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The History and Significance of the Construction of Hydrotechnical Constructions in Uzbekistan in the middle Ages (Example of Abdullakhan Bandi)

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ABSTRACT

In this article, the history of the construction of hydrotechnical structures in the Middle Ages is covered in the 80s of the 16th century by the Khan of Bukhara, Abdulla Khan II, as an example of the dam built in the Nurota oasis. The reservoir is located in the Beklarsoy Gorge, and little information about it has been preserved in various books. The history and significance of the construction of Abdulla Khanbandi was described in detail for the first time in the article.

KEYWORDS: *Abdullakhan Bandi, Nurota, Beklarsoy Gorge, Makhondarya, hydro-technical facilities, reservoir, mountain ranges, floodwaters*

Introduction

Akchobsoy Reservoir (Photographed by the author)

The climate and topographical function of Uzbekistan requires agriculture with the help of reservoirs and channels. The architectural history of Samarkand has been formed typically for many years. Along with land structures, hydro technical structures have gained great importance in the history of human development. The results of the study of construction materials, mathematical and architectural solutions and constructions of the historical water structures that have been preserved in the territory of our republic show that the masters of water management and agricultural masters of that time had strong knowledge in the field of pyrotechnics and hydromechanics. A vivid example of this is that the hydraulic solution used by engineers in the Khanbandi reservoir built in the 10th century in the Forish district of the present Jizzakh region was discovered by the French physicist Blaise Pascal after 7 centuries.

Literature review. In the process of gathering information for this article, I consulted many books. While reading and analyzing the books, I noticed that the core meaning of the hypothesis were similar with each other, only certain words were paraphrased for printing process. For example, in "National Encyclopedia of Uzbekistan" (State Scientific Publishing House, 2000) and "Ancient Hydro technical Structures of Uzbekistan" (T., 1997) by A.Muhammadjonov, the data about Abdullakhan dam is the same in content. Detailed information about Abdullahkhandamcan be obtained from the work of historian Hafiz Tanish Mirmuhammad Al-Bukhari "Abdullanoma" ("Royal honorific"). "Abdullanoma" explains the history of Movarounnahr in the 16th century. It was written by Hafiz Tanish Mirmuhammad Al-Bukhari in Persian between 1584 and 1590.

Research Methodology. In the article, research methods such as on-site study of the preserved part of the dam, monitoring of its current state, classification and systematization, natural research, photo fixation, analysis and scientific generalization of collected materials, drawing conclusions are used.

Analysis and results. In August 2022, under the supervision of Professor UralovAkhtamSindarovich, we conducted research in the preserved part of the Abudullakhandam. Bukhara historian Hafiz TinishMirmuhammad Al-Bukhari in his work "Abdullanoma" described the construction history of Abdullakhanbandi, which was built in the 16th century in the Beklarsoy gorge of Koshrabot district of Samarkand province: On his way back from his military campaign to Istan, Nurota passed through Okchob near the village of Josh. A lot of floodwater accumulates here in the spring months, but these waters are hardly used for agriculture. Khan ordered to build a big dam in the valley of Okchob (Beklarsoy) in order to collect the flood waters and use them in agriculture" [1]. The remains of this water structure have been partially preserved in the Beklarsoy gorge, near the village of Eski Okchob, Koshrabot district, Samarkand region, 65 km east of Nurota district of Navoi region.

Samarkand. Kushrabot. Beklarsoy Gorge.

Although the dam of Abdullakhanis damaged, it has been preserved for many years. Afterwards, dam is replaced with Okchob reservoir. Scientific research was conducted here by

