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ON THE HISTORY OF IRRIGATION AND WATER SOURCES OF THE ZARAFSHAN OASIS

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Zarafshan River with tributaries of the Fandarya, Iskanderdarya, Kshtutdarya and Magiandarya is the main water source of the basin. It starts from the Zarafshan glacier and before the confluence of the Magi Darya is called Matcha, at the Chapanatinsky heights it is divided into Akdarya and Karadarya, forming the island of Minekal, and after their confluence it is again called the river. Zarafshan. At the Makhankul discharge, the river is divided into Mahandarya and Karakuldarya. The catchment area is 11722 km2, the weighted average height is 2930 m. The length of the river (from the confluence of Fandarya and Matcha to the Karakul fan) is 576 km.

Irrigated agriculture in the Zarafshan valley began to develop in the second half of the 2nd millennium BC, where the Zarafshan river played an important role. It received the greatest development in the I-IV centuries. AD with the creation of channels by Darg, Mirzaaryk, Kalkanat, Zandana, Romitan, Shahrud, etc.

In ancient sources, the Zarafshan valley and its mountainous part are referred to as a developed agricultural country (Curtius Ruf, 1963. P. 291; Strabon, 1964. P. 489).

In Chinese sources of the period of antiquity and the early Middle Ages there are more detailed data on agriculture, cultivated crops and soil fertility of the Zarafshan valley (Bichurin, 1950. P. 272; Stavisky, 1959a. P. 79-93).

Sogdian documents from Mount Mug contain important information about the ancient period of Upper Zarafshan, which contain important information about cultivated crops, sale and purchase of land, winemaking and many other sides of this region (SDGM, 1963. P. 30, 32-35 , 49, 52, 66).

After a strong entry into the Arab caliphate, Maimurg was one of the rustaks (districts) of the Samarkand region, with its southern part - Saidzharfegan and northern - Varagsar – constituting sensible rustachi (Bartold, 1914.S. 107).

Especially important was the separation of Varagsar, since it contained the head structures of the canals irrigating the entire Samarkand oasis. In the Chronicle of At-Tabari, only Varagsar and Panjakent are mentioned. The first of them is mentioned in connection with the military operations of 720, 735, 739. In 735, during the uprising of the Sogdians, supported by the Turges, the Arab governor Asad ibn Abdallah, unsuccessfully trying to capture Samarkand, ordered the construction of a dam in Varagsar to divert water from the rebellious Sogdian S. 140).

Many sources report a Mongol invasion, a great devastation and a significant decrease in the population are reported by the Chinese Chan-Chun, who visited the Zarafshan valley after the Mongols took it (Palladium, 1866, p. 347). Among the sources after the Mongol period, one can mention Boburnama ”and vacufic documents. Bobur reports a sufficient quantity of water from the crops grown and their high quality in Samarkand, the bulk of which was average Zarafshan (Babur, 1958., p. 60). The sources provide many examples of non-participation rulers of Samarkand

Fig. 1. Charpai facilities on the river. Zarafshan.

or Bukhara in the restoration of the Dargom dam. Thus, according to the reports of Hafiz Tanish ibn Mirmuhammad Bukhari, the author of the historical work “Abdullaname”, in 1556 the ruler of Samarkand, Navruz Ahmadkhan, was engaged in the correction of the dam (Hafiz Tanish Bukhariy, 1968. S.

237). In 1748, restoration work was headed by the ruler of Bukhara, Rakhimbiy (Abu Tahir Khoja, 1899, p. 240).

