁵ *PSI* VII.787 (Arsinoite, II AD).

⁵⁶ *P.Ryl.* II.167.

Another papyrus⁵⁷ which dates back to the second century AD, is an offer submitted by Immouthis to lease a mill in one of the villages (in the Arsinoite nome), with machinery, grinding stones and a mortar, for a period of 4 years, with an annual rent of 160 drachmas, of which 135 drachmas were paid for the machine (grinding stones). It includes paying a rent in kind, 2 pigs and he will pay the rest of the amount in three installments, so he pays 8 drachmas every 4 months. He will pay the flour tax, work permit fees, bread-making taxes, and state treasury taxes. If he wants to supply the mill with mortars, he will bear all costs. The mill will be delivered at the end of the period free of any defects or dirt, along with the doors and keys.

A contract⁵⁸ dates back to 268 AD refers to the division of some properties in Hermopolis Magna. These properties included a mill for grinding grains.

4.2 Public Mills

4.2.1 Mills Annexed to the Estates:

Additionally, Ptolemaic and Roman Egyptian estates included mills that produced bread and flour for their populace. The mills could be used for more than just grinding. Since bakeries were connected to some public (commercial) mills, bread was produced there for sale.⁵⁹ This is evidenced in a document⁶⁰ dates back to 239/240 AD. It is an account of an estate called the estate of Aristokles in Arsinoite nome. It states that the rented rooms included four double-rooms with a mill that was used by Anops, miller and lessee, free of all charge. It is clear from the document that this mill was one of the larger mills that produced bread in bulk. The evidence for this is that the rooms used as a mill were double. It's most possible that the mill was sizable and that it was attached to an estate, necessitating the manufacture of significant amounts of flour for the workers in the estate to use in baking bread.

Another document⁶¹ refers to the mills in the estates in which a woman with her cousin, requesting for permission to build a mill, in the house she owns, in the estate of Metrodorus, in the Heraclides district. It stated that she will pay for grinding tax and additional taxes.

4.2.2 Government Mills

Apart from the aforementioned mills, there was government mills connected to the city governments. To suit the requirements of the people living in these cities, they made flour. There is a document⁶² from the Oxyrhynchus Papyri collection that sheds some light on these large state mills. This document which dates back to 169 AD is a contract between Sarapion, also called Horion, the grandson of the Eutheniarch⁶³ in order to equip and supply five eutheniarchs in Oxyrhynchus with the animals necessary to operate the five mills, each of whom supervises a mill, for a period of one month from 30 Pauni till the 29th of Epeiph. This same person supervises the sixth mill in partnership with his grandfather. The animals will be used to grind twenty artabae of wheat daily, and each one of them will feed the animals that work in the factory he supervises with grass and barley.⁶⁴

⁵⁷ *PSI*. VII.787.

⁵⁸ *P.Flor.* I.50.

⁵⁹ Goma 2020, 194.

⁶⁰ *P.Mich.* XI.620 (=SB.VIII,9898).

⁶¹ *P.Rain.Cent.* 60.

⁶² *P.Oxy.* VI. 908; Johnson 1936, 373, No. 218.

⁶³ Eutheniarch was an official whose duties included the supervision of supplying the city with food, Kelly, B. (2011). XV.

⁶⁴ Alston 2002, 192.

4.2.3 Mills annexed to Temples

The third type of mills is represented by the mills annexed to the temples, where the temples owned mills.⁶⁵ These were managed by millers under the supervision of the temple priests to meet their needs for bread and beer. If the mills stopped working, the priests sometimes rented them in exchange for repairing them, so that the temple may not incur the costs of repair. After rental and repair, the temple restores these mills operating at full capacity to supply the temple with its needs of the said products.

