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SOI: [1.1/TAS](#) DOI: [10.15863/TAS](#)

### International Scientific Journal Theoretical & Applied Science

p-ISSN: 2308-4944 (print) e-ISSN: 2409-0085 (online)

Year: 2020 Issue: 05 Volume: 85

Published: 30.05.2020 <http://T-Science.org>

QR – Issue



QR – Article



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## HISTORY OF HYDROGRAPHICAL RESEARCHES ON THE AMU DARYA IN THE XIXth CENTURY

**Abstract:** Water resources have great importance all over the world. Their study is necessary for planning agricultural production, hydrotechnical and hydropower facilities, schemes for the integrated use of water resources, drawing up water balances, planning work projects for the construction of water facilities, planning operation modes of reservoirs and much more.

Hydrographic and hydrological observation on the territory of modern Uzbekistan, in particular, the study of the Amu Darya began in the 19th century. The paper considers the so-called Amu Darya expeditions organized by the Russian Empire after the conquest of a significant part of Central Asia. The author reveals the objectives of these expeditions, describes the progress of these studies, and also highlights their main results. It was shown that the task of these expeditions was to resolve the “Amu Darya issue”, that is, to search for a waterway from the Caspian Sea to the Amu Darya along one of the old river beds, called the Uzboy. Since the organization of such a waterway would solve many of the economic and military-strategic tasks of the empire in the conquered region.

**Key words:** Amu Darya, Aral Sea, Caspian Sea, Uzboy, Sarykamysh, N.Stoletov, A. Glukhovsky, Samara Expedition, survey.

**Language:** English

**Citation:** Khakimova, S. B. (2020). History of hydrographical researches on the Amu Darya in the XIXth century. *ISJ Theoretical & Applied Science*, 05 (85), 927-934.

**Soi:** <http://s-o-i.org/1.1/TAS-05-85-176> **Doi:**  <https://dx.doi.org/10.15863/TAS.2020.05.85.176>

**Scopus ASCC:** 1202.

### Introduction

UDC 330

One of the hugest rivers of Central Asia, Amu Darya is formed by the connection of the rivers Panj and Vakhsh. The length of Amu Darya from Panj to Aral Sea is 2540 km, 1000 kilometer of which leaks through Uzbekistan. The river basin includes quite large area (approximately 1327 thousand square kilometers). It leaks through the borders of Uzbekistan with Afghanistan, then through the area of Turkmenistan and returns to Uzbekistan and finally flows into Aral sea. When it approaches Aral sea it forms a big delta equal to 300 km. Two huge feeders from right (Kaphirnikhan and Surkhandarya) and one left feeder (Kunduz) also flows into Amu Darya. No any other influxes join to it till Aral sea. The river crosses the deserted area and divides Karakum and Kizilkum into two separate deserts. As a result of

evaporation in the plains from Kerki to Nukus, absorption and usage for irrigation Amu Darya loses most part of its flow. According to the level of silt this river is in the first place in Central Asia and in higher position in the world. Amu Darya takes its water from ice and snow. Its water supply consists of 68,63 cubic km on average. The main part of its flow (85%) contains of the feeders Vakhsh and Panj, the rest 15% belongs to the rivers Surkhandarya, Kofirnikhan and Kunduz.

Amu Darya was first mentioned as Ox or Oxus in the works of ancient Greek and Roman historians. Herodotus, Strabo, Arrian, Pliny, Ptolemy, Marcellinus wrote that it flows into Caspian sea [4, p.443]. That is why it was thought in Europe for a long time that Amu Darya flows into the Caspian. In the Middle ages Arabic-Persian authors (such as Idrisy and Istakhry) stated that it flew into the Aral. Historian Khamidullakh Kavziny, who lived in 14th century,

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writes that Amu Darya is divided into two tributaries, one of which flows into the Caspian and the other into the Aral. This information was also approved by Jurjony [4, p.443].

The first geographical atlas "Map of Siberia", created in Russia in 1699-1701 by S.U. Remezov, depicts the Aral Sea with two rivers flowing into it, that is, Amu Darya and Syr Darya [11, p.97].

However, modern research shows that Amu Darya has been flowing into the Aral for thousands of years.

