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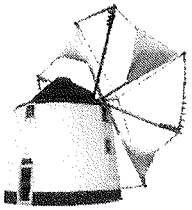

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EDITED BY
JORGE AUGUSTO MIRANDA
MICHAEL HARVERSON

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EUPHROSYNE RIZOPOULOU - EGOUMENIDOU

CORN-GRINDING WATERMILLS IN CYPRUS (18TH – MID 20TH CENTURIES)

INTRODUCTION

Cyprus is the third largest (9,250 sq. kilometers) island in the Mediterranean, after Sicily and Sardinia. Its economy was based mainly on farming, stockbreeding and the export of agricultural products. The Island produced wheat and barley in abundance and Cypriot bread was well known from ancient times (for references in antiquity see Michaelides 1998, 29-31). Therefore, corn-grinding mills had a dominant position in everyday life in traditional, pre-industrial Cypriot society.

In this paper I will proceed with a brief exposition of the mills of Cyprus with reference to their sources of energy, and then I will concentrate on the watermills. I chose these because of their connection with water, a source of life very precious to Cyprus still, but also because the watermill was the most common and widespread kind of mill on the Island. Before the exploitation of waterpower, other sources of energy used for grinding were human and animal muscle power and probably wind power.

When in 1801 the Rev. Edward Daniel Clarke was entertained in a house located in the village of Athienou, he observed upon the ground "the sort of stones used for grinding corn, called querns in Scotland, also common in Lapland and in all parts of Palestine" and commented further on them as follows: 'These are the primeval mills of the world; and they are still found in all corn countries, where rude and ancient customs have not been liable to those changes introduced by refinement. The employment of grinding with these mills is confined solely to females; and the practice illustrates the observation of our Saviour alluding to this custom in His prediction concerning the Day of Judgment: "Two women shall be grinding at the mill; the one shall be taken and the other left"' (Cobham 1908, 385). In Cyprus, the hand mill was an indispensable implement in every household and was still widely used until the middle of the 20th century.

The Roman hour-glass-shaped Pompeian style mills also operated by manpower, as well as by harnessed animals. Those found in Cyprus were manufactured from Levant lavas. Mule-driven flour mills are documented for the mediaeval period in Ammochostos and Nicosia: "Molin de bestes a Nicossie" are mentioned, for example, in a Cypriot document of 1367 in the Vatican Archives (Richard 1962, 104), while, according to the Relatione di Domenigo Trevisan (A.S.V., b.84, f 6v) in 1560 there were 14 "molini da cavallo" in Famagusta. Flourmills worked by animals ("vortonomyloi") were very popular until the first decades of the 20th century in Ammochostos district.

Man- and animal-driven mills, based on rotary motion, were also used for crushing olives from the Hellenistic period down to the 20th century and are still occasionally employed for grinding wheat for the preparation of "ressi", the festival meal in traditional weddings (made of wheat and mutton).

As I have proved in my recent research (Rizopoulou – Egoumenidou 2001, 10-16 and Rizopoulou – Egoumenidou 2001a, 397-423), windpower was exploited in Cyprus and corngrinding windmills did exist. They belong to the Mediterranean type of cylindrical tower mills with rotating cap, which has been traced from the Dardanelles to the coast of North Africa. Their presence on the Island is well documented for the period from the 18th to the early 20th century, but they may have existed during the mediaeval period or even earlier. The geographical distribution of windmills shows that they existed in those regions where scarcity of water and lack of appropriate geomorphology did not allow the construction of watermills, whereas, on the other hand, weather conditions were favorable for the exploitation of windpower. In fact, winds were not especially favorable and this, together with other factors, explains why the Cypriots did not trust windpower to the extent that other islanders (e.g. in the Aegean) did, and preferred to grind their abundant grain in watermills.

Waterpower was the main source of energy exploited in Cyprus. In general, watermills tended to be preferred even when conditions favoured the use of windmills, for several reasons: watermills were cheaper, easier and quicker to construct, they tended to suffer less wear and tear, and the miller's task was less arduous.

It is worth noting that waterpower has also been used in the past for the operation of cane sugar mills. In Cyprus cane sugar production developed into an industry of vital importance from the late 13th to the 16th century. Remains of sugar refinery buildings and installations have been excavated in Kouklia (Paphos), Episkopi and Kolossi (Limassol). According to archaeological evidence, a two-stage milling process was used for sugar cane. In the first stage the cane was crushed in an animal-driven mill with a large runner-stone revolving in a vertical position; in the second stage the mash produced by crushing, was squeezed out by a water-driven mill with a horizontal wheel (for cane sugar mills see: Wartburg 1983, 298-314; Wartburg 1992, 207-254; Wartburg 1995, 126-153; Brigitte – Porée; 1995, 377-510; Solomidou – Ieronymidou 1997, 65-71).

The Ottoman conquest of Cyprus in 1571, interacting with the growing competition from cheaper West Indian cane sugar, put an end to the sugar industry of the island, and by the early 18th century, according to the traveller Heyman, the Greeks were entirely ignorant of the process (Cobham 1908, 247). Corn-grinding watermills operated in parallel with sugar mills but they had a much longer history, which can be followed from the 12th to the 20th century.

The scope of this communication is to present the water-driven flour mills from different aspects: their historical perspective, their connection with water and water rights, the mill buildings and installations, including the hydraulic works related to them, the milling process, the location and distribution of watermills, their role in rural economy and traditional life, furthermore the treatment of both the mill and the miller in folklore; finally the decline of the watermill and the changing attitudes to the mill as an object of cultural heritage.

HISTORICAL PERSPECTIVE

The earliest known reference to watermills in Cyprus is in the 12th century register of the possessions of the monastery of Theotokos ton Krineon in the village of Lithiko near Vasilia in Kyrenia district (Constantinides and Browning 1993, 57-59). References to watermills occur frequently in mediaeval documents. "Custodi aque molendini" are mentioned, for example, in 1317-1318, in Psimolofou, and a "molin de l'aigue" in 1468 in Agros (Richard 1947, 131, 142; Richard 1983, 118).