There is a document⁶⁶ dates back to the 2nd century refers to a mill operated by the priests of Soknopaiou Nesos in the Arsinoite nome in Parias, close to the settlement of Heraclia. This lease agreement is for a mill owned by the Soknopaiou Nesos temple. According to the contract, Ammonaphis, son of Papeis, the miller, was given a five-year lease on the grain mill owned by the priests in the Pisais district, close to the settlement of Heraclia, on the condition that the mill be repaired during that time. Starting from the 6th year, he pays an annual rent of 120 silver drachmas, 20 date clusters with two chickens worth 8 drachmas, and 20 eggs as a gift. Clusters should be delivered starting from the second year to the heads of the priestly community. The mill and mortars should be hand back intact after the lease expires.⁶⁷

The analysis of this papyrus confirms that some temples own mills, and their priests are allowed to rent them, especially when they are no longer working, with the aim of re-operating them to meet the needs of those residing inside the temple, whether priests or refugees of the same temple, or servants and others, provided delivering the mill workable after the end of the lease period. It can be seen that the tenant will spend the five-year lease on its repair, and undertakes to hand back the mill and mortars intact after the expiration of the contract. Perhaps this mill was inoperative before renting it and the temple does not get any returns from it, so the priests rented it to one of the millers provided repairing and operating it.⁶⁸

Another document⁶⁹ which dates back to 163/164 AD, is a draft declaration of the sources of revenue of the Temple of Athena Theoris in Oxyrhynchus. The sources of revenue included some amounts paid by the craftsmen's guilds affiliated with the temple, and among these guilds included the flour makers' guild (ἀλευροποιῶν) and bakers' guild.

Another document⁷⁰ is a report submitted by the topogrametius Onnes on the accounts of the Temple of Mendes in Taposiris (Abusir). This report mentions the quantities of barley consumed in the process of milling and baking bread in the bakery of the mentioned temple. It is clear from the two previous papyri that mills and bakeries were built in the same place, where grains were ground and turned into flour to be used in making bread. These mills and bakeries of the temples were supplied with the necessary tools for grinding grains and making bread.

5. Grains grinded by mills

There is no doubt that the millers used food grains as the raw materials needed for their craft, such as wheat, barley, corn, sesame, and fenugreek, which they ground to make bread, various pastries, beer, ice cream, tahini, and sweets. This can be inferred upon knowing that the miller was grinding wheat and barley to make bread inside the temples to achieve their economic independence.⁷¹

⁶⁵ Bevan 1927, 180.

⁶⁶ *P.Lond.* II.335, p. 191 = *W.Chr.* 323; Connor 2015, 251.

⁶⁷ Hobson 1984, 98; Johnson et al 1936, 368-369, no. 211; Connor 2015, 248, 250, 251.

⁶⁸ Johnson et al 1936, 368-369.

⁶⁹ *P.Mert.* II.73.

⁷⁰ *BGU* IV.1202.

⁷¹ Bevan 2014, 180ff.

In addition, millers used measures to weigh the grain to be ground to estimate the required amount of bread. The millers used the artaba (Ἀρτάβη), which is of Persian origin.⁷² This is confirmed in a papyrus⁷³ dating back historically to ca. 161. - 160 BC. It indicates “the presence of a mill in the city of Memphis, in which millers grind some food grains for making bread, as well as grinding sesame in preparation for making some types of pastries. Hence, the millers used to sieve the ground grains and use the waste for feeding animals.” Therefore, some animals and birds were raised next to the mills, as they were fed on the bran of ground grains.

6. Lease of Mills

Lease of mills was common in the documents of Ptolemaic and Roman Egypt.⁷⁴ Many of the aforementioned documents referred to the lease and sale of mills. It is clear from these documents that the rents of mills were always paid in cash. The rent is sometimes accompanied by additional payments in kind in addition to free services provided by the tenant to the landlord.⁷⁵

It turns out that one of the mill's contents, the Theban stone mill, was rented, so this was not restricted to the lease of the full mills. This can be found in a document⁷⁶ dates back to 17 AD. This document was found in Oxyrhynchus, and it is a contract for renting an entire mill with all its tools (an entire Theban mill). It stated that Isidorus has leased an entire mill to Heracleus, son of Soterichus, for a period of seven months at a monthly rent of 2 drachmas and 3 obols of silver. The lessee shall pay the rent without delay, and delivers the mill intact at the end of the period as he received it. If the tenant does not maintain it, he will pay the lessor the value of damages as agreed upon, namely, 100 drachmae of silver, and for every month that he fails to return it, 1 1/2 times the rent.

