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## TRADITIONAL METHODS OF WATER SUPPLY OF THE ARID ZONE OF KAZAKHSTAN: ETHNO-ECOLOGICAL STUDY OF WELLS

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### ABSTRACT

It is important for both domestic archeology and ethnology to master the history of well development from the scientific and practical point of view. The theme of “well” is a topic that reveals its full meaning at the intersection of disciplines. Traces of wells found in the urban settlements of the ancient tribes inhabiting the Kazakh land are not only provided information about the system of hydraulic engineering of the ancient peoples, but also clarify the sources of ancient life, the development of craft, natural products and household needs. In order to cover a well inside, at the end of autumn, when it is dry, the saxaul (haloxylon) is picked up with the bottom and thrown on the sand together with the root. The dew of saxaul comes out when it snows in winter, gets cold, and in spring when it rains on it. For saxaul covering are selected not too thick, thin logs, and the sticks (branches) are broken into 70-80 cm. Due to the fact that the saxaul rod is round, there are often used 8-10 sided types.

Currently, there is a lack of archeological and ethnographic material and intangible heritage on the topic of “wells”, “digging wells”, firstly, due to the bury of common shallow wells, and secondly, the number of elderly people have been decreased who provides ethnographic information, know the source of water, mastered folk knowledge. Changes of the place names also make it difficult to collect toponymic and onomastic data on the names of wells. The scientific information of the problem is strengthened by the refinement of the fund of professional words and names related to the well collected during the expedition with the help of data from the records of the first authors and historical maps.

### **Keywords:**

Permanent wells, Shall and temporary wells, deep, shallow, shallow wells are.

### **Introduction**

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It is important for both domestic archeology and ethnology to master the history of well development from the scientific and practical point of view. The theme of “well” is a topic that reveals its full meaning at the intersection of disciplines (archeology, ethnography, historical toponymy, historical onomastics, historical geography). Traces of wells found in the urban settlements of the ancient tribes inhabiting the Kazakh land are not only provided information about the system of hydraulic engineering of the ancient peoples, but also clarify the sources of ancient life, the development of craft, natural products and household needs.

In order to strengthen the well were used in the Kyzylkum haloxylon, tamarisk, gray poplar; burnt ceramics in the settlements of Kazaly, Kyzylorda, in the settlements of the ancient city along the lower flows of the Syrdarya; oak brought from Arka; willow in Western Kazakhstan in the Napyn sands, Khan Opda; tamarisk in West Kazakhstan in the area of Zhanakala; calligonum, calluna, weeds in the Kapakum, Tokabay, Shizhaga, Sazdy areas of the Apal, stone in the Akipek, Akbay, Zhalanash (before Birlestik) in the area of Aral, stone in Apal and Caspian regions.

Currently, there is a lack of archeological and ethnographic material and intangible heritage on the topic of “wells”, “digging wells”, firstly, due to the bury of common shallow wells, and secondly, the number of elderly people have been decreased who provides ethnographic information, know the source of water, mastered folk knowledge. Changes of the place names also make it difficult to collect toponymic and onomastic data on the names of wells. The scientific information of the problem is strengthened by the refinement of the fund of professional words and names related to the well collected during the expedition with the help of data from the records of the first authors and historical maps (Sala & Deom, 2020; Kartaeva et al., 2020).

## **1 Traditional methods of water use**

### **Types of traditional wells**

A well-educated person who knows how to dig a well and recognize the source of groundwater had been called a “kudykshy” (wellman).

The system of folk hydraulic knowledge of the Kazakh people, passed down from generation to generation from ancient times, formed a kind of profession called “kudykshylyk” (welling). In the arid steppe regions, the reputation of wellman and watermen was high among the Kazakhs. Depending on the level of groundwater in the source of water and the composition

of the soil, the type of local material, the formed technology of excavation of wells, strengthening technology was a system of special connections between nature and man.

The depth and shallowness of wells depends on the path of groundwater, the level of the aquifer, and the width or narrowness of the wellhead depends on the composition of the soil, soil type (sandy, swampy, rocky, gravel and others).

Depending on the period of use of wells, we classify them as permanent, temporary, and depending on whether the walls are fixed or not, they are classified as non-fixed.

*Permanent wells* were dug on the streets, caravan routes, temporary wells were dug in temporary settlements. Permanent wells were shallow up to 4-5 meters, medium depth from 4 to 10 meters, deeper than 10 meters. The walls of all types of permanent wells were strengthened. The strengthened walls were last for many years. They were wells, the walls which were strengthened with plant species, stone types, or wells that replace strengthening with the natural stone layer.