The ancient spring system was switched to the Dargom canal, supplying water through the three main channels of the ancient settlement Afrasiab (Samarkand) and its environs. The head part of Dargom consisted of a dam, a tunnel with several water intakes and ventilation wells. One of the holes has been preserved to date, its diameter reaches 1.5 m. The ancient, tunnel, part of Dargom passed almost parallel to the coast. Subsequently, it was eroded, and the head section of the canal connected to the floodplain of the Zarafshan River. Water intake from Zarafshan was carried out using temporary dams in the riverbed 5-7 km long from sepoys, forest, brushwood, straw, stones and turf (Fig. 1). Dams were often destroyed by spring and summer floods. The Dargom dam and water intake dams caused special concerns for the Samarkand rulers of the population. Supervision of them was introduced as a service to residents of the village of Varaksar, exempted from the haraj-land tax (Bartold, 1930. P. 23).

In ancient times, to the northeast of the city center of Samarkand, on the left bank of the Zarafshan River, there is a huge brick arch. This arch is one of the spans of a medieval water structure - a divider bridge built on the watershed of Zarafshan, in the place where the river is divided into two channels - Akdarya and Karadarya. In the literature, this historical monument is mentioned under several names: “Timur Arch”, “Bullets Shadman Malik”, “Abdullahan Bridge”. The history of this building is usually associated with the activities of Temur or Abdullahan. According to written sources, it was built by Khan Sheybani at the very beginning of the sixteenth century. Therefore, it can be called a bridge-divider Sheybanihana. Sheibanikhan Bridge was the main water distribution facility in Zarafshan. The water distribution dam went straight from the bridge, and the waters of Zarafshan, bypassing the arches, were divided into two parts and flowed along two channels

- Akdarya and Karadarya. That is why this structure was called a bridge-water divider (Mukhamedzhanov, 1969. S. 5-8).

For the water supply of Samarkand in antiquity and the early Middle Ages, the aqueduct lined with large-format burnt bricks on mortar was of great importance. The aqueduct threw the water of the canal Dargom through the Siab basin (Terenozhkin, 1947. S. 131).

A well-known role during the Middle Ages was played by reservoirs in mountain gorges for holding mudflows in spring. The bottom of them was built in the X century. in the Honbanditau mountain gorge with a granite dam in a lime mortar. The second dam, Abdullahanbandi, was located 65 km east of the Nurata district of the Samarkand region (Mukhamedzhanov, 1978.P. 257).

By IX-XI centuries. after decline and long neglect, irrigation systems gradually recovered, and irrigated agriculture reached its peak. The total area of irrigated lands in the Zarafshan Valley was about 300 thousand ha, of which 100-120 thousand were ancient irrigation in the western part of the oasis. Irrigated lands were divided into 22 rustak (districts), including 15 - inside the fortress wall of Kampir Devar, erected in 782-830. for protection from raids of nomadic tribes. Rustaks were irrigated by the waters of the Zarafshan River with 17 main canals (Muhammedov, 1961. P. 49).

The Zarafshan river basin, located between the Turkestan and Gissar ranges and the western spurs of the Turkestan and Zarafshan ranges (Chumkartau, Nuratau, Karatepa, Zirabulak and Ziadinsky heights), separates the two largest river basins of Central Asia - Amu-Darya and Syr-Dar.

The Turkestan, Zarafshan and Hissar ranges, especially in the east, and the Zarafshan ridge between the transverse valleys of Fandarya Kshtut reaches very significant heights. Individual tops first

two ridges exceed the elevation of 5000 m, and the Hissar ridge almost 5000 m. Therefore, for a considerable extent, the ridges of the ridges rise above the snow line, bear the cover of eternal snows and have a large number of glaciers (Schulz, 1965. S. 466-467).

The Zarafshan River is one of the most important rivers of Central Asia, which in ancient times was a tributary of the Amu Darya. The river flow is completely formed within the mountain systems of the Turkestan, Zarafshan and Gissar ranges. Zarafshan is a river of glacial – snow nutrition with a long flood. There are about 387 glaciers in its catchment. The total area of glaciation reaches 476 km2 (Shcheglova, 1960.S. 208; Schulz, 1965.

S. 466).

The Zarafshan River is formed mainly from the village of four large tributaries.