Another document⁷⁷ which dates back to the year 61 AD, is a contract for the sale of stone mill in Karanis, where Petesouchos, son of Horos, sells a mill to Pekmeis of Mesoeris along with the netherstone and the pestle. Additionally, there is another document⁷⁸ dates back to 99 AD which refers to the sale of mill and its contents. This document is a contract of selling a stone mill, whereby Thatres, daughter of Psenamounis, and her brother Pakysis (as her guardian), sell the Theban mills that belongs to his sister, with the netherstone and handle, to Pnephros, son of Satabous, for the sum of 28 silver drachmai.

Bread-baking was connected to mills, and it appears that the mills encompassed a bakery where bread was made from flour.⁷⁹ There is documentation⁸⁰ from 30 AD that attests to this. This paper talks about leasing a bakery and mill. “*There in a Theban millstone with nether millstones and a grinding handle, and one mortar and one oven,*” the paper states. The lease contracts for mills, which list additional payments in the form of loaves and the obligation to pay taxes, further demonstrate that mills are involved in the manufacturing of bread and are not just for grinding.

⁷² *P.Tebt.* 1, pp.43ff.

⁷³ UPZ 1.62 (161 160 B.C).

⁷⁴ *P.Tebt.* II.278; *P.Petaus* 103; *SB.* III.7199.29.

⁷⁵ *P.Mich.* X.586; 227, 2007 المغربي.

⁷⁶ *P.Oxy.* II.278

⁷⁷ *P.Athen.* 25.

⁷⁸ *P.Mich.* IX.550

⁷⁹ Mundy 2018, 72.

⁸⁰ *P.Mich.* X. 586

The lease of mills was always paid in cash,⁸¹ and it was sometimes accompanied by additional payments in kind in addition to free services provided by the tenant to the owner.⁸² The additional payments consisted of loaves of bread, as well as the tenant grinding and kneading 11 loaves per month without payment from wheat, and grinding and kneading quantities of flour without payment per year.⁸³ As for the method of paying the rent, it was paid in cash annually in one case, or in semi-annual payments, or quarterly. As for the method of estimating the rent, it was usually done annually, but in the case of the Thaban mill, it was determined on a monthly basis and the payment was made monthly. Some documents regarding the tax obligations of the mills refer to the quarter tax for the sale of bread⁸⁴ and another document⁸⁵ refers to the tax for the production of bread, which was paid by the tenant.

The short-term lease periods for mills were four years at most, and the lease begins in cases that record the start date of the lease in the months of Amshir (January 26 - February 24),⁸⁶ Tut (August 29 - September 27),⁸⁷ and Paremhat (February 25 - March 26).⁸⁸ The lease period usually lasted for a year. However, if the lease began in the month of Pashons (the ninth month in the ancient Egyptian calendar), the lease period extends for sixteen months.⁸⁹ It is evident that they took into consideration the consistency of the lease year with the calendar, so that the lease ends with the end of the last month of the year. This can also be found in the case of leasing the Theban mill, where the lease period lasted for seven months, starting from Amshir (January 26 - February 24) (the sixth month in the ancient Egyptian calendar).⁹⁰

The relationship between landlord and tenant was one of the important elements relevant to the buildings for industrial purposes like mills that contain tools susceptible to damage and may require necessary repairs to continue operating. For example, the owner was responsible for those repairs in the two papyri that stated the stipulations for repairs.⁹¹ Some contracts stipulate that the tenant must return the tools to their original condition after use.⁹² As for the animals needed to operate these mills, there is no reference to these animals in the subject of rent, so most likely the tenant had to provide these animals.⁹³

Concerning the tax obligations, they varied as indicated by the present papyri. For example, a papyrus⁹⁴ recorded that the landlord and tenant shared the general taxes, so the landlord has to pay a tax called *πελωχικόν*, that is a tax whose origin is unknown, but it is clear that it was imposed on mills.⁹⁵ Meanwhile the tenant has to pay the tax on the sale of bread. Another papyrus stipulated that the tenant gets the permissions of animals (used in animal-powered mills),⁹⁶ while the owner bears the tax of *πελωχικόν*. In another papyrus,⁹⁷ the tenant bears all taxes, which are the

⁸¹ Mundy 2018, 77.

