

Early Water Conservancy Project and Chinese Culture in Ancient China: the Cases of Liangzhu Water Conservancy Project and Dujiangyan Irrigation System

Wenqiang Liu¹, Ting He²

¹ College of History and Culture, Sichuan University, Chengdu, Sichuan Province, China

² First Grade Teacher, Pengshan No. 1 Middle School, Pengshan, China

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Abstract: Liangzhu Water Conservancy Project and Dujiangyan irrigation system are both large-scale water conservancy engineering systems in ancient China. They not only bring benefits to Chinese history and Chinese civilization in terms of Engineering benefits. but also embody two aspects of Chinese traditional culture that correspond to each other in their concepts of “blocking” and “dredging”, and infiltrate the way of doing things and the philosophy of life of ancient and modern Chinese people.

1. Introduction

In the early period of ancient China, there were many water conservancy projects, such as quebei, Zhengguoqu, Zhanghequ, Lingqu and so on. Among them, two are the most representative. One is the Liangzhu Water Conservancy Project, which was built about 5000 years ago,[1] and the other is the Dujiangyan irrigation system, which was firstly built around 256 B.C.[2] These two water projects are not only early in the years, but also have a huge amount of works, which are also the most representative in the construction concept. Through the in-depth analysis of these two cases, we can not only have a more understanding of the two important water facilities and cultural heritage in China and even in the world comprehensively, but also have a clearer understanding of their role in historical development of china. In addition, through the analysis and study of these two cases, it will also provide a new perspective for in-depth understanding of Chinese culture and Chinese way of doing things.

2. Case Studies Analysis

2.1 Liangzhu Water Conservancy Project

Liangzhu Water Conservancy Project is located in Pingyao Town, Yuhang District, Hangzhou City, to the west of Liangzhu Culture Ancient City. Since 2009, after several years of systematic archaeological investigation, the water conservancy project in the periphery of Liangzhu ancient city has been basically identified. Based on carbon fourteen dating and the observation of unearthed relics in strata, it is concluded that the age of the water conservancy project is about 5000 years ago, and it is the earliest large-scale water conservancy project discovered in the history of China.[3] The whole hydraulic engineering system is about 10 kilometers east-west, and it is also the largest hydraulic system in the world at the same time. In short, Liangzhu Water Conservancy Project is a high and low dam system. The earth dams built by man-made barriers block the water in the low places of mountains and plains, and play the role of blocking flood peaks. The Ganggongling dam group constitutes a high dam system. The top of the dam is 25-35 meters above sea level and the dam body is 60-80 meters wide. The liyushan dam group consists of a low dam system. The top of the dam is now 9-10 meters above sea level and the dam body is 50-100 meters wide. Tangshan Dam Group has an elevation of 12-20 meters above sea level and a dam body width of 20-50 meters. It can not only cooperate with the low dam system to store water, but also form a drainage channe,

or have a certain role of water diversion and flood discharge (Fig. 1).

