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Structure, Function and Historical Importance of Watermills in the Swat Valley

Abstract

The paper deals with the architecture and function of watermills in Swat valley. Watermill is a seldom-used term; however, it has played a significant role in the socio-cultural and economic lives of people in the past. This research work explores the case study of water mills in the Swat region. It examined in detail its processing and operation. The watermill was not only an instrument used for grinding purposes but also determined the mode of production, class system and social values of people. Modern technology has though changed people's behaviors and social formations up to a large extent, but it couldn't erase people's memories and history. A qualitative method has been used for conducting this research work. An ethnic-archaeological method was focused on recording the history of this tremendous ancient technology which contributed widely to the socio-cultural context of people.

Key Words: Water Mill, Swat, History, Archeology, Culture

Introduction

In the present-day Khyber Pakhtoonkhwa (KP) province of Pakistan, the lush green Swat Valley lies between 34°-40° to 35° North and 72° to 76°-6° of the East. Swat has divided into Swat Kohistan, Swat proper and the mountainous region. Swat proper has been subsequently divided into Bar and Kuz Swat ([Rome 2008:14-15](#)).

The ancient history of Swat had scarcely been recorded. Since 1954, excavations have been carried out by different archaeological missions in Swat. Premium information, both rhetorically and symbolically, has unlocked the ancient history with excavated remains of the region ([Rome, 2008](#)).

Swat Valley has a rich history that dates back over more than two thousand years. The valley, called Udyana in ancient times, came under Achaemenid influence for a short time. The towns Udegram and Barikot, called Ora and Bazira in Greek accounts, were captured by Alexander in 327 BC. By 305 BCE, the region became a part of the Mauryan Empire. Finally, the Kushan dynasty absorbed Swat, and this was the time when Gandhara civilization flourished. The Muslim era in Swat began with Mahmud of Ghazni from Afghanistan, who conquered Swat amongst other areas in 1001 CE and reached into India. Afterwards, people from different Pukhtun tribes settled in Swat and came to be known as Swati Pukhtuns. It was not until 1915 that the modern state emerged out in Swat, which lasted till 1969, the year of its merger with Pakistan ([Naqvi, 2009](#)).

Geographically, Swat is a rugged district situated among the foothills of the Hindukush mountain range. This range runs in the general course of North and South and has a differed rise inside the Swat region, starting from 600 meters above ocean level in the South and climbing quickly up towards the North, to around 6,000 meters above ocean level. The Swat locates, holding the winding Swat River, is likewise home to lavish green valleys, snow-secured mountains, woods, glades and fields ([Paine, 1982](#)).

Swat valley is the drainage area of the river Swat and its tributaries. It contains a series of relating rich terraces which are still extensively cultivated. All parts of the valley are so fertile that they do not need a number of labors to achieve good crops. Rice, maize and wheat are the main diets of the people.

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Historically, the people of Swat used a hand mill to grind crops and fulfil their household needs. Later on, people discovered water mills which played a productive role in the lives of Swat people. It was though not that much developed in the beginning, but later on, it has changed in every aspect of its function and architecture. Watermills lay in every territory of the Swat region due to sufficient water, also known as the land of water.

The watermill is one of the earliest examples of human efforts to bind natural forces to do mechanical work as the ancestor of a long line of machines. Water-milling greatly increased per capita productivity in the time-consuming and widely needed grinding of grain into flour and enabled greater specialization in labor, with the water miller emerging as a separate figure from the miller-baker of the earlier Roman period. The spread and uptake of the watermill are therefore important in the economic development and technology of a government in some parts of the world (Room, 1988).

This paper explores the historical importance of water mills in the social context of Swat and would be helpful to provide facilities for future researchers. It is an important contribution in the ethnoarchaeological perspective as watermills are physical evidence in the analysis of any past culture. Interviews, fieldwork and documentation in research will fill the great gap and will add new data and analysis to the study of Swat's social formation and culture. It will also increase the importance of watermills to become an important part of museums.

Literature Review

"Ancient watermills" is an article written by Robert MacAdam. This article represents the accurate ancient wooden water wheel near Ballymoney with the help of Mr. James Bell research. The researcher compares the construction similarities of ancient wooden watermills, which have found in different territories of Europe. The excavated water wheels of the different areas have kept in the Belfast museum, which is recently occupied for the garden.

Republics Ancient and Modern, written by Paul. A. Rahe is about the ancient regime in Classical Greece, including technology like the watermill. The writer coherently describes the overall society of Greece in terms of their honors, cultures in all forms, technology innovation and economic activities to preserve the history of Greece. This research also explores the entire educational policies of ancient Greece (Rahe 1994).