The most renowned, however, were the watermills of Kythrea (13 km to the northeast of Nicosia). Kythrea had the highest concentration of watermills, due to the abundance of water from the spring of Kefalovryso. These watermills are the most frequently mentioned in written sources from the Frankish period onwards. They are referred to as royal. In 1210 King Hugh I conceded to the Knights of St. John the right of grinding their corn in the mills of Kythrea, and ten years later the widow of Hugh, Queen Alice, conceded on a permanent basis the right of use of the royal flour mills, free of all charges and tolls, to Archbishop Eustorge and the Church of Nicosia, for the redemption of the souls of the king, the queen and their forebears (Coureas and Schabel (eds) 1997, 167-168, no 62).

In 1232, the Longobards of Friedrich II, destroyed the watermills at Kythrea (Hill II, 1948, 119), but this was soon put right and, according to Florio Bustron, in the 16th century there were more than fifty mills in the area (Bustron, 29).

Under Venetian rule, the Republic had considerable profit from renting the mills of Kythrea. According to documents in the State Archives of Venice, in 1513, two of the mills were sold to an individual for 2,257 ducats (Aristidou 1994, 149-153). By the end of the 16th century, Estienne Lousignan refers with admiration to the water, which operated the mills of Kythrea, and irrigated an area full of gardens, cotton plantations and grain (Lusignan 1580, 33). In 1683 Cornelius De Bruyn from the Hague, made the first known drawing of Kefalovryso and described the spring-head: "It lies under a hill and disperses itself in several directions. The water falls first into an oval basin, and with such swiftness that it eddies round and round" (Iacovou 1997, 278, Cat. no 189; Cobham 1908, 237). About a hundred years later, Giovanni Mariti was impressed by Kefalovryso, where three large jets threw so much water that a few paces only from the source it turned a mill and many more below for grinding grain for the neighborhood and for the city of Nicosia (Mariti (1769)1971, 60-61). In 1790, Michael de Vezin counted 32 watermills in Kythrea (Cobham 1908, 373), and as

many are still remembered by their name by the people of the village, who were forced to abandon their homes in 1974 because of the Turkish invasion. The names of most watermills were preserved as mentioned in documents and recall their mediaeval past.

Kythrea overlooks the plain of Mesaoria, the granary of Cyprus and, being close to Nicosia, its mills were of strategic importance. During the period of Ottoman rule, there were instances of uprisings, as in 1680 and in 1765, when rebel Turks, in order to force their Governor to yield to their demands, captured the mills of Kythrea, thus causing starvation from lack of bread in the capital (Kyprianos (1788) 1902, 461-462 and 479).

A very important aspect of the history of mills is their ownership. Mills were an essential part of Ottoman *chiftliks* (agricultural estates). Many of them belonged to the Church. The rich monastery of Kykkos owned watermills all over the island (Perdikis 1989, 21, note 9). The Dragoman of Cyprus Hadjigeorgakis Kornessios (Dragoman from 1779 to 1809) exploited five watermills at Kythrea and profited from their rent as well as from the trade in millstones (unpublished manuscript of Hadjigeorgakis' list of property). Other mills fell within the category of *vaqf* (religious foundation) property - like the mill of the Selimiye Mosque (St. Sophia) - and were rented out to individuals, Greeks or Turks, who could concede their rights to other persons in return for money. In the case of death, the rights were inherited by male descendants and if there were none, they went back to the *vaqf*. Sales or other deeds were ratified by documents (*tezkere, sened, hüjjet*, etc.), many hundreds of which have survived and elucidate the history of the watermills, as well as their economic importance. When the British arrived, in 1878, a great number of watermills belonged to Turks, but most of them were gradually purchased by Greeks, and are often found to be shared by many owners.

WATER AND WATER RIGHTS

It might seem strange that in a place like Cyprus, where lack of water has been a longterm problem, waterpower was the main source of energy used for the grinding of grain. This meant that in a time of drought, which is often recorded in documents, there was not only a want of water but also of bread. In fact, the geological evolution of the Troodos mountain range over more than 20 million years, especially its differential uplifting, created an impressive topography with an altitude of about 2,000 m. The topography increased dramatically the perennial precipitation (more than 1,000mm) and the penetration of water into its deeper parts. This underground water formed springs at various elevations of the Troodos mountain range and supplied water to the rivers even during the dry seasons (information from the geologist G. Constantinou). Water was exploited wherever possible both for irrigation and milling, but, as it was a precious asset, proper management was necessary. Looking in the past, we find that the use of water was mostly regulated by custom. The sharing of the water of the Solia River, for example, was regulated by things such as the length of a man's shadow or the rise of stars, the Pleiades or Orion (Christodoulou 1959, 89-90).

Water rights in the case of large perennial springs like Kythrea and Lapithos were regulated by rules established since mediaeval times. An ordinance of 1413, for example, dealt with the ownership and division of rights in the use of the spring at Kythrea, and mentions also a "neroforo" as inspector of water (Mas Latrie, II, 1852, 504). The water was divided into branches known after the name of the locality for which it was destined: "Voniatiko", "Trakhonitiko", etc. Holdings of water from springs were measured in hours per week or fortnight, and the same system is documented from the 12th down to the 20th century. The pressing need for water is clearly reflected in the litigation about water rights, which appears frequently in written sources.

Under Ottoman rule, firmans granted by Sultans conferred extensive water rights on favorite persons or groups, to such an extent that there were rivers completely owned by individuals. Large water holdings by religious institutions were also common. Water rights constituted an important item of property, as did watermills. In times of drought, disputes were violent and often led to bloodshed. The complicated water rights in Cyprus were subsequently respected by the British legislation because they were deeply rooted in the past and had developed along with the population (Ohnefalsch – Richter (1913) 1994, 27).

HYDRAULIC WORKS; MILL BUILDINGS AND INSTALLATIONS; THE MILLING PROCESS.