In the Middle Ages and later on trade road from Russia to Khorezm and Bukhara crossed through Amu Darya during the reign of Peter I the interest in trade between Asian countries and India across Amu Darya increased. As a consequence maps describing Amu Darya flowing into the Aral were created. But systematic investigation of the river began in the late 19th and early 20th centuries.

When the Russian empire began its aggression against Central Asia, it was interested in establishing a comfortable way of communication with the regions to be occupied in the future. Therefore, among the Russian dominant circles, it was important to know why Amu Darya changed its ancient bed Ouzboy that was directed to the Caspian. Authorities wanted to change the directions of the flows into the Caspian again and by this the "Amu Darya problem" was created to determine the prospects for the creation of the water road between Russia and Central Asia. It was important to know why the river flowed into the Aral. At that time, there were two theories: the river's evolution as an artificial factor and natural factor. The artificial factor implies the anthropogenic effect and the direct and indirect effect of the river divided into two tributaries, which is called bifurcation. The direct effect is that the river flowing through the Caspian Sea has been blocked by the dam by residents, and that the entire river flows into a stream that flows into the Aral. Indirect impacts of the river flowing into the Caspian Sea for the use of river water for irrigation purposes reduce the flow of water, reduce the flow rate, and increase sedimentation levels and gradually disappear. Among the Russian scientific community, the theory of natural factors has been widely disseminated, and its supporters have proposed several hypotheses:

a) The turning of the river is explained by geological reasons, that is, it is possible for water to flow into the Caspian Sea as a result of the rise of the soils. This hypothesis is supported by the majority;

b) Amu Darya moves to the right, that is, according to the Bare law, rivers flowing through the meridian flows to the right. A member of the Russian Geographical Society, Professor R. Lentz promoted this hypothesis;

c) Amu-Darya has changed its flow from the Crimea to the Pamirs through the Caucasus, as a result of the rise of the earth's surface. First of all, it was the place where Ouzboy had been laid, and its water flew

toward the East. This view was mentioned by Bogdanov in 1873 at the meeting of the Russian Geographical Society;

d) In 1875 another prominent tourist and scientist N. A. Severtsev proposed another hypothesis. The eastern part of the Aral Sea is characterized by the fact that the water escapes from the coast and the presence of river sediments at certain points above Amu Darya. Severtsev concluded that the water has dried up and the water level decreases. As a result, the water level in the river flowing to the Caspian would also be reduced, but due to the fact that there were no signs of construction in the Caspian, it did not penetrate deeper, but on the contrary, the water stopped to run;

e) In 1875 Zoologist and Cartographer Alenitsin as a result of his observations concluded that the North-West Bank of the Aral Sea is thinner than the South-East edge and the river deepened towards the North-West. This shift is explained by the rise of relief of the Pamir Mountains. As the Amu-Darya started off from the Pamir Mountains, the rise of the relief increased flow velocity and the river naturally tries to straighten its bed along the straight line. At the same time, the river flows into the Caspian Sea, causing the river to blow up the shoreline and create a new flowing stream towards the Aral Sea. It has created another hypothesis about the turn of the river [1, p.31]. Although the above hypotheses sometimes contradict each other (for example, Bogdanov and Alenitsin versions), most of them explain the turn of the river with geological changes taking place in the earth.

Although the initial efforts to find a solution to the Amu-Darya problem began in the middle of the 19th century, Russians were limited because of the fact that the dry beds were located in the territory of the Khiva Khanate, which had not yet been transformed into vassals.

Therefore, the scientific study of the Amu Darya was carried out systematically only after the invasion of the Khiva Khanate and its occupation. For the first time, the initiative of establishing an expedition to study Uzbay and to re-bring the Amu Darya into the Caspian Sea was suggested by V. G. Grigoryev in 1864 in a special letter to the Council of the Russian Geographical Society. The mission of the expedition was to depict the southern parts of the Ustyurt region, to map the area between the Balkhan Gulf and the Khorezm oasis, and to detail the ancient ruins of the Amu-Darya and its surrounding settlements. Although the geography community encourages it, there is no expedition due to lack of support for such research.