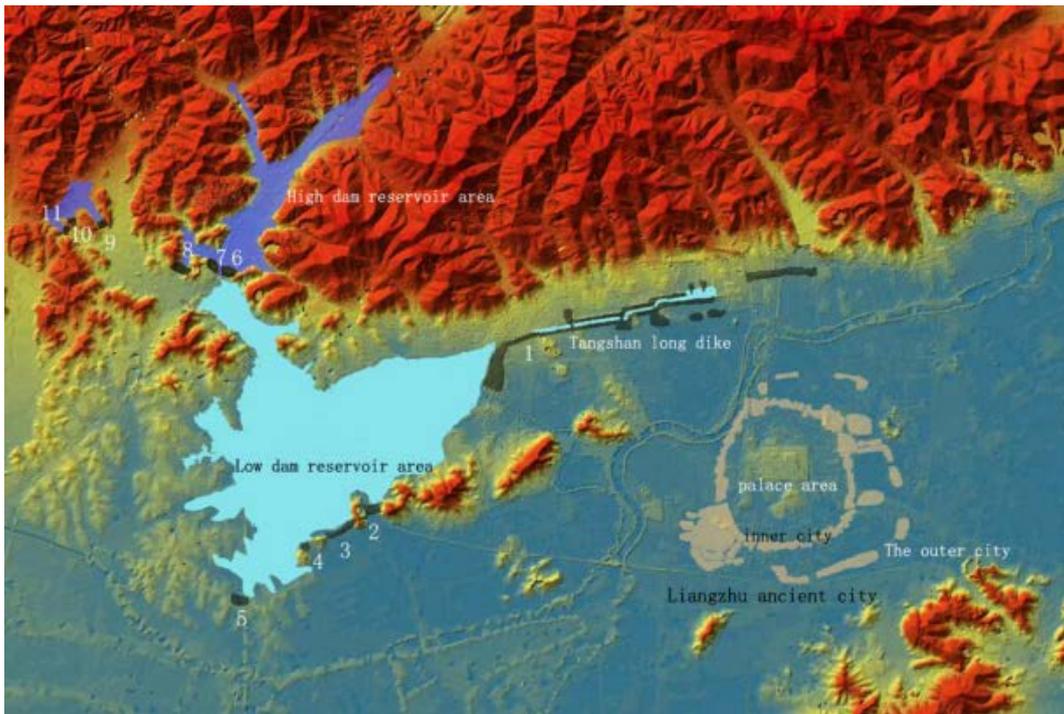


Fig.1 Drawing of Water Storage Effect of Liangzhu Water Conservancy Project

3. Tangshan 2. Shizishan 3. Liyushan 4. Guanshan 5. Wutongnong 6. Ganggongling 7. Laohuling 8. Zhoujiafan 9. Qiuwu 10. Shiwu 11. Mifengnong [1]

The Tianmu Mountain area where Liangzhu Water Conservancy Project is located is the largest rainstorm center in Zhejiang Province. It is easy to form mountain torrents in summer. On the one hand, the torrents directly threatened the personal safety of Liangzhu ancestors in the downstream plain, On the other hand, there is also devastating damage to crops, etc. Therefore, it is particularly important to change the local natural geographical environment which is easy to causes mountain torrents. The Liangzhu Water Conservancy Project uses two large natural valleys in Tianmu Mountain to build dikes and dams at the narrow location of the valley mouth, and ingeniously forms two reservoir areas, one high and one low. These two reservoir areas can form about 12.4 square kilometers of water storage surface in the north and northwest of Liangzhu Ancient City, with a water storage capacity of more than 6 million cubic meters. These dams can block 870 millimeters of continuous precipitation in the short term, which is equivalent to the standard of once-in-a-century precipitation in the region. On the one hand, these two reservoir areas can become the lung lobes of Tianmu Mountain area with abundant rainfall and frequent mountain floods, and play a role in ensuring water sources and regulating floods. At the same time, the huge water surface formed by the two reservoirs also has an effective shipping capacity. Ship transportation can greatly improve the efficiency compared with manpower transportation, and has a positive significance for the development of Liangzhu ancient country. Thirdly, a stable water source also has a very important function in agricultural irrigation, and also can provide great convenience for domestic water use. Fourthly, Liangzhu's multi-dam hydraulic engineering system should, in theory, also have a certain effect of preventing seawater from backfilling.

The construction of Liangzhu water conservancy project has greatly promoted the development of Liangzhu culture. In the plain area downstream of the dam, Liangzhu people built a large-scale city site and a large number of rice fields,[4] and made exquisite stone, jade and bone wares ; formed their own way of life and production and cultural belief system In addition, the water conservancy project itself and the Liangzhu culture, which is promoted by its advantages, have also enriched the connotation of Chinese culture and made great contributions to the development of

Chinese civilization.