In Cyprus, there are only isolated examples of waterpowered mills with a vertical, externally mounted wheel (Avlona, Akaki, Akanthou); the vast majority of Cypriot watermills – like those in the Balkans and Asia Minor - were provided with a horizontal wheel, which could be turned by considerably less water. Hydraulic infrastructural works made in order to divert, collect, store and direct the water, form an important part of watermills. The most impressive hydraulic installations preserved in Cyprus, are connected with the watermill in the village of Pyrgos, near Limassol. Here a spring entered the stream of the river where a dam raised the water level sufficiently to feed a rectangular cistern 24, 80x19, 50 m., bisected by a wall. A canal must have brought water about 500 m. to a triangular cistern, which fed the mill. The water was channeled to the angle facing the mill, dropped about 7m. from the mill race, turned the mill and then went into the stream. The entrance to the room, which once housed the waterwheel, is a Gothic arch. This sophisticated hydraulic system is regarded as a typical work of the Latin monastic order of the Cistercians, who had actually founded a monastery in Pyrgos about 1240 and (although they departed after 15 years) they preserved their property there until the 15th century, perhaps even later (Schabel 2000, 354).

In the traditional mills of later times, hydraulic works were simpler and on a smaller scale. Water from a river or spring was directed to the mill by means of a feeder channel, which could be dug out of the earth, or rock-cut, and then continued with an aqueduct which brought the water to a tower-like mill race.

The aqueduct, in the form of a rendered channel, ran along the top of a tall stout wall, sometimes with buttresses on either side. In other cases the aqueduct was carried on an arch or a series of arches, which, apart from saving labour and building materials, facilitated movement from one side of the field to the other, not to mention their aesthetic value. The water channel ended on the top of the shaft of the tower. The penstock or chute conveyed the water down behind the working floor of the mill building to the nozzle in the wheel chamber.

The droptower is the dominant feature of the mill, a durable structure commonly 5 - 9m. high. It appears in a variety of forms: in most surviving examples it is square or rectangular in plan with steps on the front or on all three sides. These types are common mainly in the Aegean islands. There are cases, however, as in the region of Mavrokolymbos, in Paphos, where towers are cylindrical. This type appears also in some Greek islands, like Crete and Kea. The interior of the water tower is cylindrical or in the shape of an inverted truncated cone or pyramid, and is covered, as also the channel, with impermeable plaster in order to retain the water and facilitate its flow. The average diameter is 80cm to 1m.

Aqueducts and water towers are impressive stonebuilt structures, which still form a striking feature of the Cypriot landscape. The use of local stone in each case differentiates their masonry and general morphology.

The mill building is placed in contact with the lower visible part of the tower. It usually consists of one room, either rectangular or square in plan, covered with a flat, sloping or pitched tiled roof, which rests on beams or on stone arches. The whole is constructed according to local tradition and with building materials of each region. As a rule, mill buildings are stone structures, but there are also examples with mud bricks superstructure (e.g. in the village of Pera, Nicosia district). They have a plain and unpretentious façade interrupted by the entrance and one or two windows. The floor was in most cases covered with slabs or cobbles.

Adjoining or separate auxiliary rooms served as storerooms or stables, or as accommodation, should work continue into the night. The miller's residence could be either part of the same building or a separate unit nearby.

As it was standard practice to divide the mechanism of the watermill into two sections, the mill building was constructed always on two levels: At the lower level was a narrow vaulted room which housed the waterwheel with its fittings and above it the main work room with the grinding machinery consisting of the millstones with their fittings. There were also auxiliary systems for regulating the millstones, transmitting and converting the power, stopping the mill, and so on.

through the floor of the workroom and transmitted the motion to the grinding mechanism. The lower end of the shaft rested on a beam of wood, this forming the lower bearing. At the back of the room housing the waterwheel, one could see a large piece of stone with a hole bored through it. This was wedged into the chute at the base of the tower, and it was from this hole that water sprayed onto the paddles of the wheel.

Depending on the water supply and affecting the power provided, wooden nozzles of varying diameters were used.

Typology and size of watermill buildings changed little throughout the ages, though, as far as the placing and function of millstones is concerned, remarkable changes took place when the first industrial techniques were applied. Accordingly, two main categories of watermills exist today: 1) the traditional or pre-industrial mill and 2) the technologically advanced, proto-industrial mill. In the first category the pair of millstones is embedded in the floor exactly above the vaulted chamber of the waterwheel, so that the waterwheel and the runner stone are rotated by means of the same vertical axle. Next to the millstones, at a lower level, a stone trough was constructed for the collection of the flour. None of these watermills is in an operational state today.

Millstones used in this type were imported from the island of Melos. Melian stone was most suitable for grinding as it was porous and with a rough surface. These millstones were never monolithic, but were assembled out of many pieces (14 to 20 or even more) bound together with metal hoops. Apart from surviving millstones in Cyprus, there is evidence from written sources about the trade in Melian millstones, which were exported to all parts of the Mediterranean, including Cyprus. The export of Melian millstones to Cyprus is mentioned by Saulger in the 1670s (reference in Vrettou – Souli 2002, 80-81).

In the second category of watermills, the millstones were removed from the axle of the waterwheel and were placed on a timber platform approximately 1, 00 m. above the floor level. This innovation was introduced when a second pair of millstones was installed in the mill, and is associated with the use of French millstones, which were imported by the end of the 19th century from La Ferté-sous-Jouarre, near Paris. These were driven by a horizontal wheel, which was set onto the waterwheel axle and was connected with a belt to a steel wheel below the French burrs. The Melian millstones were also placed on the timber platform, next to the French set, and were mainly used for grinding barley. The belt wheel on the waterwheel axle was used to drive either the Melos millstones or the French set, or both. This arrangement is also found in more modern mills, which operated with diesel motors or electricity.

French millstones found in Cyprus are composed of 4-7 pieces held together by steel bands. All of them have a plaster backing and bear, impressed in the plaster, the trade mark with the initials S.G.M. (Société Générale Meulière). The runner stone bears also a metal trademark fixed into it, with the following inscription cast in relief: MEULES À MOULINS SOCIÉTÉ GÉNÉRALE MEULIÈRE LA FERTÉ-SOUS-JOUARRE.