Machines, power and the ancient economy is an article written by Andrew Wilson in the Journal of Roman Studies. This paper explores the relationship in the ancient world between the design and use of mechanical technology, social and political patronage and investment and economic returns, using three main areas as a case study: water-lifting devices, the water-powered grain mill, and the diverse use of water power in mining. The article emphasized the use of devices and techniques which replace human power with alternative power sources and especially water power (Wilson, 2002).

Swat State, written by Sultan-i-Rome, is about the state formation in Swat. It is a holistic study of Swat state, its history, geography, culture, nomenclature, natural vegetation, ethnic lineages, along with an analysis of political, administrative, socio-political and economic developments (Rome, 2008).

East and West, Vol. 38, founded by Giuseppe Tucci, includes watermills in Urartu. It can be compared with the watermills of Swat. The article is about archaeological remains of watermills in the ancient era. It also includes the history, formation and technological development. (Olivieri and Vidale, 2006).

East and West, Vol. 56 includes an article on the archaeology and settlement history in a test area of the Swat Valley. It is about the archaeological mission of the Swat region. It discusses in great details different archaeological sites of Swat (Roos, 1988).

Frontier Perspectives, written by Charles Lindholm, is about essays in comparative anthropology. This book generally focuses on the social and political structure, norms, values, family structure, and marriage system of Pashtuns (Lindholm, 1996).

The traditional architecture of Iranian water mills is written by Reza Muhammad. It is a study of the artisanship involved in the construction of Iranian Watermills and delineates cultural aspects of traditional architecture and construction. This article aims to make a better understanding of the effective construction techniques in Iranian watermills, which utilizes natural resources without the consumption of additional power (Reza, 2010).

The Swat Pathans, written By J. John Honigmann is about the people of Swat. The first section of the work draws attention to the organization of the political power of Swat. The power refers to two types: coercive authority based on the physical force in small local groups; another power is the dominant power, exercised by rulers of the Hindu Kush mountain state. The second section of the work reveals the short history and hegemony of Yusufzai Pathans, their language, norms, culture, and traditions. This study is based on an ethnographic survey in the Swat region ([Honigman, 1961](#)).

The Yusufzai State of Swat in the Geographical Journal is written by W.R. Hay. It is about the people of the Yousafzai Tribe. The object of this paper is to describe the creation and progress of an autocratically ruled State which since 1917 has come into being in the Tribal Territories on the North-West Frontier of British India, called the Yusufzai State of Swat. This article reveals the history of the Swat state and details of its administrations. He also discusses the archaeological importance of the Swat valley ([Hay, 1934](#)).

There is no specific research work conducted on the water mills in the Swat region. Watermills have great architectural importance and played a significant role in the progress of social structure and system in Swat territory. Researchers and historians have not focused on water mills and their structure, history, function and utility. Therefore, specific research is needed to be done on water mills in relation to their importance in a social setup. Even in Europe, there is also insufficient research available on watermills and their historical importance. There are only a few studies about watermills, but their research is not ample to understand the overall archaeological, ethnoarchaeological, ethnographic and historical importance of watermills.

Methodology

Primary and secondary sources have been consulted for the research. Primary sources include photographs, interviews, and survey have been conducted for data collection. Secondary sources, books, journals, newspapers and research papers have been considered for this work. The proposed research is analytical, descriptive, qualitative and historical. An ethnic-archaeological method was adopted by researchers by spending plenty of time in a few villages of Swat to collect primary data.

Research Questions

1. What is the history of the Water-mill in Swat?
2. How the architecture and technology of the watermill created in Swat?
3. What is the importance of watermill in the social organization of Swat?

Discussion

External Architecture

The outer view of the watermill depends upon the time of its construction. There are basically two kinds of watermills in Swat, typical ancient and modern keeping great differences in between. Construction materials of the first type compare simple mud and stones, while the modern watermills are made up of baked bricks, cement-bajri along with blocks and wood. Both ancient and modern architecture of watermills have windows at the centre of every wall for getting light inside the room. The roof of the typical watermill was made up of wood containing one main pillar fixed at the centre (called stay pillar) and a suitable number of barge and a beam. Such kind of architecture was also in vogue in other buildings like houses, Hujras, mosques and market places. The introduction and arrival of new building material replaced the traditional style.



See the figure above for both modern and ancient water mills of the Swat Valley.

The Building Mechanism and Internal Architecture of Water-Mill (JRANDHA)

In constructing Jrandha, the first step is to find a water channel called wala with a closed-end, called a band. Both need a sloping and terracing area to get the water stored in large amount and then to speed up its flow. The waterwheel cannot rotate with the low speed of the water. There should be a distance between the watermill and the water pond. This increases the temperature of the water, and it hits the turbine fast. At the top of the dam, there has a special water breaker to maintain the speed of the flow.