1. The Matcha River, 200 km long, originates from the largest glacier in the pool - Zarafshan, then numerous side

rivers flow into the river, originating from glaciers and springs of the northern slope of the Zarafshan and southern slopes of the Turkestan ranges. The irrigated agriculture of the gorge is completely based on them, since the river flows through a deep bed inaccessible to farmers. The Matcha River gives 49% of the runoff, as well as almost the entire runoff of suspended sediment, the Zarafshan River (Schulz, 1965. P. 473).

2. The Fandarya River, 24.5 km long, is formed from the confluence of the Yagnob and Iskandarya Rivers. The Yagnob River, 120 km long, flows from east to west along a deep and cramped gorge (Kireev, 1936. S. 65-67).

The Iskandarya river began from the mountain lake Iskandarkul. The upper course of the river is called Karakul, which originates from the left slope of the Gissar Range. The basin area of this river is 974 km2 (Schulz, 1965.P. 475). In the Yagnob gorge and the lower reaches of the Iskandardarya basin, for irrigation, land uses exclusively the waters of rivers and streams flowing down the slopes of mountain ranges. Only in the upper reaches of the Iskandardarya Gorge

its beginning both from the river and from small tributaries.

1. 1. The river Kshtutdarya is formed from the confluence of the Voru and Artuch rivers, of which the first in terms of catchment area and water content significantly exceeds the second. In the back and partially, in the middle course, the Voru River in the mountain ranges reaches more than 5000 m, which is why quite a considerable glaciation takes place in this part of the basin. The Arthuch River is the beginning of the high-mountain Kulikalon Lake. From its beginning, the Kshtut River flows 10.5 km along a narrow valley and flows into Zarafshan. The total length of the river is 53 km (Schulz, 1965.S. 490). Basin irrigators mainly originate from numerous small lateral water sources, as well as from Voru Artuch to their village.

2. 2. The Magiandarya River — the last major tributary of Zarafshan — originates from the glaciers of the northern slope of the Gissar Range and consists of two tributaries — Shingdarya and Magiandarya. After their confluence, Magiandarya cuts a ridge, goes into the valley and flows into Zarafshan east of Penjikent. The catchment area of the river occupies 1100 km2, where there are 45 glaciers. The total length of the river is 67 km (Schulz, 1965.S. 490-492). After the last tributary merges, the total runoff of the Zarafshan River from the mountainous region averages 190 m3 / s (Schulz, 1965. P. 467).

Fig. 2. The upper course of the river. Zarafshan

After the confluence of Kshtutdarya with Zarafshan, the valley expands sharply. In this part of the valley, i.e. Penjikent, from the Zarafshan River, water supply is possible only on floodplain and coastal lands. Significant land moat

terraces of both banks of the river, the land of the slopes and soles of the Zarafshan and Turkestan ranges are irrigated by the waters of numerous mountain rivers and springs. In the upper reaches to Zarafshan, in addition to Fandarya, Kshtutdarya and Magiyandarya, about 50 mountain rivers flow from the Turkestan, Gissar and Zarafshan ranges and their spurs. With the onset of summer, these rivers dry up (Mukhamedzhanov, 1978.P. 20-21). (Fig. 2).

The total area of the Zarafshan water basin to the Dupul water measuring site is 10,200 sq km (Sheglova, 1960. P. 213). Below the Panjakent, Zarafshan does not accept larger tributaries; on the contrary, it feeds irrigation canals with its life-giving moisture. 15 km west of Panjakent, the river faces a vast plain formed as a result of

alluvial deposits of Zarafshan.

The river catchment is located at a considerable height and consists of high peaks with very steep slopes, deep canyons and narrow valleys, which -
it spills out a large erosion of the catchment basin. From 1 km2 of the catchment area, the Zarafshan River in the lowland region annually carries 421 tons of suspended water -
sediment and medium
their annual stock Fig. 3. The ancient riverbed. Zarafshan
equal to almost 4.5 million tons. (Schulz, 1965.S. 467-489).