The next issue was raised in 1867 in the Geographical Department of the geographical society. A special commission was established under the leadership of P.I.Semyonov, consisting of A.I.Butakov, A.Geyns, A.I.Gluhovskoy, V.V.Grigoryev, N.Ivashnitsov, S.Zelyoniy,

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A.N.Savich and M.G.Chernyayev. The Commission considers the expedition organization to be very important, but as a condition of its implementation, a large military force must be mobilized for guarding and the Amu-Darya River should first be laid. Therefore, it was decided to postpone the expedition until the appropriate moment [9, pp.330-332].

On February 5, 1870 R.E.Lents at the meeting of the Natural Geography department delivered a lecture entitled "Our knowledge of the earlier flow of the Amu-Darya River and its flowing into the Caspian Sea".

Prior to the report, P. Semyonov reminded that in 1864, the blockade of the Krasnovodsk Bay was eliminated by the 1869 blockade of the expedition. The secretary of the Society announced that he was ready to provide the necessary transport and specialists for the expedition on behalf of the Chairman of the Committee, Mr. O.P.Litke. However, in preparation for the expedition, it was known that an expedition to Krasnovodsk was being organized in Tbilisi and the Amu Darya expedition was postponed for an indefinite period[9, pp.330-332].

The geodesist I.I.Stebnisky, who is part of the Krasnovodsk expedition, was able to carry out research in the last 100 versts (verst – Russian distance mere equal to 1066,8 metres – S.Kh.) of the Igda well of Uzboy in 1872 and concluded that it was indeed a river's bed. As a result of barometric saturation of the points along the river's bed it was clear that the river has a slope towards the Caspian Sea. Based on this, he argues that the Caspian Sea has not been lifted anywhere [10, p.14] and thus rejects the idea that Uzboy has dried up as a result of the rise of relief from the Caspian Sea.

It is known that in 1873 the Russian empire attacked the Khiva Khanate in four directions. The squad involved in this process included experts in various fields. In particular, by the Krasnovodsk detachment, the river Uzboy is examined further from the Igda well, to the well of Bola-Eshon, another 52 versts. After Khiva was conquered on June 19, Orenburg group had to return to the territory of the Khorezm oasis along the ancient Urgench, then to Khodjeyli and Kungrad on the eastern border. Along the way, they had to study the territory, especially the ancient valleys of the Amu-Darya. The main task was to go to the Sarikamish lake across one of the ancient beds of the Amu-Darya – the Kuhna Darya (another name is Urundaya). As a result, the Urundaya expedition was formed.

For this colonels A.B.Kaulbarsov and C.I.Djinlinskiy, captain D.M.Rezviy, topographers Kusikov, Shimanovskiy and Uliyanov, poruchik Petrov and interpreter podporuchik Bekchurin participated in, under the supervision of the real member of the Geography community colonel A.I.Gluxovskiy [9, p.793]. In order to guide 15 assistants were hired amongst indigenous turkman

and uzbek population. The safety of expedition was secured by hundreds of Cossack soldiers. Along the way, the member of expedition talked with aborigens and gathered information about the ancient watercourses of Amu-Darya. By the time getting to the ancient Urgench from Khiva, the expedition had investigated two watercourses of Amu-Darya: Daudon and Kuhna Darya . On July 6th the members of expedition arrived at the Sarikamish lake and dividing two groups, they conducted initial survey along the eastern and western coast. Being comprised of two watershed that is merged with each other by the bay, the lake was found to be 160 versts wide. Although the water in the lake was clear, the water was unable to drink as it was stinky and salty.

The Expedition was going to investigate the spots of Sarikamish lake until the place where Uzboy starts. But owing to the problems with fresh water the main squad moved other place, thus the research groups that is arrived to the lake had to return back. The expedition collected a bundle of data about several inflowings and irrigation channels that is available within the Khanate. As a result, it is concluded that Amu-Darya waters that flows to Kuhna Darya could not access Sarikamish as it was blocked by dams and used for irrigation in different parts of the watercourse. Yet, if more water was sent through this watercourse it could easily reach lake Sarikamish and by this way it would be possible to unite Amu-Darya with Caspian Sea. This conclusion encouraged the supporters of the idea of uniting Amu-Darya and Caspian Sea and established the next significant expedition to research the old watersheds meticulously.