⁸² المغربي 2007، 228-227.

⁸³ BGU IV.1067, ll.11-16 (Euhemeria, 101-102)

⁸⁴ *P.Ryl.* II.167, l. 22 (Euhemeria, 39 AD); BGU IV.1067 (Euhemeria 101-102 AD)

⁸⁵ *PSI* VII.787 (Arsinoite, II AD).

⁸⁶ *P.Oxy.* II.278 (Oxyrhynchus, 17 AD).

⁸⁷ *P.Ryl.* II.167 (Euhemeria, 39 AD).

⁸⁸ *PSI* VII.787 (Arsinoites, II AD).

⁸⁹ BGU IV.1117 (Alexandria, 3 BC).

⁹⁰ المغربي 2007، 229.

⁹¹ *P.Mil.Vogl.* II.53, ll. 18-20.

⁹² *P.Ryl.* II.67, ll.26-29 (Euhemeria, 39 AD).

⁹³ المغربي 2007، 230.

⁹⁴ *P.Ryl.* II.167 (Euhemeria, 39 AD)

⁹⁵ Wallace 2015, 222.

⁹⁶ *P.Mil.Vogl.* II.53 (Tebtynis, 152-153 AD).

⁹⁷ Wallace 2015, 122.

πελωχικόν tax and permissions (perhaps what is meant as permissions for using animals), baking and the sale of bread.⁹⁸

7. Results and Conclusion

The study of mills in Ptolemaic and Roman Egypt sheds light on the intricate relationship between food production, technology, and social structures in these ancient civilizations. It refers that grinding grains was one of the important crafts in Ptolemaic and Roman Egypt, as the process of grinding grains was an essential step in bread production. It showed that the process of grinding grains took place on a daily basis in every home. Therefore, various types of mills were used at homes for bread production.

Mills witnessed development throughout the ages from the Dynastic Era until the end of the Greco-Roman Era. For example, "mortar and pestle" as well as "saddle quern" were used in the Dynastic Era, and continued to be used in the Greco-Roman era. As for the Ptolemaic and Roman era, the Theban Mill or the rotary hand mill was used widely in homes in the Ptolemaic and Roman eras. It consisted of two stones. It was found in the courtyard of the house or in one of the rooms of the house and was used to grind small quantities to meet the daily need of the homeowners for flour. It was easy to move it from a place to another or rent or sell (table no.1).

Mills developed in the Roman era, when animal-powered mills, or the so-called Pompeian mills, appeared. They were rotated by donkeys, cows, or sometimes by slaves. They were used at homes and large estates in order to produce large quantities of flour. Mills were manufactured in Ptolemaic and Roman Egypt of various types of stones, the most famous of which are granite, in addition to diorite, sandstone and basalt. After studying the different types of mills, it became clear that the Theban mill was the most mentioned in the papyri (table no.1).

Ownership of mills varied from individual households to temples and government-affiliated mills in cities, highlighting the diverse ownership and usage of mills in the Graeco-Roman Period and indicating a diverse distribution and utilization of milling technology across different sectors of society. This was evidenced in the literary and pictorial resources (table no. 2).

According to the study, small mills found in homes were used by the homeowners, whether women or workers due to their small size, while the large mills found in cities were operated by animals. Reconsidering the documents, The mills were not limited to just grinding grain but were also involved in the production and selling of bread, with bakeries often attached to the mills, showcasing a comprehensive food production system.

Through the documents and archaeological evidences included in the research, it became clear to us that the presence of more than one type of mills, whether millstones, pestle and mortar, or the Theban mill in one room. It also became clear to us that large mills were found in separate rooms in the house, or the house was rented and used as a mill, while small mills were found in the courtyard of the houses.

It is clear from the study that millers grinded different grain including wheat, barley, corn, and sesame. They were ground to produce not only the flour needed to making bread but also various pastries, and sweet beer.