French millstones had grooves on the grinding surface, which created a scissor-like cutting action on the grain and facilitated the cooling of the flour.

With use, the millstones lost their coarse surface and had to be dressed periodically with an iron bill. The

surface of the Melian millstones was made rough again, while "dressing" for the French millstones meant the remaking of their grooves. This tedious job was usually a specialist's task, not easy for every miller to do. In order to be "dressed", millstones were lifted either with a lever, or with a stone-crane.

Over the set of millstones was placed an inverted pyramid-shaped hopper for the grain. A feed shoe from the aperture at the base of the hopper, ensured a constant flow of grain to the millstones .The millstones were encased in a larger tun, which trapped the meal as it was flung out and directed it to a chute.

French millstones improved the efficiency of the output as well as the quality of the product, and have long been considered the finest for grinding wheat (for millstones in Cyprus see Egoumenidou and Myrianthefs 2003, 175-183).

The waterwheel, originally made of wood and later of metal, was fixed to a vertical shaft, which passed through the floor of the workroom and transmitted the motion to the grinding mechanism. The lower end of the shaft rested on a beam of wood, this forming the lower bearing. At the back of the room housing the waterwheel, one could see a large piece of stone with a hole bored through it. This was wedged into the chute at the base of the tower, and it was from this hole that water sprayed onto the paddles of the wheel.

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LOCATION OF WATERMILLS

In Cyprus there were mills situated in mountain regions near to the source of the water, river or spring, but also valley mills, which were fed by a contour leat from a considerable distance upstream. As a rule, however, mills were built in sites with a steep incline, which allowed for a fast flow of water above the mill and an efficient run off below. The features of the landscape were utilized to the utmost. Depending on the availability of water, mills could be found within the villages or on their outskirts, but also at a distance from them, along rivers or streams. Mills were often arranged in small groups, or in larger complexes along the river, making use of the water one after another. Chains of mills are found in the village of Kritou Terra (Paphos), in Karavas and in Lapithos, where the water was carried by an aqueduct of dressed stone down the hill and passed from one mill to another. The most interesting case, however, was the 32 mills of Kythrea, which were fed from the head-spring. Two of these mills, "Kefalovrysos" (head-spring) and "Iatros" (doctor), received a double quantity of water. There is no archaeological evidence that they operated with two sets of millstones; at "Iatros" mill only one metal wheel was recently found on the site and there is insufficient space in the underhouse for a second wheel. What is certain is the fact that its droptwoer was a substancial one, buttressed at the base to contain the great pressure. After "Kefalovrysos", the water was divided into two halves and there was a series of six mills on either side. The water was then reunited and, after operating the "Iatros" mill with its two waterwheels, it was divided again to turn two more series of mills.

Mills served not only neighbouring villages, but often those in a wider area. In 1879 Sir Samuel Baker noticed that the corn was brought from great distances to the mills of Kythrea, e.g. from Larnaca, 40 km away (Baker 1879, 74-75). Access to the mills was also very difficult, due to lack of a proper road system. Old people still remember how hard it was to cover long distances on foot and to cross flooded rivers with mules laden with wheat and barley or flour.

DISTRIBUTION

Watermills were not evenly distributed throughout Cyprus. Most of them existed in the western part of the island, where there was abundance of water and appropriate geomorphology. In the district of Paphos the distribution of mills coincided with the areas of wheat cultivation, while in the eastern part the pattern shows the general maldistribution of the watermills (compare distribution of mills and wheat cultivation in Christodoulou 1959, 101, fig. 58, and 127, fig. 64). In Mesaoria and the Karpas, windmills and animal-driven mills were used as a substitute, but most grain was transported to Kythrea.

THE ROLE OF WATERMILLS IN RURAL ECONOMY AND TRADITIONAL LIFE

Until the recent past, the economy of Cyprus was based almost exclusively on agriculture, and grain was of vital importance, both for home consumption and export trade. The Turkish Government exercised a monopoly on the sale of wheat, though cases of illegal export and black marketing were not unknown. Wheat and barley production was abundant though it suffered from major fluctuations due to the variability of rainfall.

Moreover, locust attacks, serious droughts and famine have been all-too-familiar features in the past, causing considerable hardship to the people. Thus, in the drought of 1835 the tax-gatherers removed the beams from peasants' roofs (Report by Acting Consul Lang upon the Commerce of Cyprus for the Year 1870, in Papadopoullos (ed.) 1980, 128; see also Christodoulou 1959, 91). The importance of grain is the reflection of a subsistence economy prevailing on the island down to the 20th century.

Bread, much praised by foreign travellers as the best in the Levant, was the main source of nourishment for the vast majority of the population. According to Surridge's survey of rural life in Cyprus in 1929, a family 64with three children consumed 3 okes (1 oke = 1,280 kg) of bread a day (Surridge 1930, 31). People actually

lived on bread. It was baked at home at least once a week, and because flour could not be preserved in storage for a long time, frequent visits to the mill were necessary.

Milling was a rural activity closely tied to areas of production before it became an urban industry. Watermills were not just a source of profit for the rulers, they also responded to the requirements of the wider strata of the population. Elderly people still remember watermills working day and night throughout the year. The production capacity, however, varied and, depending on water, many mills were seasonal.

THE MILL AND THE MILLER IN FOLKLORE TRADITION

Until the middle of the 20th century watermills formed an integral part of everyday life in the Cypriot countryside. The important role of the mill in rural society is reflected in its special treatment in folklore, proverbs, tales and songs. Grain had to be sifted through a sieve, washed, dried and put in sacks in order to be carried by mules or donkeys to the mill. People, usually women, might spend days and nights there, waiting their turn. Mills were places of social intercourse, and the miller or his attractive wife appeared as protagonists in love affairs, which were favoured by the dark, mystical atmosphere of the mill. People believed that it was in remote watermills that goblins and ghosts took refuge. As for the miller, he was usually paid in kind, 4-5%, and was totally dependent on his customers. Nevertheless, he was usually considered a thief. This is expressed in many sayings, proverbs and tales, but also in scenes of the Last Judgment depicted in Byzantine churches, in which the miller is represented, among other sinners, with two heavy millstones hanging round his neck (see fig.10).