After the Urundaya expedition one of its members Baron A.B. Kaulbars was commanded to escort the informer along Amu-Darya delta till Aral flotilla, who was going to deliver about brutal expulsion of Turkmens by the Russian troops under the leadership of General Golovachev nearby Chandir. At the same time, he was assigned to delve into an aqueduct access road through the Aral Sea to the Amu-Darya River. To accomplish astronomical observations with him, topograph podporuchik Sirovatskiy and yunker Rudnev set off. Travelers navigated to the Aral Sea in the Khiva boats, along with the horseman appointed by the Khan to study the Amu-Darya delta. During the trip along with the Amu-Darya River Main Areas, many prospects were explored. He also wrote valuable information about the irrigation systems and lifestyles of Turkmen, Karakalpaks, Kazakhs, and Uzbeks living in the Aral Sea and the Amu-Darya delta.

In the end of 1873, after the results of the Urundaya expedition to Khiva, A.Gluhovskiy and another researcher at Khiva's military expedition, M. Bogdanov reported on their research, the debate on the Amu-Darya problem was resolved in Geography Society. A commission was set up to address them and

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discuss issues related to studying the Aral-Caspian plain and sending them to the expedition. Secretary of the Society I.Venyukov assigned the following tasks to the future expedition: 1) Determination of the Amu-Darya water level and its suitability for navigation, and measuring in all the rivers. 2) Determination of irrigation water volume in the Khorezm oasis. 3) Topographical, geological, natural-historical study of the dry stratum of the Amu-Darya River, and complete the leveling survey of Uzboy nearby Igda well which is near 450 meters from ancient Urgench. 4) Investigation of the drainage of the water bodies and the spread of sand. 5) Collection of detailed information on the natural and cultural production of Khorezm oasis. 6) Gather information about the best land routes to the Caspian Sea by Khiva. 7) Studying the nomadic population of the Aral Sea region, the number of livestock in them, relationship between them and to Khiva khanate. 8) Gather as much meteorological information as possible. The area covered by the expedition was defined as the Amu-Darya basin, the territory of Russia and the Khiva Khanate, Uzboy and Yangidarya. Then the Deputy Chairman P. Semyonov contacted to the Governor of Turkestan Konstantin Petrovich fon Kaufman and ask him to carry out the expedition. The Governor-General responded positively but said that the research could be carried out only in the territory of the Russian Empire due to the situation in Khiva Khanate. This inevitably deprived the expedition of the opportunity to study the dry beds of Amu Darya. However, on February 9, 1874, the emperor permitted to organize an expedition to Amu Darya. 20,000 rubles were allocated for its expenses [9, pp.798-799]. The expedition was supposed to include 100 Cossacks and 25 soldiers. It was also owned by one of the steam ships of the Aral Sea.

Colonel Nikolay Stoletov was appointed as the chief of the expedition. He actively participated in the events in Turkestan and he founded the city of Krasnovodsk in 1869. The expedition consisted of five sections: geodetic-topography (head N.G.Stoletov), hydrography (head N.N.Zubov), meteorology (head F.B.Dorandt), natural history (leader N.A.Severtsov), ethnography and statistics (head N.G.Stoletov). As it was evident, N. Stoletov headed the Geodesy-topography, Ethnography and Statistics groups of the expedition. A special group headed by A. A. Tillo performs the task of leveling between the Aral Sea and Caspian seas. As members of the expedition, the chief of the British royal service, the engineer Herbert Vood and Prince Rizoquli Mirzo, the representative of the ruling dynasty of Iran, participated in the expedition. In general the expedition was attended by more than 20 experts and prominent Russian scientists.

The expedition's hydrographic department was led by lieutenant-colonel Nikolay Nikolayevich Zubov. Captain-lieutenant Bryukhov, podporuchik

Shevashov, engineer H. Wood also worked in the department. N. Zubov took part in the military campaign to Khiva in 1873 and organized the crossing from the Amu-Darya River. During the Amu-Darya expedition, he entered the Amu-Darya River through the Yangisuv River, and set up regular boat trips to Petro-Aleksandrovsk [5, p.60].