The Zarafshan sediments contain 1.5–2 times more phosphorus, and 2 times more potassium than the deposits of Amu Darya and Syr Darya (Molodtsov, 1963. P. 62-63). Rational use of sediment in the upper part of the valley plays a large role in the development of agricultural C rops (Eshonkulov, 1985a. P. 8-11).

Fig. 4. The head building of Dargom

The northern border of the valley adjoins the low hilly southern foot of the spurs of the Nurata Range, the southern border borders with the Adyrs of the Zarafshan Range. The width of the valley is 35-40 km, in some places it is somewhat wider

Fig. 5. The bridge — the water divider of Sheybanikhan.

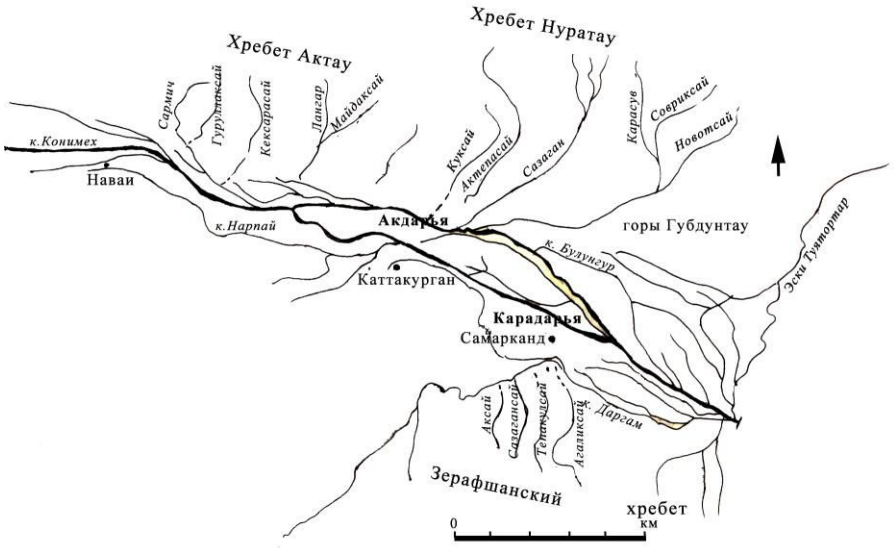

Fig. 6. The average course of the river. Zarafshan

With access to the plain, Zarafshan becomes wider. Here the river forms a number of islands and is divided into several branches; the width of the river bed reaches 1-1.5 km (Fig. 3). Large and small irrigation canals that cut both banks of the river originate in this area. Most of these irrigation arteries originated near the area of Rapvatkhoja, mentioned in the works of medieval Arab geographers ("Varksar" - "head of the dam"). Since ancient times, this place has been the head building of the Dargom canal, supplying water to Samarkand and its environs (Fig. 4).

7 km north-east of Samarkand, near the height of Chupanat, the Zarafshan River is divided into two branches: the northern - Akdarya and the southern - Karadarya (Fig. 5), which form the island of Miyankal. Miyankala is 100 km long and 12-15 km wide. Due to the convenient geographical position, Miyankal was mastered and turned into the most comfortable part of the valley in antiquity. In the eastern part of Miyankala, the width of the valley reaches 30-35 km, to the west

the valley narrows, in the Kattakurgan region its width does not exceed 10-12 km.

In the central part of the valley, many mountain rivers flowing into the Zarafshan flow from the southern slopes of the Nurata Range. In spring, their stormy waters flow into the Zarafshan River, and in summer, many of them dry out.
At the confluence of Akdarya and Karadarya, the valley again widens somewhat and reaches 18-20 km. From the south and north sides, the valley, having cut through the foothill adyrs, gradually narrows towards the west. Near the city of Navoi, its width does not exceed 8-10 km. In this area, the Kenimech oasis separates from the valley, wedging into the steppe in a north-westerly direction. Its width reaches 3-4 km. In the north, the oasis borders on the western spurs of the Nurata ridge, and in the south, the Aftabachi adyrs adjacent to the Kanimekh steppe (Fig. 6).