*According to the depth are:*

deep, shallow;

Deep wells are – *abyss, stone well, aikel well, kurdym well*;

shallow wells are – *shegen (stone, willow, calligonum, tamarisk, saxaul, etc.), kuyi, espe, orpa, tanky, apankuduk, aibarkuduk, kumkuduk, ilme well, oyma well*.

According to the depth of the study of Mangystau and Ustyurt wells, Lomakin grouped them as follows: shallow wells are – *espe*, wells with a depth of 2 inches is – *orpa*, wells with a depth of up to 4 inches is – *kuyi*, those with more than 5 inches is – *shynyrau* (abyss) (Lomakin 1873: 8). Lomakin refers the well *kuyi* as medium depth well. In the course of field ethnographic research, we found out that in the Mangistau region, wells up to 6 meter are considered shallow, more the 6 meter is deep, and the Syr Kazakhs consider wells up to 5 meter is shallow, more than 5 meter is deep.

*According to the construction material are: stone well, willow well, calligonum well, calluna well, saxaul well, tamarisk well, ceramic well and others.*

*According to the taste of water are: aksu, fresh, algau, algauly, bitter, more bitter, hard, honey, milk well.* *Aksu* is the ancient name of a well, a clear, fresh, tasty water from a well. The word *Aksu* was used in the middle flow of the Syrdarya, in the area of Turkestan, South Kazakhstan (Voeykov 1915: 11). Well water with a hard taste is suitable for drinking. *Algau* – is the water of the well with a bitter, hard taste. *Algauly* – is water with a hard taste. This interpretation of the people proves that the taste of well water is not related to the taste of water in rivers and lakes in the region. This is because the water of the Syrdarya River was used as drinking water by the people lived along the river. During the winter, suat was dug from the ice

and got drinking water. *Milk well* is – a well dug in the mountains, at the foot of the hills from springs, rich in water, fresh water.

*According to the volume of water:* Depending on the amount of water in the wells, depending on the amount of water produced, different equations and names as *akshelek*, *sutti*, *suly well*, *karakoz well*, *kozdi well*, *akpa well* were used. If the well is rich in water, it is called “*akpa well*” in Karaganda, Karkaraly, Zhezkazgan (Agad.) area. The equivalent of *akshelek* was applied to a well with a headwell, plenty of water and a shallow well in the lower flow of the Syrdarya, Mangistau and Western Kazakhstan. *Ak+shelek*, *ak* was formed due to the fact that it is rich in water and rise water with the help of bucket. The water from the *Akshelek well* was enough for 500 sheep or 2-3 herds of horses to drink at the same time.

In the sandy villages as Sazdy, Shizhaga, Karakum in the north of Aral, a well with plenty of water, quick extraction of water is called *karakoz well*.

In Karmakshy, Terenozek and Zhalagash regions of Kyzylorda region, the abundance of water from wells is also expressed as “*aspa*”. “The water in this well is *aspa*” (means too much). “*Akpa*” is due to the large inflow of water from groundwater sources, and “*aspa*” is due to overflow of well water. The names of *sutti* and *suly* wells are also associated with the abundance of well water. The name of *sutti well*, as mentioned above, is also used in connection with the taste of water. *Kudergi water* – is an inexhaustible supply of water.

According to the withdrawal and use of water are: *kurkudyk*, *kurlangan kudyk*. *Kurkudyk* is a well that has dried up. The dried well was buried or redug. *Kurlanu* – is the withdrawal of water from a well. Shrinkage can be caused by a lack of water, low water or clogging of the water source.

The water of all types of wells is clear, pure and clean. The presence of water does not depend on the material of the well, but on the composition of water in groundwater channels. In ancient times, water was filtered through a canvas before being used for drinking.

The general name of the wells fixed by the method of weaving, laying, trimming, sorting the walls of the well is *shegen well/ shegendi well* (strengthened). Using local materials to strengthen the walls of the well, there was formed a unique method of its development and folk knowledge.

Strengthen materials were used as following, in the Kyzylkum – saxaul, poplar, in the lower flow of the Syrdarya – burnt ceramics, oak from Arka, in the Naryn sands of Western Kazakhstan – willow, spruce, pine, in the Zhanakala region of Western Kazakhstan – stone, in the Aral and Caspian valleys, in the rocky areas of Turkestan – stone.

All types of wells strengthening have the same function, it protects the walls of the well from sand falls, fixing the walls, acting as a natural filter for water sources and groundwater. The natural filter does not only traps the soil and allows fresh water to pass through, but also provides a large supply of water. Although water-resistant plants as calligonum, calluna, willow are used for the well strengthening, they are replaced once every 60-80-100 years. This is due to the fact that with this type of plant, the soil in the wetlands is lined with wells, and over the years the soil is compacted, the willow strengthenings are gradually bent and when the time comes, the density of calligonum, calluna interfere to the natural filter.