3.1 Dujiangyan Irrigation System

Dujiangyan, located in Dujiangyan city of Chengdu, is an ancient large-scale water conservancy project constructed by Li Bing, The prefect of Shu County, Qin State, who leads the people, at the end of the Warring States Period. Dujiangyan Water Conservancy Project is actually a dredging and diversion system. It is mainly through the opening of Baopinkou in Yulei Mountain and the construction of diversion dike that the diversion and diversion of water are realized, and the control of river flow direction and flow is realized, which can play the role of collecting and diversifying flood, diversion irrigation and shipping. The main body of the project is fish mouth type dividing dike, BaoPingKou and flying sand weir.

Fish mouth type dividing dike is named for its shape like fish mouth. There are similar records about the construction of diversion dikes in Minjiang River in “Huayangguozhi” and “Shuijingzhu”. The Fish mouth type dividing dike mainly play the role of diverting the flow of Minjiang River into the inner and outer rivers; Baopingkou is located at the corner of Yulei Mountain. It is formed by excavating Yulei Mountain and is the throat of the water entering the inner canal; The flying sand weir is a low weir between the lower section of the diversion dike and the mouth of the treasure bottle. It mainly plays the role of flood discharge and sediment discharge (Fig. 2).



Fig.2 Structural Chart of Aerial Photographs of Dujiangyan Water Conservancy Project

Before the construction of Dujiangyan Water Conservancy Project in Chengdu Plain, there were two natural environmental problems: flood and drought. With the Minjiang River as the boundary, the western region of Minjiang River is often threatened by floods in rainy season, often destroying farmland and residential buildings, and the people's lives are unbearable; while the eastern region of Minjiang River is often drought year after year, and the water for crop irrigation and people's daily life is relatively scarce, which has a great negative impact on agricultural development and people's lives. Therefore, it is extremely urgent to redistribute the yield of water on both sides of the Minjiang River.

The construction of Dujiangyan Water Conservancy Project firstly uses the principle of thermal expansion and cold contraction to excavate the exceptionally hard Yulei mountain body with the natural method of fire and cold watering, forming a water intake called Baopingkou for diversion. Then, in the upper reaches of Baopingkou, the water diversion dyke was built by bamboo cage and stone filling to change the direction of water flow. The natural landforms such as high and low drop, bend and so on were used perfectly to make suitable water flow into the mouth of Baopingkou and the artificial rivers to the east of the Minjiang River. The construction of Dujiangyan Water Conservancy Project redistributes the water volume on the East and west sides of the original Minjiang River, which makes the flood-prone west side of Minjiang River no longer flooding, and

also makes the drought east side of Minjiang River effectively irrigated.

The completion of Dujiangyan Water Conservancy Project, on the one hand, has played a huge role in flood control and water logging control and agricultural irrigation, greatly changed the face of frequent floods and droughts in Sichuan Basin before, making the Chengdu Plain “fertile fields thousands of miles” since then. On the other hand, it also has practical navigable capacity. Since the completion of the Dujiangyan Water Conservancy Project in today's Sichuan Province and the Lingqu Canal in today's Guangxi Province, the grain of Bashu could be transported directly down to Lingnan by river, which played a vital role in the recovery of Lingnan and the unification of the whole country in Qin Dynasty. In addition, it also plays an active role in protecting drinking water sources and regulating soil structure in Sichuan Basin. Comparatively speaking, Dujiangyan played a more obvious role in promoting the development of agricultural economy. It directly promoted the prosperity of Bashu area, making Chengdu Plain a famous “world granary” in China at that time. The abundant agricultural economy also further promoted the development of various industries, making the Sichuan Basin eventually replace the Guanzhong Plain as the “Heavenly Land of Plenty”.