Below Navoi, Zarafshan is surrounded by steppes on both sides. On the right side, the river washes the southern part of the Kenimekh steppe, on the left, the northern part of the Chulimalik steppe and then carries its waters through the narrow Khazar valley, squeezed by the mentioned steppes from the northern and southern sides. In this area, the valley is narrowing, its width does not exceed 2.5-3 km.

Coming out of the Khazar gorge, the river flows into the lower part of the valley. With the entrance to this part, Zarafshan flows to the south-west and forms a cone-shaped Bukhara oasis, bordering the north and west with the lands of ancient irrigation, covered with moving sands and adjacent to Kyzylkum. The Chulimalik, Kyzyltepa and Kuyumazar adyrs adjoin it from the east, and the Karshi steppe from the south. The width of the oasis reaches 65 km. 7 km west of Kyzyltep from Zarafshan, its ancient tributary Vabkentdarya is separated. The place where the Vabkentdarya River originates is known by the name Kharhur. 10 km from Kharkhur, the Shokhrud Canal originates, feeding Bukhara and its environs with its waters. This place is called Duaba, from here Zarafshan is called Karakuldarya. Approximately 78 km below Doua

ba, not far from the Yakkutut station, from the right bank of the Karakuldarya in the north-west direction, the ancient dry channel of Zarafshan - Mahandarya is separated. In this region, Karakuldarya emerges from the Bukhara oasis and carries its waters through a narrow valley to the Karakul oasis. At this point, the width of the valley does not exceed 2.5-3 km (Mukhamedzhanov, 1978.P. 22-23).

25 km below Yakkutut, the Zarafshan-Karakuldarya river forms its lowest fan-shaped oasis with the same name. The length of the Kara-Kul oasis is 20 km, its width is more than 35 km; stretching from the east and north-west in the direction of the south-west, it is surrounded by adjacent to the Kar-

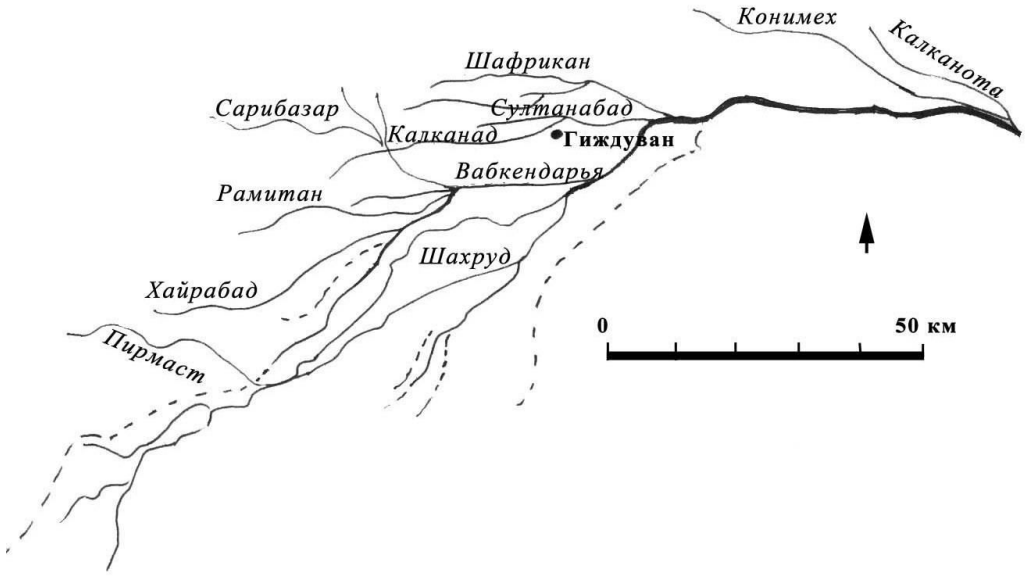

Fig. 7. The lower course of the river.