To replace the strengthening, drain the water and remove a layer of soil from the bottom of the well. To clean the well, the strengthening material was prepared in advance, and a few young men quickly re-woven and laid it. Because the water source in the well grows quickly and prevents the laying of strengthening. Wells strengthened with stone, brick, ceramics, pine and oak were strong, so they did not replace the strengthening of the wells, only clean the bottom (sole) and water. In ancient times, wells in seasonal settlements, when they came to the settlement, they were drained and drank fresh water. This is because unused water in the well has been salted for a long time. Each time the well was pumped, it was replaced by fresh water.

Any type of well strengthening is not only an ancient hydraulic education in the system of folk education, but also a unique example of construction, underground architecture.

## **2 Shall and temporary wells**

### **Shallow wells**

4-5 men started to dig wells together in shallow water, sandy loam or loamy soil, worked together as relatives, did not receive wages. The man who ordered to dig the well slaughtered the sheep, prepared the food, and hosted the wellmen.

Shallow wells were dug every year over the old or dug new ones. If the ground is sandy, the well is dug up to 3 meters in diameter. The mud from the well was thrown in the surroundings of the well and raised the head of the well by  $\frac{1}{2}$  - 1 meter. Raising the head of the well prevents the animal from falling into the well and prevents dirt from falling. The windy and sandy, the well was covered with mat. Some wells were lined with mud, plastered, and even raised with stones. As shallow wells provide temporary use, a portable wooden beam was placed nearby (Ishenko 1928: 62). In 4 hours it was able to dig shallow wells with a depth of 4 meters from the soft, sandy ground. Shallow wells were shared by the community, the individual did not have the right of ownership, and the shynyrau (abyss) had the right of ownership (Ishenko 1928: 66). To dig shallow wells were chosen mainly land with licorice and shea (AEM). Shallow wells were cleaned by nomads every year. Sometimes

after usage shallow wells were bored and re-excavate or re-dig the following year. A.E. Eversman said: “In the Big and Small Borsyk sands, Karakum sands, groundwater came out of the shallows, where wells were dug in the plains and ravines” (Eversman 1841, p. 255). The wells were mostly shallow in the sandy areas and at the foot of the mountains. According to Mag-Gahan notes, shallow wells were common in the Tamdy valley, at the foot of the Bukan mountain, and the distance between the wells was 25-30 kilometers (Mag-Gahan 1875, p. 67).

Mangistau adais and tabyns who came to the pasture in Emba district dug about a dozen or more wells. It was 2-3 inches deep and 1.5-2 inches wide. The water of fresh, shallow wells was shared by the villagers (Levanevsky 1894, p. 105-106).

Shallow wells were usually dug in areas with abundant groundwater (Fielstrup 1927: 105). Nomads annually dug thousands of ditches and shallow wells. They were used temporarily, the walls were not strengthened and could not be reused, that is, the collapsed wall automatically closes the water source (Levanevsky 1894: 106). In Mangistau, shallow wells were dug at the foot of the Karatau and Aktau mountains. There was a lot of spring water here (AEM).

In the Mangistau and Shevchenko regions, a type of shallow well with low water reserves was called *shylapay well*. The word *shyl* derived from the verb “to wet, soak. *The wells with little amount of water was dug by passengers with the help of their hands.*

It takes at least two people to water cattle from a shallow well. One drew water from the well, and the other made sure that the cattle did not interfere with each other.

### **Aibar well**

It is a type of well with non-strengthened walls, large size, a hard sand, lowland, dug in the place of gathered snow water. The word *Aibar* itself means “big”, “huge”. The mouth of such wells on the ground was several times larger than the source below. Only a wealthy man dug *aibar well* and watered his cattle in this well. In the spring, in order not to collapse the walls when the heavy snow melted, it was carried out as triangular in the West Kazakhstan region (AEM). Nowadays the triangular excavation was eliminated. This type of well was temporarily used, the bottom was cleaned every year. *Aibarkuduk* worked for about two or three years while clearing the hard soil. If the soil was soft, they dug in the summer and buried it.

### **Apan well**

It is a type of well, where the soil was loamy and the groundwater came out of the shallows, the wellhead was wide. There were placed a board in two places on the well and drew water standing on two boards with feet. The swamp was able to hold the board because it was

harder than the sand. The name Apan is also associated with the wide excavation of the wellhead. The Kazakh people described a large, wide object as “apandai” (Traditional system of ethnographic categories, concepts and names of Kazakhs. Encyklopedia, Volume I, p. 233-234). In Gabidin Mustafin's novel “After the Storm”, there was described the nature of Apan well, which he wrote that four young men drew water from the well with two *kauga* (large dishes) (Mustafin 1962). The capacity of the skin *kauga* was at least 15 liters of water. A *kauga* with a capacity of 20-30 liters was not enough for one person, if two guys did not pull it together.