The members of the expedition investigated 431 versts in the Amu-Darya delta, 252 versts from Nukus to Tuyamuyin on the border of Bukhara Emirate and 600 versts along the dry riverbed of Yangidarya. A total area of 3000 square versts was examined. Ulkan-Darya, Kuvonch-Yorma, Davkor lakes, and Yangisuv, which form the central part of the Amu-Darya delta, had been studied, determining the water velocity and soil properties. The use of river water was at its lowest level near Tuyamuyin - 120,000 / sec and the highest figure is 160,000 cubic feet. The surveys showed that due to the depth of the river, the absence of underwater rocks and the fact that the majority of the coast is available to mooring of boats, navigation of strong high-speed ships across the Amu-Darya to Nukus could not cause problems [9, p.803]. As a result of levelling, the peculiarities of the relief were determined. The level of the Aral Sea coast, according to A. A. Tillo, indicated that 245 feet i.e 74.67 meters above the Caspian Sea. It could have made it easier for the Amu-Darya to flow the Caspian Sea. As a result of astronomical observations, the geographical location of 11 points: Kazalinsk, Nukus, Petro-Aleksandrovsk, Chimbay, Khiva, Khodzheyli, Kungrad, Kushkhonatog, Akkala, Qilichkala and Irgiz were determined and magnetic observations in 176 points executed. Meteorological and hydrological stations were set up in Nukus, Petro-Aleksandrovsk and Pitnak under leadership of Ferdinand Dorant, the head of the expedition meteorology group, and from October 1, 1874 to October 14, 1875 at the Nukus station measurement work was constantly carried out [9, p.804]. During the year, observations were made on such indicators as air temperature, freezing and ice-frost during winter. Observations allowed some of the features of the Aral Sea climate and the hydrological regime of the Amu-Darya and the Aral Sea.

F.Dorant carried out a comparative analysis of the sediments in the Amu-Darya with the world's largest rivers, such as Mississippi, Raine, Dunay, Visla, Trent, Umber, Nile and Gang [3]. According to N.N.Zubov's research, the amount of water consumed per year for irrigation of Khorezm oasis varied from 77,432 cubic feet to 84,729 cubic feet [12, p.320]. During the observations, the amount of water evaporating from the Aral sea surface, taking into account water of rainfall, was higher than in the Amu-Darya and Syr-Darya rivers. This indicated a gradual decline in the sea level. N.Zubov, F.Dorandt and N.Severtsov concluded that the Aral Sea level was declining. As a proof, N.Severtsov pointed out that the sea bank was becoming like a terrace shape [13].



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The Amu Darya expedition was not allowed to cross the Khiva Khanate, but the middle part of the Amu-darya valley, located between the Caspian Sea and the Khiva khanate, remained unexplored. In order to eliminate this problem, in June 1875, the group headed by General N.P.Lomakin for the recognizing works was sent from the Igda well to the Sarikamish lake. The Caucasus administration had set up D.L.Lupandin for this squad. He captured Uzboy from the well Bola-Eshon to the lake of Sarikamish at 267 versts, connecting the final points of the research carried out by Gluhovskoy from Khiva and Stebnitskiy from Krasnovodsk. According to Lupandin, Uzboy started from the lake of Sarikamish, though this mistake was later corrected by Konshin [2, p.89].

In 1876 the great prince Mikhail Nikolayevich Romanov created the Uralsk commission headed by N. Petrushevich. He was accompanied by engineer A.H. Gelman, topographers Prokofyev and Cheromsky. The route of the commission ran along the left bank of the Amu-Darya from New Urgench to Hodjeyli, then to Kuhna Darya along the Sarikamish lake. Experts had managed to line up and measure the depth of the Sarikamish hollow. The measurements made in the Kuhna Darya and several small channels showed that their relief lies westward towards the Caspian Sea. This conclusion had increased the possibility of turning the Amu-Darya water into the Caspian Sea.

Sarikamish Lake's surface is lower than Caspian Sea to 5.72 sazhen (sazhen – Russian measure of length equal to 2.16 meters) [7, p.83]. This condition meant that Sarikamish lake should be filled with the huge amount of water as required so as to turn Amu Darya to Caspian Sea. The investigations of Urundarya commission summarizes that new waterways towards Caspian Sea should pass around Sarikamish via dry watercourse except of Kuhnadarya.