The study showed that the mills were rented and sold. Documents mention the rental agreements, taxes, and obligations related to the operation of these mills, highlighting their role in the local economy. Documents aslo indicated that the rent was paid in cash and some payments in kind. In addition, they showed that either the

⁹⁸ Mundy 2018, 72.

tenant or the owner may assume some tax obligations, and the rent was paid annually or semi-annually or quarterly.

According to materials used in building millstone, the production of millstones may took place in different quarries especially on the quarries of eastern Bank of the Nile in Aswan. This is evidenced by several roughouts discovered by Stefanie Wefers & Mangartz in Aswan. They were manufactured heavily in that area from the Ptolemaic period till the Byzantine Period. This may refers that millstones manufactured in the Aswan region traded.⁹⁹

In this study, the researchers relied on nearly 40 documents, either Greek papyri or inscriptions on ostracas. It became clear through the study of these documents that most of them date back to the Roman period. It is also clear that these documents are mostly from the Arsinoites nome and a few documents from Alexandria, Oxyrhynchos, and Ashmunin. The researcher also relied on some remnants of archaeological evidence of mills, millstones, mortars and pestles. These evidences are from different periods from the dynastic era to the late Roman period. Some of these evidences are from different civilizations outside Egypt that were contemporary to that period. These remains of archaeological evidences were concentrated in the Arsinoites nome, especially in Karanis, and many of them were found in the quarries of the eastern desert and Aswan.

Table (1) Appendix of documents and inscription which mentioned various types of mills

Type of mill	Place	Date	Document
Mortar and pestle	Arsinoites	180 BC	SB.16.12375
	Tebtynis (Arsinoites)	30 AD	P. Mich. X,586
	Euhemeria (Arsinoites)	39 AD	P.Ryl. II.167
	Arsinoites	48 AD	P.Mich. V.230
	Ptolemais Euergetis (Arsinoites)	93 AD	P.Mich. IX.554
	Oxyrhynchos	164 AD	P.Oxy. III.502
	Euhemeria (Arsinoites)	101-102 AD	BGU.IV,1067
	Soknopaiu Nesos (Arsinoites)	14 AD	SB. I,5238
Rotary hand mill (Theban mill)	Philadelphia (Arsinoites)	275-226 BC	PSI. V.530
	Philadelphia (Arsinoites)	263-229 BC	P.Lond. VII.2059
Large Mechanical Mills (Donkey Mill)	Talei (Arsinoites)	129-130 A.D	PSI.Com.VI.12
	Arsinoite	176-177 AD	PSI. VII.787
	Tebtunis	152-153 AD	P.Mil.Vogl. II.53(= SB. VI,9265)
	Theadelphia.	253 AD	SB. XX,14197,VI, L.16, V4 L.68.
	Tebtunis	152-153 AD	P.Mil.Vogl. II.53

⁹⁹ Wefers & Mangartz 2014, 83–96.

Table (2) Appendix of documents and inscription which mentioned ownership of mills

Ownership of mill	Place	Date	Document
Private Sector Mills (Mills built inside Homes or Annexed to Homes or in separated places out of houses)	Arsinoites	164 AD	P.Rainer Cent. 60
	Oxyrhynchos)	287 AD	P. Wash.Univ.1.19
	Ptolemais Euergetis (Arsinoites)	298 AD	P.Wisc. 58 and 59.
	Philadelphia, Arsinoites	265-227 BC	P.Mich. I.79
	Soknopaiu Nesos	14 AD	SB. I,5235
	Arsinoites	213 AD	SB. XIV,11705
	Alexandria	13-12 BC	BGU. IV.1116
	Philadelphia (Arsinoites)	298-299 BC	P.Mich. XII.627
Private sector mills (Mills with unspecified private ownership)	Tebtunis (Arsinoites)	30-31 AD	P.Mich. X. 586.
	Euhemeria, (Arsinoites)	101-102 AD	BGU IV.1067 ll. 11-16
	Euhemeria (Arsinoites)	39 AD	P.Ryl. II.167
	Arsinoite	176-177 AD	PSI. VII.787
	Hermopolis	269-270 AD	P.Flor. I 50
Public Mills (Mills Annexed to the Estates)	Arsinoites	240 AD	P.Mich.XI.620 (=SB.VIII,9898)
	Arsinoites	A.D. 164	P.Rainer Cent. 60
Public Mills (Government Mills)	Oxyrhynchos	199-200 AD	P.Oxy. VI. 908
Public Mills (Mills annexed to Temples)	Soknopaiou Nesos (the mill in the estate of Pasias, close to the settlement of Heraclia)	166-167 or 198/199 AD	P.Lond II.335
	Oxyrhynchos	163-164 AD	P.Mert. II.73
	Busiris (Herakleopolites)	18-17 BC	BGU IV.1202.