the Makhondarya archeological detachment of the Institute of History and Archeology of the Academy of Sciences of Uzbekistan in 1957-1962. The results of the research show that the the Abdullakhan dam is built of shale stones, and stone slabs are attached with a special water-resistant ganch mixture. The length of the lower base of the dam is 73 m, the upper base is 85 m, and its height is 14.5 m above the ground. The thickness of the dam is 15.3 m at the base, 4.5 m at the top, and 15 m high. Taking into account the water pressure and its strength, the front side of the structure is raised vertically, and the backside is made in the form of a staircase to withstand the pressure and overturning forces of the fifteen-meter-deep water reservoir accumulated in front of the dam. That is why the base of the dam is built almost 3.5 times thicker than the top 2. The water collected in front of the dam was approximately 1.2 million cubic meters. It should be emphasized here that the 16th century hydraulic engineers who built Abdullakhan's dam, when choosing a place for the reservoir, first, were able to determine the strongest geological and hydrogeological part of Beklarsoy and the most convenient part of the gorge narrowed by two rocky noses. The fact that the gorge in which the Abdulla Khan dam was located was chosen for the construction of the reservoir indicates that the hydrography of Beklarsoy has been studied for a long time and the changes in its flow have been carefully observed. However, studies have shown that the 16th century irrigators who built the Abdullakhanbandi reservoir were able to save only 10 percent of the annual flow of Beklarsoy into the reservoir. Abdullakhan's dam consisted of a complex of several water structures, such as a sluice with a well-controlled by a shaft, a stone underpass, and a water thrower that ejected excess water to the outside in case of a flood.[4] Concerning on reservoir constructions of the Middle Ages, we naturally questionnaire the constructors about how large hydro technical facilities were built for their time when cement was not yet discovered. Over the decades, the main problem of the construction of irrigation structures has been the pressing of bricks or stones. This was the immensely significant issue for medieval irrigator-builders who did not have cement. Discovering water-resistant bonding compounds was the optimum solution for architectures of medieval period. In fact, water management facilities such as Khanbandi, Gishtband, Abdullakhanbandi, built in the 5th-10th centuries ago, would not have been built without the development of binding compounds used in the construction of medieval hydro technical structures. It is written in historical sources that stonemasons cut stones from the mountain and architects cooked alabaster. Then, the prepared the dust of alabaster was boiled in molasses together with the camel milk brought in wineskin. The dam was built using a ready-made binder mixture. The candidate of technical sciences revealed the secret of this binding mixture by performing chemical analyzes with the help of samples taken from N.S. Grajdankina. Chemical analyzes indicate following results:

The part of Abdulla Khan Bandi that has survived until now

Name of the building	Period	The composition of the construction mixture in %			
		Alabaster	Bleach	Plantash	Dirt
Khonbandi	X century	-	50	-	50
G'ishtband	XII century	-	80	20	-
Abdullakhonbandi	XVI century	-	55	45	-
Karaulbazar reservoir (pond)	XVI century	-	56	44	-
Qorovulbozor reservoir (dome)	XVI century	100	-	-	-

Table 1

Based on the results of the above table, it is evident that the architects of the Middle Ages prepared a building mixture by mixing equal amounts of lime and sand or by mixing 25-30% vegetable oil. The facility was used to supply water to Kamar, Okchob, Urganji, Josh, Ravot, Jilontamgali and Soykechar villages located in the territory of Ko'shrabot district of Samarkand region. Due to the construction of the dam, the local citizens have flourished 1-1.2 thousand hectares of the land area of this area. Currently, the inhabitants of these villages are engaged in viticulture and agriculture. The dam is an important milestone for Central Asian hydromechanics, and on January 18, 2008, it was included in the UNESCO World Heritage List in the field of Culture[2]. During the reign of Abdulla Khan II, many canals were built such as Abdullakhanbandi, Tuyatortar Channel, Bakhsh. The investigations of our archeological researchers efforts play an important role for our country, a number of hydro technical structures were found and their history was thoroughly studied.

Conclusion/Recommendations. At the end of this article, we conclude that the Middle Ages, in the X-XVI centuries, was a period of rapid development of the construction of hydraulic structures in Uzbekistan. Owing to the research, it is clear that the architects, engineers, and mirobs (the responsible person for water management) of this period had mastered the sciences of mathematics, geometry at a perfect level. Since the 10th-16th centuries, hydro technical structures in the irrigation industry have been built according to pre-prepared plans, that is, projects. Architects and engineers directly supervised the constructions. Since the reservoirs are located in a mountainous, clean and historical area, keeping a safe distance from them:

1. Rest areas
2. Tourist centers
3. Recommended to organize summer camps.

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