Dujiangyan Water Conservancy Project created a stable and prosperous Bashu, and the rich Bashu became the food bag of the Qin State at that time. The key battles between Qin and Zhao in Changping, Qin's extermination of Chu and the expulsion of Lingnan and other battles after that all depended on the stable Military Grain Support from Bashu. Ancient literature records: “In the early Han Dynasty, various princes rebelled, people lost their jobs and starved, rice prices were extremely high, there was a phenomenon of human cannibalism, more than half of the original population died of hunger, so the emperor Liu Bang ordered people to sell their children and go to Shuhan to live”. When Emperor Wudi of the Han Dynasty, Shandong River flooded. “For several years there was no harvest, people ate each other, one or two thousand miles... Relief for Disasters with Food from Bashu” and so on, These records vividly describe the relief of grain from Bashu to the people in famine-stricken areas throughout the country in later generations.

4. Analysis of the Ideas and Impacts

In terms of construction concepts, these two large-scale water conservancy projects in early China have obvious concepts of “blocking” and the other is “dredging”. Many levees and dams of Liangzhu Water Conservancy Project embody the persistence of “blocking”, while the shunt and diversion of Dujiangyan Water Conservancy Project show a preference for “dredging”, and there are many records about “blocking” and “dredging” in ancient Chinese literature.

“The Classic of Mountains and Rivers” contains: “Floods are so great that Gun does not wait for the emperor's orders. He steals the emperor's xirang(a kind of soil that can grow continuously) to block up the floods. The emperor ordered Zhurong to kill Gun on the outskirts of Yushan Mountain. Gun's son is Yu, and the emperor ordered Yu to continue to harness the water and divide the country into nine regions.”

In “Shangshu”, Yu said, “The flood is very high. And the flood surrounds the mountains and submerges the mausoleum. People are confused by the flood. I and Yi, as well as other people, have used all kinds of methods and traveled all over the corner. To Open the ditches to the rivers and Dredge rivers to the sea... “

From the above and similar ancient literatures, we can see that the ancients attributed the failure of water control of Gun to “blocking”, and attributed the success of water control of Yu to “dredging”. Therefore, “blocking” and “dredging” were summarized as two distinct water control concepts by ancient Chinese. and Ancient Chinese advocated “dredging” and despised “blocking”, which was summarized as the ancient law of “Deep clean beach, low weir”, and is still engraved on the walls of the Erwang Temple in memory of Li Bing, the builder of the Dujiangyan Water Conservancy Project. This thought has deeply influenced China for at least 2,000 years (from the end of the Warring States Period when “shangshu” finished, there may have been relevant thoughts and records before). Until today, people often talk about Yu and his “dredging” methods for water control, as well as the benefits of “dredging” practices, while few people can objectively treat

“Gun” in the literature and his “blocking” method.

On the one hand, as two figures of flood control in the literature, Gun and Yu One fails and one succeeds, so it is easy for the ancients to compare the advantages and disadvantages of the two water control methods; On the other hand, one is water retaining and the other is water diversion. Like the intuitive feeling conveyed by the Dujiangyan Water Conservancy Project, there are new ways for water to go wherever it goes, an effective and good diversion can be achieved through the “dredging” approach. But Liangzhu Water Conservancy Project is that where water goes there are dams to control it, even if it spills over the high dam reservoir area, there are still low dam reservoir areas to continue to be blocked. Although Liangzhu Water Conservancy Project was submerged in the dust of history in the late Warring States Period when the relevant literatures were recorded, the word “blocking” is always less pleasant than the word “dredging” to Chinese people. Therefore, the understanding that “dredging” is better than “Blocking” has been deeply rooted in Chinese traditional culture. This kind of understanding and Prejudice also deeply influenced the way of doing things and the philosophy of life of Chinese people in past dynasties. Up to now, the Chinese people attach great importance to the smooth mean while neglecting personality, and the Chinese society attaches great importance to propaganda and value guidance while attaches less importance the “blocking” such as the rule of law and punishment, which are also some negative effects brought by the thought of “dredging” is better than “Blocking”.

However, objectively speaking, the different concepts of Liangzhu and Dujiangyan water conservancy projects are mainly due to the differences of geographical environment and the different purposes of water control. On the surface, Liangzhu Water Conservancy Project and Dujiangyan Water Conservancy Project seem to be two opposite design ideas and construction concepts. However, in actual engineering construction, “dredging” and “blocking” often complement each other and cooperate with each other.