It is worth noting that the hand mill was also used as an instrument of torture: According to the chronicle of Leontios Makhairas, Queen Eleanora, in order to punish the king's (Peter I, 1359-1369) pregnant mistress, ordered her women to grind with a hand mill upon her womb. Although they ground two measures of flour, she did not have a miscarriage (Dawkins 1932, 234).

Protective symbols, which are a common feature above doorways of houses, seldom occur on mill buildings, but sometimes appear, either in the form of apotropaic faces (designed to ward off evil) or a cross in relief, to avert the evil eye. On the other hand, antagonisms occasionally led to the appeal to harmful supernatural powers. Magic spells, which survive in manuscripts, were cast for the destruction of the mills.

THE DECLINE OF TRADITIONAL WATERMILLS

No magic spells were needed for the decline and desolation of traditional watermills.

Over-exploitation of water resources, along with the decrease in rainfall (14% in the last 100 years), deprived mills of their driving power. The international economic crisis of 1929 – 1931, was followed by the severe drought of 1932 – 1933, which seriously affected agricultural production. More and more mills became seasonal. In Kythrea particularly, the sinking of wells, but mainly the diversion of water from the spring for irrigation and the water supply of 13 villages in Mesaoria, in 1956, caused the exhaustion of the main spring. By the time of the Turkish invasion in 1974, only one mill, "Stephanos", was still working.

British rule brought with it the development of technology from the pre-industrial to the industrial stage. A crucial factor, which caused the decline of watermills, was the introduction of steam-mills and then the installation of diesel motors in many villages. These were independent of weather conditions, more conducive to production and labour-saving. According to figures published in the Cyprus Blue Books, until 1919 there were between 300 and 400 watermills operating on the island. They worked in parallel with windmills and animal-driven flour mills, as well as with steam mills, which had made their appearance by the end of the 19th century.

During the decades following 1920, watermills remained predominant as compared with steam mills, while windmills and animal mills were abandoned. From the early 1930s onwards watermills decrease, while steam mills show a gradual increase, with some fluctuations, until in 1941 the balance changes in their favour.

Apart from the reasons mentioned above, other factors contributed to the decline of traditional milling: Better employment opportunities resulted in a shift of the population from village to town, while the improved road network brought the rural population closer to the flourmills of the urban centres.

In post-war years a larger and larger non-food-producing population comes into existence and with a higher standard of living the market towns play a more important role, distributing food also to the rural areas. Thus, a very large number of villages buy their bread from the town, and have it transported by bus. On the other hand, increasing urbanization causes the abandonment of many villages. The final blow to traditional watermills was dealt in the 1950s by merchant milling, using more powerful machinery (roller mills) to produce flour for the growing urban population.

THE WATERMILL AS AN OBJECT OF CULTURAL HERITAGE

Following their abandonment, mill buildings fell into disrepair. However, wherever there was no destructive human intervention, mills withstood the wear and tear of time; more than two hundred examples still exist, though in a ruinous state and in most cases overgrown by vegetation. Chronologically they fall within the periods of Ottoman (1571-1878) and British rule (1878-1960), dating from the 18th to the early 20th century, and it is only in isolated cases that we can trace them to the mediaeval past. Twenty-four watermills have been declared "Ancient Monuments" by the Department of Antiquities, but only nine of them have been repaired or restored. Another three have been listed for preservation by the Town Planning Department. The mill in Kakopetria has been restored by its owner, who runs a restaurant there. Only one is still grinding corn, the mill of Styllis in Evrychou.

The watermills of Cyprus have never been studied systematically. Apart from a small book on the mills of Kythrea (Yiannos 1997), and a few articles (e.g. Morris 1984), no other published bibliography exists. Valuable information, however, is scattered in numerous documents. In 1999, within the framework of the programme "Thrace – Aegean – Cyprus", and on behalf of the University of Cyprus, a team comprising seven architects, one historian, one geologist and one archaeologist, started a systematic recording of all the watermills preserved on the island. Research continued after the end of the two-year programme and is still in progress, with a view to publishing all the watermills of Cyprus in a comprehensive work. Relevant to this research was the excavation, in June 2001, of the watermill in the village of Pyrgos, in collaboration with the Department of Antiquities and with the participation of students from the University of Cyprus (Rizopoulou – Egoumenidou, Myrianthefs and Hadjichristofi 2002, 381-399).

Watermills are important monuments of traditional architecture and pre-industrial technology. Furthermore, there is an intangible, intellectual heritage based on the mill, which can be studied only as long as the last generations of people who lived in, or worked or used the mills are still alive. In accordance with the international tendency to treat mills as objects of cultural heritage and as significant witnesses to social history, a further target of our research is to promote the preservation of the Cypriot watermills and to enhance their integration in modern society.

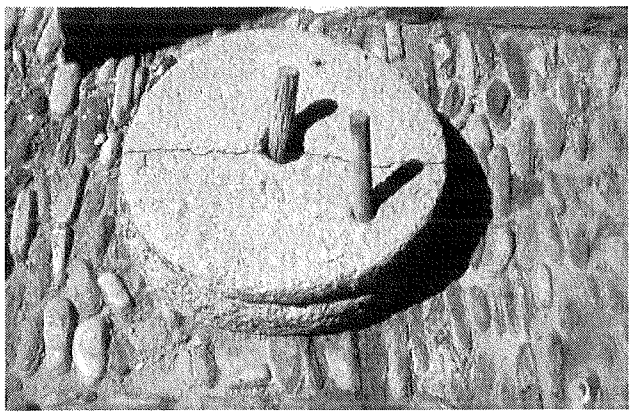


Fig. 1: Handmill. Ethnographic Museum, Paphos.