Zarafshansha steppe elevations, and on the other three sides - the eastern part of Kyzylkum covered with moving sands. Until recently, more than twenty main canals on both sides of Zarafshan in the Bukhara and Karakul parts of the valley supplied water to irrigation systems, the largest of which in the Bukhara oasis are Kalkanatinsky, Kanimekhsky, Shafrikansky, Sultanobodsky, Pirmastsky, Kharkanrudsky, Shakhkanrudsky, Shabankrudar, The Raman, Khayrabad and Saribazar canals (Mukhamedzhanov, 1978. P. 23), (Fig. 7). Technical and economic indicator of the lower reaches of the river. Zarafshan

Table 1.

Name Channels	Channel length; km	Average water consumption inm3 / s.	Irrigated area; ha.
Babkentdarya	48	49,5	40179
Shahrud	65,5	35,1	38916
Saffrican	20	25,0	9579
Sarybazar	40	20,0	21501
Sultanabad	40	17,0	10833
Harkanrud	29	16,0	8008
Hirabad	60,1	15,0	10486
Kenimeh	59,8	13,5	10539
Pyrmast	40	9,0	7058
Kalkanat	23,3	5.5	3440
Ramitan	19,0	5,4	3400

The water runoff of Zarafshan, disassembled in the upper part of the valley by irrigation systems, completely settles in the Karakul oasis. Zarafshan as a river of glacial-snow nutrition is characterized by the late onset of flood and late concentration of runoff. High water begins in the second decade of April, an intensive increase in spending continues until July, inclusive, when the high water ridge passes. The decline in spending starts from August and lasts until March, inclusive, when annual minimum water consumption is observed (Fig. 8).

Stock for July-September is 182% of the flow for March-June and 55% per annum-

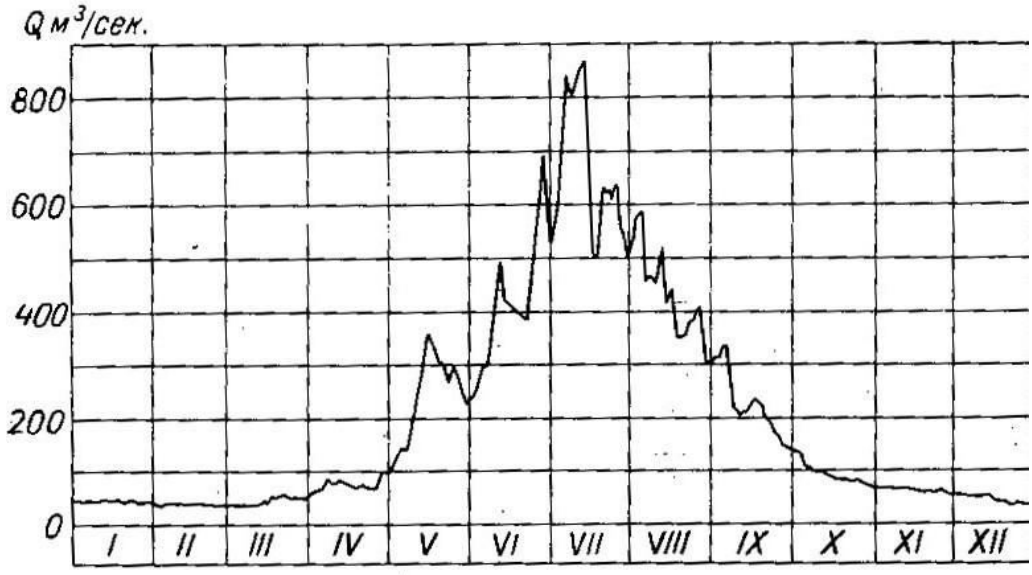

Fig. 8. Hydrograph p. Zarafshan at the Dupuli tract in 1942

water flow, i.e. within three months, more than half of the annual volume of water passes (Schulz, 1965. P. 483).