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Inside the building, there are much more millstones running, which belongs to a large amount of water—every millstone connected with different parts which ground the flour. The parts are made of various materials like wood, cement, iron and stones. All parts are interconnected with each other. Each part has its own work and function. Each millstone has its own portion for grinding the grains. A grinder would walk bare-footed to maintain cleanliness inside the watermill.

Types of Water-Mills

There are two major types of watermills, namely Garma jrandha (warm watermill) and Yakha Jrandha (cold watermill).

Garma Jrandha (Warm Water-Mill)

Warm watermills are used to grind maize crop only. In warm watermills, there lie two millstones, one above the other. Lime and coal are also being used beneath the lower millstone to give warmth in the grinding of maize.

Yakha Jrandha (Cold Water-Mills)

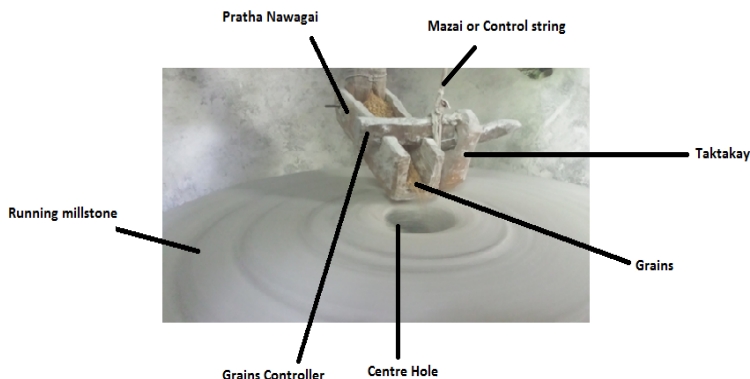
Yakha Jrandha is used for all types of crops grinding. Even pulses can also be grinded by cold watermills during the month of Ramadan. Mostly Swatis used to eat pulse pies during Ramadan month. In cold watermills, only one stone is used for all functions and do not use lime and coal beneath millstone.

Technology of Water-Mill

The technology of ancient watermills was not complicated as compared to modern watermills. With the passage of time, it became more sophisticated. Before constructing the buildings of Jrandha, other related serious and important issues are pondered upon, which obviously come first. These issues are discussed below:

Before the formation of a watermill, the flow of water speed should be kept maintained with the help of a band. The flow of water speed controls specific square type flanks of wood about two feet its length, known as Sarkhpacha. About one-foot long cylindrical type wooden rod connected with Sarkhpacha stops the water easily. Its length is about two inches. It is made from precious and strong

wood found in Swat forests, known as Ranzrha. It's sustainable and doesn't get damaged over centuries. It was also tried to make this water breaker from iron, but it proved a failure due to dampness. Now generally, it is made of Ranzrha, which resists external shocks.



In the figure above, grains are coming down through wooden pipe into a millstone

After this step, the water goes down in a specific tool, which is made up of different materials known as Nawa. Nawa is usually made from wood or iron, where three wooden flanks or iron sheets are tied together to form a Nawa. Nawa makes it in long length; that's why the flow of water speed would be fast. If the Nawa make it in short length, then the flow of water speed would be slow and would not be able to move the turbine quickly. The Nawa could not be put in 180 degree or smoothly fixed, but it should always be put at a 45-degree angle, due to which the water will fell down quickly, and the speed would automatically increase to hit the turbine fast as needed.

The surface of Nawa is covered with wooden sheets in order to protect it from falling leaves etc. Before this, Nawa was not used to cover its surface, so there had the most chances to fall down something and could reach loss to running turbines. Nawas is fixed through steel nails, and before fixing Nawa, the place is made for it with cement and bricks to put Nawa irregular in shape. Besides this stream or Wala, there should be another vacant Wala connected in case of any natural disaster. A large amount of water distributes with two streams and could save the architecture of the watermill. There is a special Wata constructed for Nawa to stop the water and make a dam where the water easily passed through the holes of Nawas. Those Wata are made from the high amount of cement, stones and also using iron rods to protect the Nawa from the flow of water or natural disasters.

Beneath Turbines

The turbine needs a high speed of water to come in motion and start rolling. Previously, the turbine was made up of wood and could easily receive damages. Nowadays, the turbine is usually made from iron that could be harmless.