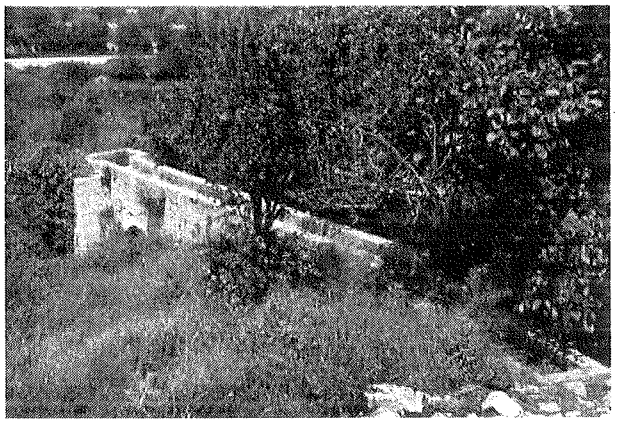


Fig. 3: Aqueduct and droptower of a watermill in Kritou Terra, Paphos.

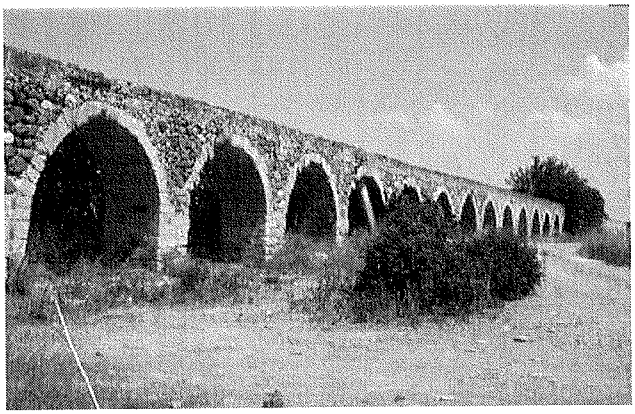
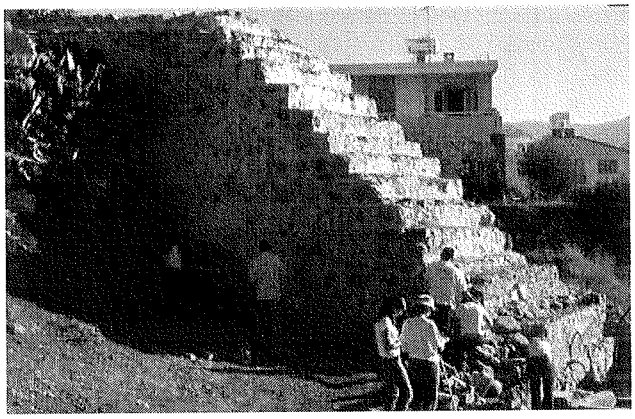
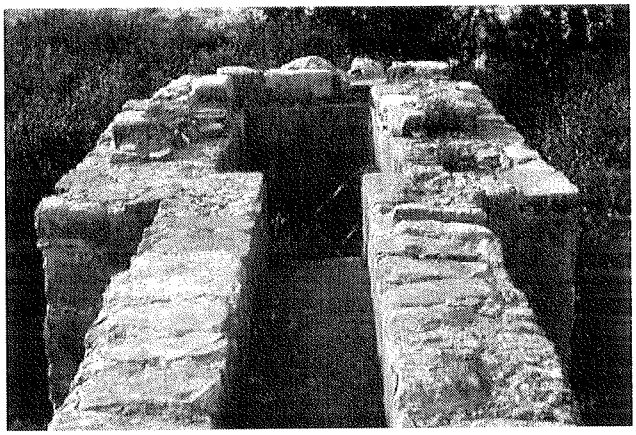


Fig. 4: Part of the long aqueduct of a watermill in Avlona, Nicosia district.





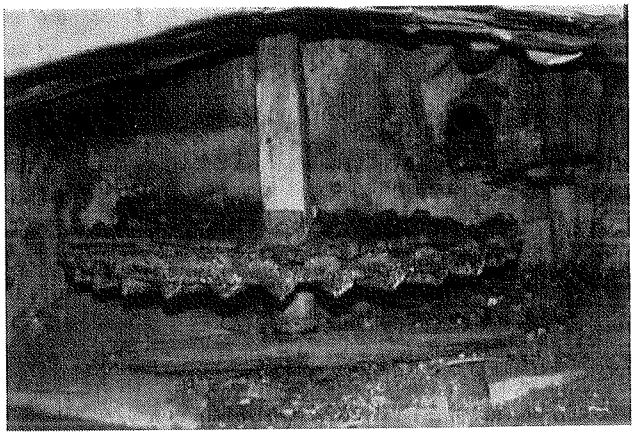


Fig. 2: Corn grinding windmill in Yialousa, Karpasia, Famagusta District (above)

Fig. 5: The watermill in the village of Pyrgos, Limassol district (under fig. 4)

Fig. 6: Stone-built channel bringing water to a tower-like mill race, Agios Savvas, Karonos, Paphos (left)

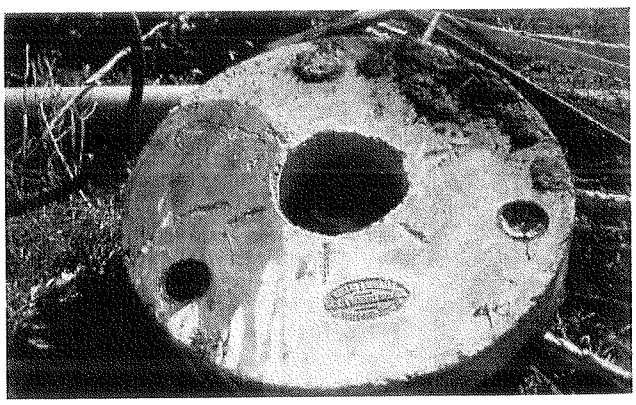


Fig. 7: Horizontal wheel of a watermill in Paphos. The nozzle can be seenin the background of the chamber (left)

Fig. 9: Millstone imported from La Ferté-sous-Jouarre, in a watermill in the village of Pera Orinis, Nicosia district (above)