Along with providing its valley with water, Zarafshan carries in the form of suspended sediments a large amount of mineral substances necessary to improve soil fertility. Sown areas on the alluvial plains of the Samarkand and Bukhara oases were formed from the alluvial deposits of Zarafshan. The average annual amount of suspended sediment in the upper reaches of the Zarafshan River — at the Dupulinsky hydrometric post — was 137 kg / s, and the average turbidity of the water was 088 kg / m3 (Schulz, 1958. P. 59).
From 1 km2 of water intake, the Zarafshan River annually transports

421 tons of suspended sediment (Schulz, Mashrabov, 1969.P. 150). Representing a variety of solid particles, the amount of which increases especially during the summer flood.
The average monthly amount of suspended sediment and the turbidity of the water of Zarafshan

Table 2.

№	Month	Turbidity of water, g / m^3	The amount of monthly sediment, thousand tons.	Period
1	January	32	3,2	Winter
2	February	29	2,3	Winter
3	March	70	6,5	Spring
4	April	157	26,0	Spring
5	May	367	488,8	Spring
6	June	868	816,4	Summer
7	July	1466	1570,4	Summer
8	august	1363	1229,8	Summer
9	September	520	252	Fall
10	October	108	23,4	Fall
11	november	53	7,5	Fall
12	December	36	4,7	Winter

Zarafshan annually carries 4.5 million tons of nanoseeds, 81.7% of the annual amount of suspended sediment falls on the summer period. The volume of sludge settled during the growing season in Samarkand and Bukhara oases in the sowing areas increases by 0.8-1.5 mm only due to suspended sediment (Molodtsov, 1963. P. 48).
Thus, river sediments harm the irrigation system, but are useful for agriculture. By the content of chemical elements contributing to soil fertility, the waters of Zarafshan are not inferior to such large rivers of Central Asia as the Amu Darya and Syr Darya. As a result of comparing the chemical composition of sediments for important elements that determine soil fertility, it was found that Zarafshan sediments contain more phosphorus (1.5–2 times) and potassium (2 times) than sediments of the Amu Darya Syr Darya. Thus, the chemical composition of the waters of Zarafshan is somewhat better than the waters of the Amu Darya and Syrd- rye.

If during the growing season 36 kg of chlorine per hectare comes from the waters of Zarafshan, then 320-400 kg of water from the Amu Darya and Syr Darya, as a result of which the lands irrigated by the waters of Zarafshan, in comparison with the lands irrigated from the Amu Darya and Syr Darya , saline 10-15 times slower (Mukhamedzhanov, 1978.P. 28-29).
It is known from history that when the country was captured, the external enemy sought, first and foremost, to take possession of the head part of the main canal and to destroy water structures in order to strike at the defending forces and leave the population of the valley without water. Therefore, significant water forces of the state were concentrated near the

water nodes of the Zarafshan Valley, which were of strategic importance. Thus, the area of Rawathodzha, near which the head dam of the Dargom Canal of the Varsksar — the main irrigation system of the Samarkand oasis was located — was turned into a fortified fortress even in the early Middle Ages.

Currently on the river. Only one arch was preserved in Zarafshan, which testifies to how unique, in general, was this water construction of the beginning of the 16th century. It is of great importance in studying the history of the development of hydraulic engineering in Central Asia.

Thus, p. Zarafshan not only supplies water to the Samarkand and Bukhara oases, but also sufficiently fertilizes the soil with chemical elements, and its suspended sediments at one time played an important role in the formation of the alluvial plain of the Zarafshan valley.

In general, the Zarafshan oasis played an important role in the history of the agricultural culture of Sogd and Central Asia. A developed ancient agricultural culture has developed here, complex labor-intensive irrigation facilities have been created, the lands of its plain and mountain parts have been developed.

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