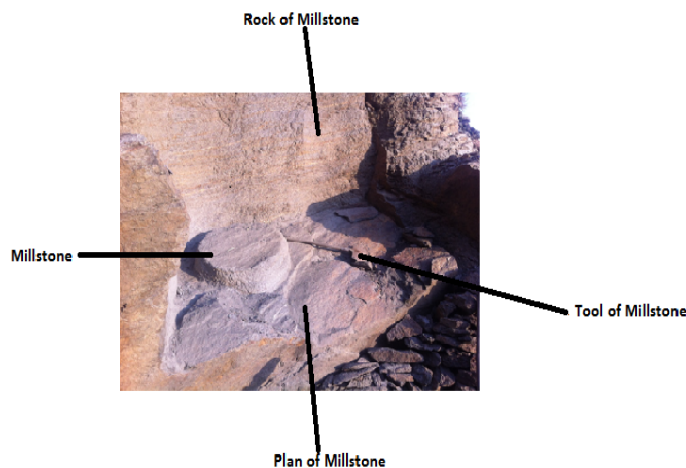
In the figure above, the turbine runs by water to rotate the upper millstone

The external shape of the turbine is rounded circular in shape while the internal is highly sharp. The water hits those sharp blades and moves them clockwise. There is an iron axle connected with a turbine; as the turbine comes in movement, the axle also comes in motion the same clockwise. This rod or axle connects with the upper millstone; as the axle is moving, it gives motion to the upper millstone.

This turbine is always put down on the surface of the stream when the millstone stops grinding grains. Whenever the miller starts grinding, there is a circuit that needs to be pulled up while the turbine moves from the surface of the earth and start a movement. This circuit is fixed inside the architecture of the watermill.

Procurement of Millstones

There is one place in Swat named Ser Taligram in which the millstone is prepared in rocks and transfer to every territory of Swat where the watermills exist. The millstone is being prepared in one month by two labors and sold from thirty thousand to sixty thousand per stone. The tools used by the labors for making stone are heavy hammers and seven feet long iron rod. The exact location of millstones where it has been constructing in ser telegram is known as Badar. The labors first observed the rock whether the stone could be appropriated or not, while they also draw a map on the surface of the rock to bring the regular stone round in shape. If the stone comes irregular in shape, then it would not be used in the architecture of the watermill. There are mainly two types of millstones, different in sizes. One millstone width is 1 foot which is only used for warm watermill (Garma jranda), while the other one is 6 inches and used for cold watermill (yakha jranda). The distance between the rock millstone and road is almost 100 meters in length. (Najibullah, Telegram).



In the above figure, a place is shown where millstones are prepared

Role of Watermills in the Social-Cultural Context of Swat

Watermills have been disappeared or quickly disappearing in Swat. It has become difficult to collect information about this ancient tool which has been replaced by modern machines. As a result of an ethnoarchaeological study carried out in the territory of Swat, a very limited number of water mills were recorded. With the start of electric mills, water mills have lost their previous importance, and today, some of the mill houses are used as stables or shelters. Interviews with local people provided some useful information about the capacity of the mills and the kind of grain that was ground in them. All the mills under discussion belong to the 'ordinary' horizontal-wheeled type of watermill. This type may have originated at the start of the Swat region. A literary and archaeological study concerning the various types of mills showed that the type of mills found in Swat was best suitable to local circumstances.

Mills determined by water was a common phenomenon in Swat. It played an important part in the economy of the time and represented a significant investment in resources. It tells us much about the technical and investment capabilities of Swat society. People gave more preference to watermills than other kinds of property. It was considered as the key to investment in any region of the Swat. There is an axiom saying in Swat, which clearly shows the value and importance of Jrandha in terms of economic resourcefulness. It is not necessary that each axiom would be compatible for every society, but it truly manifests the socio-cultural context of a specific society.

The property measurement of the Swat has still not been counting on the digital system in villages, but it is still measured with local traditional way. The initial point of the measurement is Pao which includes six thousand square feet of its size. Now four pao pati are equal to one paysa and one paysa pati (property) has twenty-four thousand square feet area. Here now, twelve paysa exist in one ropay, which means the total area is approximately 288,000 square feet. The property dealing of the Swat villages also recently concern on paysa system.

Na yawa ropay paty aw na yawa jrandha

Translation: One watermill is more productive than one ropay (p) property.

The grains have had never been discharged in the house of the water miller throughout the year. Although the watermill belongs to the landowners, the negligible exceptions might be there of the society, but it has been running by the millers. There had reportedly too much rush at the water mills in some seasons. Until the very recent past, people used to come to keep numbers for grinding the grains. Every individual of the society was depended on the watermill because it was the only source where the grains be grounded. Watermills were not the only place of grinding but a public sphere for discussion and exchange of ideas. There is another famous quotation about watermill that:

Jrandha ka da plar da kho pa war da

Translation: if the watermill is of your father, you still will have to wait for its number.