At that moment, Russian government ordered to work on the railway project that linked the Empire with the Central Asia. Railway construction required a vast amount of money. There was an alternative to create a waterway that linked Amu Darya with Caspian Sea. At that time there was a heated debate between two opponent sides. The supporters of railway underlined that turning Amu Darya to Caspian was possible and inexpensive than railway construction. In 1878 a powerful flood in Amu Darya, that stretched to the dried watercourses in the west, inspired the supporters of turning Amu Darya. It needed to make a thorough investigation in order to come up to the last conclusion. For this reason a new expedition was organized by A.I. Glukhovskoy.

Meantime in 1879 Samara scientific expedition was organized by knyaz Nikolay Konstantinovich Romanov. It was named Samara expedition because the preparation of organizing was initially there. The

crew of the expedition included different professionals. It included famous traveler and explorer of Central Asia I.V.Mushketov with geologic explorations – naval officer captain-lieutenant N.N.Zubov with hydrografic investigations; head office colonel N.Y.Rostovtsev with astronomical investigations, Professor Sorokin – botanical investigations; zoologist Peltsam- on fauna. Except of these mentions investigators, there were Yakovlev, Lyapunov and Sokolovskiy – engineers, Karazin N.N. and Simonov – artists; Buchgoltz – photographer. Nikolay Romanov invited a young orientalist, Berlin university alum, Ramchandra Balaji. The number of expedition crew reached thirteen [8, p.154]. Geographic Society also wanted to participate in the expedition, so Mamayev was sent by the offer of knyaz. His assignment was to accomplish economic statistics in Turkestan, Bukhara and Khiva where a railway or water way should be constructed.

Travelers arrived from Tashkent to the upstream flow of Amu-Darya and planned to go to the underpoint flow where it flows to the Aral Sea.

N.N.Zubov set off a journey from Kazalinsk city with the help of 6 sailors of Aral fleet and camel caravan which was so big in the late May, 1879. He reached the city Petro-Aleksandrovsk (now Turtkul). He should have sailed towards the expedition crew by a steamship. But due to some problems Zubov decided to use boats. The head of Amu Darya region colonel A.A.Grotenhelm provided him with a soldier troop, supplies of food and other necessary items. 8 Khivians were hired from there to rule the boats.

On July 17, Nikolay Konstantinovich traveled from Tashkent to Ferghana and visited Kokand and Margilan. Then he went to Khodzgend and Samarkand through Jizzakh. On the way he had accumulated information on the methods and condition of irrigation in the Turkestan. In Samarkand, the head of the Zarafshan district, General-Major N.A.Ivanov, gave 25 Cossacks to the expedition. On August 6, the expedition headed to the south of Samarkand. They crossed the Zerafshan range, then the Karshi steppes. The researchers then go to the Amu-Darya basin through the Iron Gate Pass on Mount Gissar. Starting from the Darband town, the expedition moved towards the shore and studied the Amu-Darya. In late August, the expedition arrived in Termez, where it was joined by a group led by N.N.Zubov. The group was setting up a plan to move back after it has traveled 999 versts along the Amu-Darya for 66 days. Mushketov, Karazin, Sokolovskiy, interpreter from Samarkand D.Kamoliddinov and several expedition members went together with this group under guard of Cossacks and Bukhara military. Prince Nikolay Konstantinovich intends to go to the upstream of Amu-Darya in Pamir with the expedition members. In the territory of present-day Tajikistan, he goes to the Vakhsh river and leaves the river and reaches the place where the Vakhsh is connected to

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<b>ISI (Dubai, UAE)</b>	<b>= 0.829</b>	<b>PIHHI (Russia)</b>	<b>= 0.126</b>	<b>PIF (India)</b>	<b>= 1.940</b>
<b>GIF (Australia)</b>	<b>= 0.564</b>	<b>ESJI (KZ)</b>	<b>= 8.716</b>	<b>IBI (India)</b>	<b>= 4.260</b>
<b>JIF</b>	<b>= 1.500</b>	<b>SJIF (Morocco)</b>	<b>= 5.667</b>	<b>OAJI (USA)</b>	<b>= 0.350</b>