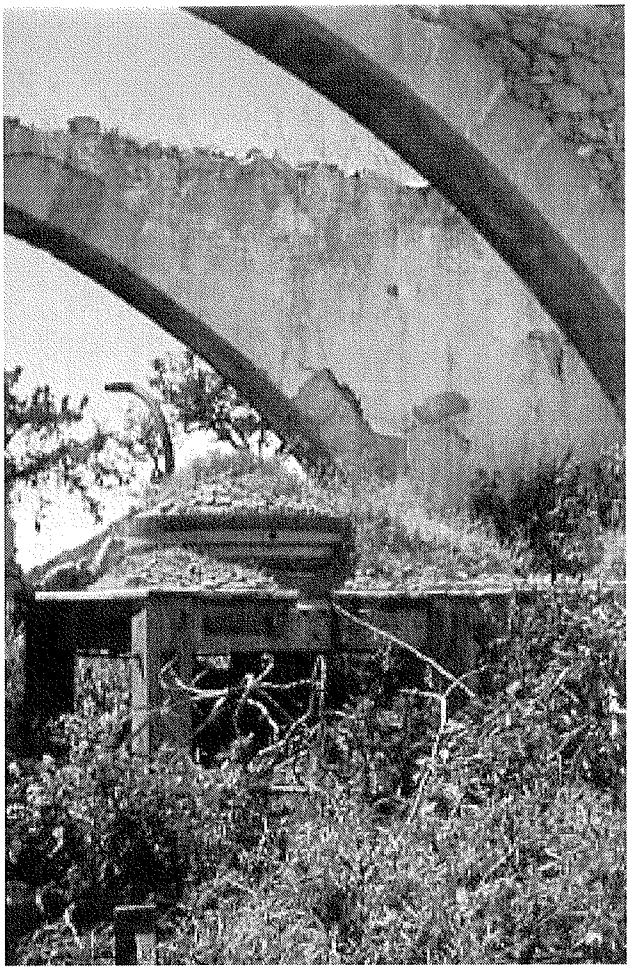


Fig. 8: Two pairs of millstones placed on a timber platform. Proto-industrial mill in Galinoporni, Karpasia, Famagusta district.

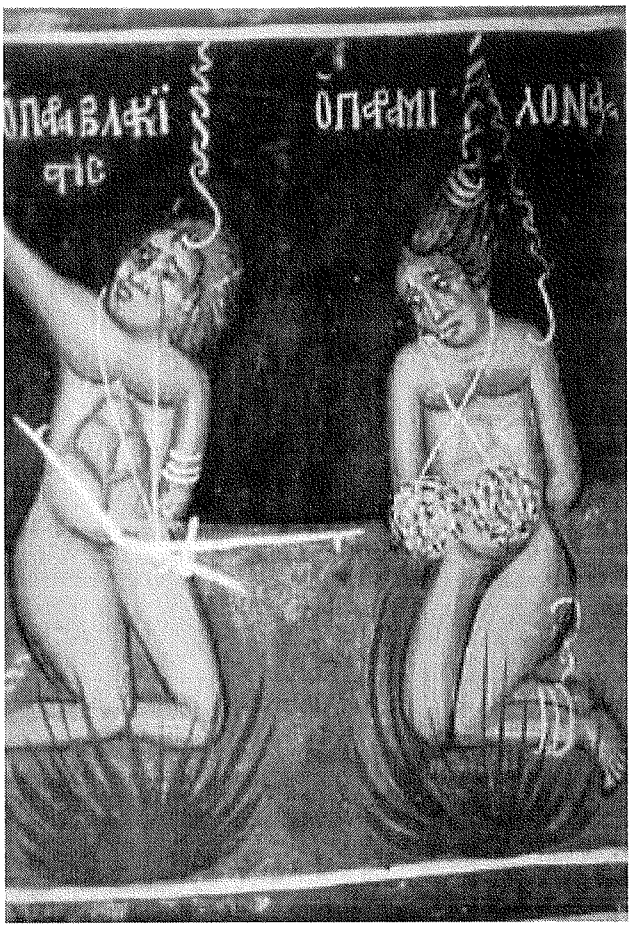


Fig. 10: A miller represented among other sinners with two millstones hanging from his neck. 14th century wall-painting depicting the scene of the Last Judgement in the Byzantine Church of Asinou, Nikirari, Nicosia district.

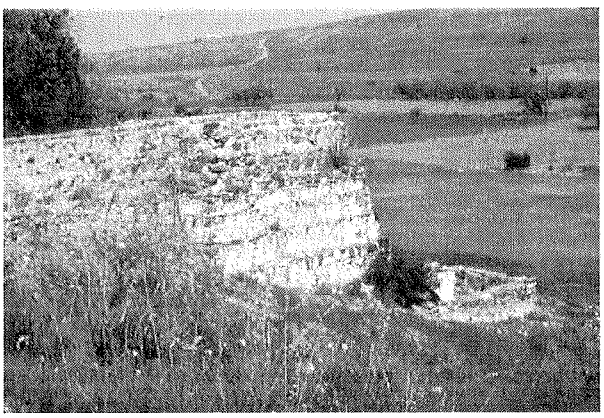


Fig. 11: A watermill in the village of Pano Koutraphas, Nicosia district.

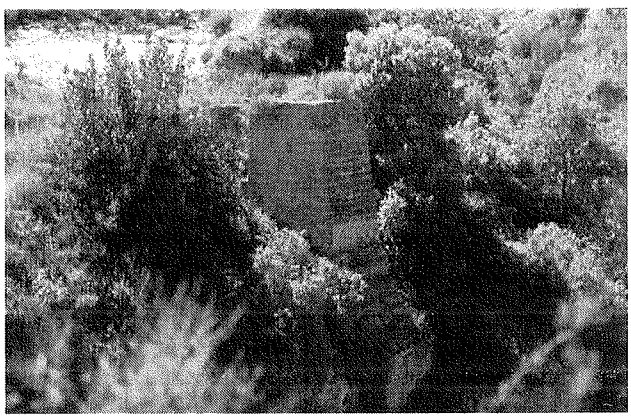


Fig. 12: Corn grinding watermill in the village of Kritou Terra, Paphos.