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I: Ancient Sources and Greek Papyri

For abbreviations of ancient sources and papyri, we adhere to the conventions of Checklist of Editions of Greek, Latin, Demotic, and Coptic Papyri, Ostraca, and Tablets (<https://papyri.info/docs/checklist>) and the texts and translations of Greek papyri as they appear in the Duke Databank of Documentary Papyri (<https://papyri.info/>). If a different text is used than that of the DDbDP, it is recorded in the footnote.

- **P.Athen.** = *Papyri Societatis Archaeologicae Atheniensis*, ed. G.A. Petropoulos. Athens 1939. (Pragmateiai tês Akademias Athênôn 10). Nos. 1—70. [MF 1.64; rp. CG]. Further texts published in *Anekdotoi philologikoi kai idiôtikoi papyroi*, ed. M.G. Tsoukalas. Athens 1962. (Bibliothêkê tês en Athênais Philekpaideutikês Hetaireias 17); reprinted in SB VIII 9860—9862.
- **BGU** = *Aegyptische Urkunden aus den Königlichen (later Staatlichen) Museen zu Berlin, Griechische Urkunden*. Berlin
- **Chrest.Wilck. (or W.Chr.)** = L. Mitteis and U. Wilcken, *Grundzüge und Chrestomathie der Papyruskunde*, I Bd. Historischer Teil, II Hälfte Chrestomathie. Leipzig-Berlin 1912. Nos. 1—382. [MF 2.120—121 (with Grundzüge); rp. GO, see Chrest.Mitt.] **P.Col.** = *Columbia Papyri*.

- **P.Flor.** = *Papiri greco-egizii, Papiri Fiorentini* (Supplementi Filologico-Storici ai Monumenti Antichi). Milan. [Rp. BdE]
- **P.Lond.** = *Greek Papyri in the British Museum*. London. At present 7 vols. (Vol. VI continues the numerical sequence of the London papyri, but forms a separate publication regarded as vol. VI only retroactively. Up to the end of vol. III, texts are usually cited by volume no., serial no., and page.) There are separate atlases of plates to vols. I—III. [Atlases, MF 2.111, 2.112, and 2.113]
- **P.Mert.** = *A Descriptive Catalogue of the Greek Papyri in the Collection of Wilfred Merton*
- **P.Mich.** = *Michigan Papyri*. Each volume has a subtitle of its own. The numerical sequence of volumes as a single series was not established until vol. II. Vol. I is often referred to as P.Mich. Zen
- **P.Mil.Vogl.** = II, *Papiri della Università degli Studi di Milano*, ed. by many collaborators. Milan 1961. Nos. 29—110. p.mil.vogl;2
- **P.Oxy.** = *The Oxyrhynchus Papyri*. Published by the Egypt Exploration Society in *Graeco-Roman Memoirs*. London. The number in parentheses at the end of each entry is the number in this series. Earlier vols. carry the heading of Egypt Exploration Fund, Graeco-Roman Branch; even after the title change numbers were not assigned to the volumes until the 1950s. The system followed here is that adopted retroactively by the EES. [all vols. EES]
- **P.Rain.Cent.** = *Festschrift zum 100-jährigen Bestehen der Papyrussammlung der Österreichischen Nationalbibliothek, Papyrus Erzherzog Rainer*. Vienna 1983. Nos. 1—166. Nos. 1—2 are hieroglyphic; 3—5 Demotic; 6—12 Coptic; 13 Pehlevi; 14—19 Hebrew; 20—162 Greek; nos. 163—166 Latin. All these texts are on papyrus. Separate volume of plates. [ÖNB]
- **P.Ryl.** = *Catalogue of the Greek and Latin Papyri in the John Rylands Library, Manchester*. Manchester.
- **PSI** = *Papiri greci e latini*. (Pubblicazioni della Società Italiana per la ricerca dei papiri greci e latini in Egitto). Florence. The first eleven volumes were edited by a number of persons under the general direction of G. Vitelli and M. Norsa. A list of reeditions of documentary texts is given by P. Pruneti in *Pap.Flor.* XIX.2, pp. 475—502. Volumes 16- are published under the title *Papiri della Società Italiana* in the series Edizioni dell'Istituto papirologico G. Vitelli.
- **P.Tebt.** = *The Tebtunis Papyri*. London.
- **SB** = *Sammelbuch griechischer Urkunden aus Aegypten*. (A collection of documentary papyri, ostraca, inscriptions, mummy tablets and related texts published in journals or unindexed catalogues. Begun by F. Preisigke in 1915, continued by F. Bilabel, E. Kiessling, and H.-A. Rupprecht). In progress.
- **UPZ** = *Urkunden der Ptolemäerzeit (ältere Funde)*, ed. U. Wilcken. (Re-publication of texts published in the nineteenth century, up to but not including the Petrie papyri. There is a concordance at BL IV, pp. 118—123.
- **P.Wisc.** = *The Wisconsin Papyri*, ed. P.J. Sijpesteijn. P.Wash.Univ. = Washington University Papyri