the Panj, ie the place where Amu-Darya was formed. It happened on September 1, 1879. The exact coordinates of this site are determined and hydrometric studies are carried out. After the prince's plan to sail in boats to the upper reaches of the Pyanj, he ordered to sail down the Amu-Darya. Travelers were on five boats. Part of the Cossacks cared for horses and followed the detachment along the shore. The boats have a range of 40-50 versts per day. Once they are attacked by the Turkmens, head of the Amu-Darya department immediately sent a hundred of Cossacks against them. Also, the emir of Bukhara, Muzaffar, showing his favor for the expedition, allocated 150 people for its protection from Kerki to the end of the route. The detachment, which was sent earlier, on September, 11 arrived in Petro-Aleksandrovsk, and from the steamer acquired by Nikolay Konstantinovich specifically for this purpose, the surface of the Amu Darya was measured near the city of Nukus and in the delta.

When the detachment headed by the prince reached Chardzhui, he sent Ramchandra to search for the ancient bed of the Amu Darya, allegedly starting from Chardzhui and through the sands reaching Sarikamish. On September, 29, this group also comes to Petro-Aleksandrovsk. Nikolay Konstantinovich enthusiastically began to study the banks of the river, irrigation canals, dams, dry river beds. The local population is informed them about it. In early October, he met with khan of Khiva Mokhammed Rahimkhan II in New Urgench, where he began negotiations with him about the direction of the water of the Amu-Darya to the west. The Khan refused to use Nikolay Konstantinovic's belongings to the emperor's family, for the sake of his consent to forgive Khiva's debt to Russia and to recognize all the land where the Amu-Darya reached as a khanate's territory. The prince agreed to all of this. In the late autumn of 1879, by order of Khan, the dams at the beginning of the aryks Lavzan and Shakhmurad were destroyed. However, due to the fact that old rivers and drainage channels have not been cleaned and the Amu-Darya river drainage is decreasing, this does not lead to expected results.

Despite this, the Khan, in the event that his conditions were met, consented to the demolition of several more dams in the spring. Since the prince did not have the authority to accept the conditions of the khan, he sent a letter to the governor-general of Turkestan, Kaufman, and tried to assure him of the benefit of the agreement with the khan. However, Kaufman believed that the Khiva Khan had no right to impose any conditions. In addition, Kaufman was instructed to direct the waters of the Amu Darya to the Caspian Sea. Therefore, he asks the Minister of War D.Milyutin to inform Alexander II and to remove the prince from the Turkestan affairs. After some time, Nikolai Konstantinovich returns to Russia [8, p.156].

Since the situation in the steppes adjacent to the Khiva Khanate was restless, the expedition did not achieve its main goal - a complete study of the ancient bed of the Amu Darya Uzboy and the determination of the possibility of connecting the Amu Darya with the Caspian Sea by directing its water to that bed. However, during the expedition's journey, it was possible to collect many rare materials on economic life, geography, nature, history and ethnography of the region. The main results of the expedition can be noted that a complete map of the Amu Darya from the place of its confluence to the junction of Vakhsh and Pyanj was made, the route to Vakhsh was surveyed, the navigability of the Amu Darya and its tributaries Surkhan, Kofirnihan, Pyanj and Vakhsh was studied, the astronomical location of 10 points was determined, barometric survey of many heights, meteorological observations were made, a rich zoological, botanical and geological collection was collected, ethnographic observations were made, were taken pictures and photos.

As for the expedition organized by the Ministry of Railways under the leadership of A.I. Glukhovskiy, various scientific societies, including specialists from the Geographical Society, were involved in it. The main objectives of the expedition were to study the ancient bed of the Amu Darya between the Aral Sea and the Caspian Sea, determine the amount of water that could be sent to the old channel without harming the agriculture of the Khiva khanate, to ensure its navigability after sending part of its water along the old channel [7, p.87].