Liangzhu Water Conservancy Project uses many dams to form two systems of high and low dams, and then forms two reservoir areas of high and low to prevent flooding in its reservoir area. At first glance, it is a method of blocking, but the capacity of the two reservoirs is limited after all, and it is impossible to enter water without leaving water forever, Thus the dam of Tangshan section is more like a spillway with both water diversion and flood discharge functions, or there may be another spillway trough in other dam areas, but the current archaeological work has not yet been found or confirmed. Therefore, Liangzhu's hydraulic engineering system can not only be “blocked”, from another point of view, Its “blocking” may also be for purposeful and directional “dredging”.

Dujiangyan Water Conservancy Project is well-known for its directing water without dams and guiding the water's trend according to circumstances. Its practices such as digging the baopingkou to divert water and building the fish mouth dike to divert water embody the “dredging” in the water control methods vividly and vividly. However, the diversion embankment built in the Minjiang River Center is also a kind of “blocking” in a sense.”Blocking” the water from the outer river to lead to the inner river. Of course, the purpose of this kind of “blocking” is also for better directional “dredging”.

Liangzhu Water Conservancy Project was built around 5000 years ago. Judging from the reservoir capacity of Liangzhu Water Conservancy Project's two high and low dams, if the dam break happens, it will be fatal for the people of Liangzhu ancient country, and the people of Liangzhu in the Taihu Lake Basin can last until about 4300 years ago[3]. At least, it shows that the operation of Liangzhu Water Conservancy Project is safe and stable in about 700 years, that is to say, it has been working about 700 years. Dujiangyan Water Conservancy Project has been continuously benefiting the people of Sichuan Basin for more than 2,000 years through continuous repair and maintenance of the past dynasties.

Liangzhu Water Conservancy Project System and Dujiangyan Water Conservancy Project have different manifestations in the construction concept because of the differences in natural environment and water control purposes. However, from a deep point of view, the “Use blocking method to guide the direction of dredging” of Liangzhu Water Conservancy Project and the “Directional blocking for dredging purposes” of Dujiangyan Water Conservancy Project are

essentially interlinked. All of them are very mature concept of water control which based on the actual situation of the local practice. And through the “blocking” and “dredging” embodied in these two large-scale water conservancy projects in the early period of ancient China, it can be seen that, whether it is “blocking” or “dredging”, in terms of water control methods, there is actually no superiority or inferiority. Whether focusing on “blocking” or “dredging”, as long as the construction is properly done in the early stage and reasonable maintenance in the later stage, it can last for hundreds or even thousands of years without collapse.

5. Conclusion and Recommendation

From the above analysis, it can be seen that Liangzhu Water Conservancy Project and Dujiangyan Water Conservancy Project are both large-scale water conservancy engineering systems in ancient China. As far as the project itself is concerned, both of them are unique and important cultural heritage in China and even in the world. They not only enrich the connotation of Chinese civilization and World Water conservancy civilization, but also provide model and accumulate experience for later water conservancy projects in China and even in the world. At the same time, in terms of engineering benefits, it has brought many benefits to Chinese civilization and Chinese history, and even affected the historical trend of China. In addition, the concepts of “blocking” and “dredging” also represent two aspects of Chinese traditional culture that correspond to each other, affecting the ideological concepts and ways of life of ancient and modern Chinese people, and providing vivid cases for further understanding of Chinese culture.

Liangzhu water conservancy project and Dujiangyan water conservancy project have very important cultural relic value and cultural heritage value as two typical water conservancy projects which clearly reflect the two different emphases of “blocking” and “dredging” in the concept of water control in China. As the construction concepts of these two water projects embody, it is important to focus on “dredging”, It is also important to focus on “blocking”.

Several months after this article was written, Liangzhu ancient city and its water conservancy project were successfully listed in the world heritage list at the 43rd session of UNESCO World Heritage Committee. The publication of this article is also a congratulation and tribute to it.

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