- **O.Stras.** = I, Griechische und griechisch-demotische Ostraka der Universitäts- und Landesbibliothek zu Strassburg im Elsass, ed. P. Viereck. Berlin 1923. Nos. 1—812; a few are Demotic or bilingual. There is an index to the Demotic material. [MF 1.79]

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الملخص العربي

مطاحن الغلال في مصر خلال العصرين البطلمي والروماني

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كان الخبز وما زال بالنسبة للمصريين احد اهم الاطعمة حيث يُستهلك يوميًا. ونتيجة لذلك، اهتم المصريون القدماء في العصور المختلفة بإنتاج الخبز من خلال عدد من الخطوات. وإحدى هذه الخطوات هي الطحن، وذلك لتحويل الحبوب إلى دقيق يستخدم في صناعة الخبز. كان طحن الحبوب مهمة هامة كانت تتم في كل بيت مصري قديم تقريبًا. وكان طحن الحبوب يتم من خلال الطواحين أو أحجار الرحي التي تطورت من عصر إلى عصر. ومن ثم، تلقي هذه الدراسة الضوء على الطواحين المستخدمة في طحن الحبوب في مصر البطلمية والرومانية. وتتضمن الدراسة أنواع الطواحين المختلفة ومن يملكها. كما يهدف هذا البحث أيضا الي التعرف علي أنواع الحبوب التي تطحنها الطواحين وكذلك إيجارات الطواحين وبيعها. ويعتمد الباحث في هذه الدراسة علي الوثائق البردية بالإضافة إلى الشواهد الأثرية في مصر خلال العصرين البطلمي والروماني. وسوف يستخدم الباحث المنهج التاريخي التحليلي لدراسة الوثائق بالإضافة إلى الدراسة الوصفية للشواهد الأثرية للمطاحن. تؤكد الدراسة علي الاهمية الاقتصادية التي لعبتها المطاحن في الحياة اليومية في مصر اليونانية الرومانية؛ فقد كانت تستخدم لإنتاج الدقيق اللازم لإنتاج الخبز. وتشير النتائج الي انهم استخدموا أنواعاً مختلفة من المطاحن وايضا تنوع ملكية المطاحن ما بين المنازل والمطاحن التابعة للحكومة والمعابد والضيعات الكبيرة.

الكلمات المفتاحية: المطاحن – الغلال- الرحي - البطلمية - الرومانية