Discussion

Michael Harverson: I personally congratulate you on your excellent coverage of a subject that has not been dealt with like this before. Wonderful pictures too. Thank you very much indeed. Secondly, a question connected with the archaeological work: Have you discovered any evidence of watermills in the Byzantine period?

Euphrosyne Egoumenidou: Well, Byzantine coincides with our medieval period. We have much evidence for watermills. They are only mentioned as "molino" or "moulin", not as "water-" or "windmills". It is only by the names that we know that these existed in specific regions where only watermills existed. For example, the 32 watermills of Kythrea are known by their medieval names because they belonged to specific people at that time. They were private or royal. And as they were recorded by their names, we know that when these mills are mentioned, they are watermills. In Kythrea there no windmills. So, it is only in this way that we can separate windmills from watermills. There are many records of watermills in sources, and there are some of them that have been continuously used until recent times. But, of course, they have been restored and repaired through the ages. There were also royal windmills. We know that they were given to Bishop Asorius(?) of Nicosia by the Queen, in order to commemorate her ancestors. We have many references like that.

I thank you very much for your support, Mr. Harverson.

John Boucher: A couple of questions. When I saw some of your type of mill working elsewhere,

between the water jet and the wheel, they had a deflector to deflect the water away from the wheel. So, rather than stopping the flow of water, you could just deflect the water to stop the mill. I wonder, was this same detail found in Cyprus?

Euphrosyne Egoumenidou:You saw the nozzle? I mean, how the water came on to the blades of the wheel.

John Boucher: Yes, that's right. It could be deflected from that to stop the wheel.

Euphrosyne Egoumenidou:There is a piece of tin, with a vertical pole so that they can handle it. They just divert the water and then the wheel stops.

John Boucher: And the second question: you made the statement that horizontal wheels use less water than vertical wheels. I wonder what evidence you have for that and I wonder if perhaps we could ask Jeff Hawksley to comment on this, either now or in his paper later on.

Euphrosyne Egoumenidou: Maybe the difference is with European overshot waterwheels that use much water. On Cyprus we don't have this kind. You have to regulate the water. So, with the horizontal wheel, they just inserted wooden nozzles when they had less water, and they could go on grinding. This is what they all say. There were only 2 examples – I've shown you one – of vertical wheels

John Boucher: I think it's probably...

Euphrosyne Egoumenidou: But you think they could work the other, the vertical wheel, with less water.? Is that what you say? There are very few examples of this.

John Boucher: All I can say I've seen lots of horizontal mills working in the Himalayas, for instance, and the water supply there has always been very considerable.

Euphrosyne Egoumenidou: So it's irrelevant. Water supply is irrelevant.

David Jones: No. Water supply is not irrelevant. It depends on the region. In some regions, it is not a significant problem, in others, it is absolutely vital. You're describing a region where the supply of water issue, for many purposes, was vital. That does not apply everywhere.

Euphrosyne Egoumenidou: Are they found everywhere....?

David Jones: Well, Scandinavia, for example,..where water is, in many places, extremely plentiful, economising is simply not an issue.

Euphrosyne Egoumenidou: Ah, for reasons of economy. Yes, it's for different reasons but the same result.

David Jones: Yes, but here you are describing a situation where it must be economised, and mills must be designed to run on a minimum.

Euphrosyne Egoumenidou: That is true. Thank you.

Yolt Ijzerman: Following this point, I would assume that the advantage of these droptower mills is that you can use smaller quantities of water rather efficiently, using a high drop. As opposed to an overshot wheel. But it doesn't have anything to do with efficiency, I would think.

Yolt Ijzerman: What was the use for the few vertical wheels? Were they also corn wheels or were they used for different functions, for instance, hammer mills?

Euphrosyne Egoumenidou: All the mills I've shown you were used mainly for grinding wheat and barley.

Yolt Ijzerman: But what about the few mills with vertical wheels?

Euphrosyne Egoumenidou: We don't know because they are in ruins. And we couldn't find even the people who used them. They are very rare, and there is scarcely any evidence.

Yolt Ijzerman: Now, regarding the horizontal wheels, we saw a couple of illustrations but was there a variety in types of horizontal wheels? We saw open wheels, but were there closed type wheels or not?

Euphrosyne Egoumenidou: No. Just the type you have seen is what we get now. But before that, they were wooden wheels. We don't have them preserved. Our main problem is that the mill building with the wheel, the building which houses the wheel is, in most cases, buried.. The building is in ruins and the lower part, with the millstones, is buried in the ground. So you actually need excavation. The one in Pyrgos was excavated, but the wheel was not there. So we only know the metal wheels. Different types, but more or less similar. A few metal waterwheels, horizontal that's all we have now.

Yolt Ijzerman: Two more questions about the technology: were there any bolters or sifters being used in these mills to make flour out of the meal? To separate the bran from the flour? Or was it all done by hand?

Euphrosyne Egoumenidou: In the first mills, the first category, it was done by hand.

Yolt Ijzerman: Also in the more modern types?

Euphrosyne Egoumenidou: Then we have the two different, more developed types.

Yolt Ijzerman:But no bolters or reels in the mills?

Euphrosyne Egoumenidou: No. Then you have the diesel mills.

Yolt Ijzerman: But to separate the flour?

Euphrosyne Egoumenidou: To separate... No, I didn't see any. But we are still in the course of study. We started with the most primitive parts.

Yolt Ijzerman:And no references to edge runners used for making olive oil, driven by waterpower in Cyprus?

Euphrosyne Egoumenidou:To make what?

Yolt Ijzerman: To crush olives, for olive oil making.

Euphrosyne Egoumenidou: We have. Yes, for olive oil...

Yolt Ijzerman: With waterpower?

Euphrosyne Egoumenidou:No, no. It's only powered by animals and men, people.

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