The above quotation clearly expresses that the grinding process of the watermill has a particular discipline made for the inhabitants of the Swat society. This egalitarian rule and regulation have been followed by the locales for a long time. This practice of discipline has avoided civil wars between families. Before this discipline, people quarrelled for grinding grains because there were no such rules to take a number in the process of the watermill. To make this discipline of watermill was a prosperity act for the people of Swat.

Water-mill has considered as the source of production. It produces numerous sorts of flour like wheat, rice, maize and pulses. Each grain needs the various speed of rolling millstone. There was a proper way of tax used for a watermill. A person usually brings sacks of grains which they match on a bawl use as a toll or tax. One bawl grain has been taken from almost twenty-five bawl. The miller daily checks the watermill and collect the grains which they grind for their daily use of subsistence. Besides their daily use of flour, the miller also sells different grains of flour which serve their extra needs.

The woman is the sole member of the household. Traditionally, women contributions to the social organization of Swat were not less than men. They have contributed a lot in all spheres, particularly in the domestic domain and agricultural sector, but the socially and culturally defined roles of women discharged their duties or contributions as a head or member of the household. According to my informants, Swat's women were engaged in many productive activities: wheat and maize harvesting, cleaning grains and storing them into their own homemade granaries (Kandoo). Moreover, they painted on mud walls inside the houses and mud carving art on mud granary (Kandoo). It was a sort of an expressive art of the local women. On the agricultural side, women also contributed with men in fields such as wheat, maize, and rice harvesting.

Conclusion

The Swat Valley, the land of fruits and flowers and that of springs and streams, is situated in the northeast of Peshawar. Its main commercial center is Mingora City, which lies at a distance of 120km from Peshawar City. All parts of the valley are so fertile that they do not need a number of labors to achieve good crops. Rice, maize and wheat are the main diets of the people. Swat people used a hand

mill (Maychana) to grind crops and fulfil their household needs. But later, people discovered water mills which played a productive role in the lives of Swat people. Watermills lay in every territory of the Swat region due to sufficient water. The watermill is one of the earliest examples of human efforts to bind natural forces to do mechanical work as the ancestor of a long line of machines. Watermills have lost their previous importance, and today, some of the mill houses are used as making flour. All the mills under discussion belong to the ordinary horizontal-wheeled type of water mill in the Swat district. Watermills were a common vision in Swat. It played an important part in the economy of the time and represented a significant investment in resources. It tells us much about the technical and investment capabilities of Swat society. Watermill had been considered as the source of production. It produces numerous sorts of flour like wheat, rice, maize and pulses.

Shaitan: Demon or evil which always tries to compel human for bad deeds.

Band: It is a place where water could stop and start for the watermill.

Bargay: These are the vertical wooden thick flanks used in the making roof of the Ancient architecture.

Taktakay: This is a manual circuit in the watermill in which the miller usually control the speed of the falling grains.

Garma Jrandha: It is a local word used for warm watermill and has various functions.

Yakha Jrandha: It is also a traditional word used for a cold watermill.

Sarakhpacha: This is a wooden square type flank connected which control the speed of the water flow.

Ranzrha: A famous trees growing in Swat forest used in the architecture of watermill. This type of wood led for centuries in building.

Nawa: It is Pashto word where the water falls down in three-sided connected flanks of wood or iron to hit beneath turbines.

Purdha: It means to cover women's body weather in veil or shawl. ^[L]_[SEP]

Fakeer: Fakeer is used for poor people or beggar. ^[L]_[SEP]

Begheratha: A person who feels fear of his wife.

Dawtar: It is a local word used for property or heritage.

Har: In other part of Pakistan this harvest is called Rabee which start from September till June.

Manay: It is known as Kharif crops and starts from July to October.

Ogra: It is a mixture of rice and water.

Batey: It is also a sort of rice where butter is being mixed and eats in breakfast usually.

Pao: The initial point of property measurement of Swat which has six hundred square feet area.

Paysa: Four pao are equal to one paysa.

Ropay: Twelve paysa are equal to one ropay property.

Kandoo: A granary where the grains are kept safe.

Saaba: It is a type of vegetable which the local women of Swat often cook in autumn season.

Jwaro roty: It is known as maize bread used for eating with vegetables.

Pati: Fields or property.

Tabakhy: It is an iron plate where bread is cooked.

Shin marchaky: It means green chili.

Maychana: It is a local word used for hand mill used by people before watermill.

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