It was envisaged that the expedition would consist of three units. One of them was to study the Amu Darya delta and record changes on the river, the other two were to study the ancient bed that lies in the steppes between the Caspian Sea and the Khorezm oasis. These two units were supposed to start work simultaneously from two points - Krasnovodsk and Khiva, and to meet between Sarykamysh and the well of Igda [9, p.817]. It was determined that each squad would consist of two engineers, four technicians and topographers in the right quantity. On April 12, 1879, the State Council allocated the necessary funds for the expedition's expenses. Since the expedition from the Geographical Society participated geologist AE Gedroits to the Society's account the amount of 5,000 rubles was transferred [9, p.817]. In addition to Prince Gedroyc, A.Kh. Gelman, engineers Bole, Svintsov, Maksimovich, Ropp, Golmstrom and several topographers participated in the expedition.

It was originally planned that all three groups will start work simultaneously. However, after informing the head of the Transcaspian department about the troubled emergence in the steppes, and that it is advisable to send a detachment to study Uzboy for a later date, it was decided to send only detachment in 1879 to study the Amu Darya delta.

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The Delta Group's mission is to diversify the flow and flow of the river, observe the speed of water, perform various surveys on the delta, observe water levels and their use, observe water depths, explore and explore rivers and rocks, access to statistical information about the economy of the region [7, p.89]. This group will conduct its activities from 1879 to 1882, and will succeed in gaining more hydrological information.

Another two groups expenses are estimated at 300,000 rubles, taking into account the severity of the situation in the regions where they operate, the widest range of activities and the number of military units that needed to be hired to guard. In the autumn of 1880, Khiva group began its work. Members of the group were engineers Svintsov and Bole, geologist A.Gedroyts and topographers and military. From 1880 to 1883, this group will study the Kukhnadarya, Dovdong, Chardzhui, and Sarikamish, Uzboy's lime, and the surrounding wells, which were dry beds of the river between the Amu-Darya and the Caspian Sea in ancient. Despite the fact that the expedition participants had to work in conditions of unbearable heat in the summer and cold in the winter, water shortages, they succeeded in fulfilling all the tasks. The expedition achieved the following results:

1. Survey and leveling was carried out from Amu Darya to Sarykamysh lake, from Chorishli well to Uzboy and on Uzboi itself. It was confirmed that the terrain has a slope towards the Caspian Sea and does not exceed the level of the Amu- Darya.
2. It is clear that there is no river bed between Sarikamish and Chorishli well.
3. It is known that Uzboy was not connected with the dry bed starting from Chardzhui.
4. Uzboy is geologically explored until the well Igda [5, p.149].
5. Make so that the passage of water from the Amu Darya to the Caspian Sea was 23 cubic fathoms per second. In this case, the water flowing into the Amu Darya is enough for irrigation and for preserving

the waterway connecting the Amu Darya with the Aral Sea [7, p.146].

6. 4 routes of a possible waterway connecting Amu Darya with the Caspian were indicated: a) from the Kukhna Darya River to Sarikamish and Uzboy; b) Lavzan channel - Kukhnadarya - Shomurot channel - Dovdon - channel bypassing Sarykamysh - Uzboy; c) Shokhobod channel - Dovdana lanyard - channel bypassing Sarykamysh - Uzboy; g) Kuhnadarya - Shomurot channel - Dovdana lanyard - channel bypassing Sarykamysh – Uzboy [7, p.167].

As it is known, the expedition will make a positive decision on the transformation of the Amu Darya through the Uzboy to the Caspian Sea. However, P.Lessar, who visited Transcaspian area in 1882, doubts that the Amu-Darya River can be routed to the Caspian Sea by Uzboy [6, p.271]. Since the construction of the Trans-Caspian railway began in 1880, doubts about the Amu Darya issue, discussions in society, the differences of scientists eventually forced the government to abandon the idea to turn the river to the Caspian Sea. In this way, this project was not realized.

However, the expeditions to solve the Amu-Darya problem described here are of great importance for the development of science in our country. Their results allowed us to generate valuable information about the Amu Darya river, basin, delta, which is one of the largest water reservoirs in Central Asia. Sufficient researches were carried out to establish shipping on the Amu Darya. These studies led to the formation of the Amu Darya flotilla in 1886. Apart from the hydrological data, during the activities of these expeditions, valuable information of a natural and geographical nature was collected on the Amu Darya and Aral basins, on the lifestyle, economy, and history of this territory. Scientific studies of the Amu-Darya basin have not only been limited to the above-mentioned expeditions, but have continued in recent years to address irrigation and irrigation issues in the region as well.

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