There was not set rim to draw water on Apan well, was not needed force of a camel or a horse, because the mouth of the well was not closed and raised. Another information about the Apan well can be found in Saken Seifullin's story “Fruits”. In this story, the poet compared a hole with apan well that hidden by the thirteen people with their horses [Seifullin, 1958]. In the swamps area of Mangistau, south of Aktobe, there was a kind of this well in ancient times. There are traces of apan wells as Kaskyrapan and Taldyapan, dug in ravines in Zhaindy that was 150 kilometers from the east of Oymauyt village to the center of Arka, Baiganin district, Aktobe region. Due to temporary use, the wall was not strengthened (AEM).

### **Espe well**

There are two types of espe, with strengthened and without strengthened walls. Espe (water) was the name of the groundwater in the aquifer, which was located close to the surface, above the first impermeable layer. It has no pressure, the water level changes every season for 1 year. As precipitation increases, it rises, the land dries up, and the water level decreases. Espe water was distributed at a depth of 3-4 meter. In the sparsely populated areas of the river system of Kazakhstan, espe water and deep interbedded groundwater were of great importance. People had been using espe water since ancient times. A strengthened wall with shallow walls, dug above a large source of water, well with shallow water. In Mangystau, the strengthened espes were carried out in the ponds, at the foot of the cliffs, in the hollows. The rise of the mouth was the same as the rise of the mouth of the abyss. Although shallow, the *aikel* was placed in the wellhead and the inside was strengthened with stones. In some cases, the bottom was dug wide and the place where the water collects was called *koraba* (box). The stone strengthened espe were served in constant use.

Kazakhs of Karakalpakstan strengthened the walls of the well with saxaul and wood (Regional Dictionary of the Kazakh language 2005, p. 218).

The espe wells without strengthened wall were used in the sands of Mangistau, in the Oiy area of Aktobe region, in the Aral, Syrdarya, Zhalagash parts of Kyzylorda region, in the north-east of the Aral Sea. The name of the village of Akespe on the Aral was associated with espe

well. There is a difference in the excavation of Mangistau and Aral, the rise of the wall of espe wells. In the spring, the Aral espe was excavated as a large area, 500 meters from the Aral Sea, 1 km from the lowlands in the sandy villages. A hole was dug in the middle so that the depth was 1 m. The water collected from the snow formed a reserve water. The inside of the espe was cleaned and dug, and the water lasted for 1 month. After dried up another was dug in lowland. In one village were dug several espe at the same time. There were several espes in Akkum of Aral. It could easily get water from the espe with dishes. The espe depth was 1 meter. Nowadays, with the retreat of the Aral Sea and the low snowfall, the water level has decreased. Aral espes are out of use at present times.

It is obvious that such place-names as Kyzylespe, Aschiespe, Akespe were connected with the type of espe well.

### **Orpa well**

It is a well with a wide mouth, water comes out of shallowness, dug for temporary use in the sand, in the traditional size of two inches (4-5 m). Orpa wells were used by Kazakhs of Mangistau, West Kazakhstan region, Zhuryyn district of Aktobe region, Kazakhs of Turkmenistan, Kazakhs of Uzbekistan. Orpa wells are dug in barren, sandy and loamy soils. The latter are mostly seasonal, and little attention is paid to excavation techniques. Only their inner strengthening is covered with stones, if there are not stones with saxaul and tamarisk. In the photo "Orpa well in the south of the Kyzylkum" that was taken by W. Pelz, the well was dug at the foot of the sand dune and the mouth was raised with saxaul twigs. According to the decision of the owner of the orpa, there was a temporary well, but the walls were strengthened with plant branches.

*Orpalyk* also called the place where the well was dug. As orpa wells were dug wide, so the surface was open, and if it is possible, they put a tree horizontally on the surface. Orpa wells were found in the pastures of the northern part of Aktobe. Nomads annually dig thousands of ditches and shallow wells. Because of its temporary use, it was often used without even weaving the wall. There were species of orpa which raised the rim of the well from the dead soil. Because of non-strengthening, their walls collapsed and could not be reused, the fallen wall automatically closes the water source (Levanovsky 1894, p. 106).

By raising the rim of the orpa wellhead, it protected the well from being filled with sand during the wind. When two orpas were dug at the same time, they were called "kos orpa" (double pits).

Orpa wells are dug where fresh water comes out of the shallows, they are often dug in several nearby places. The orpa is easily dug by the herders themselves and there is no dispute between the villagers for this type of well. Sometimes a new orpa was dug, and in some cases the old one was cleaned again if it was well preserved. The next year, which village moves to the pasture first they will start cleaning the well. If the village and community are large, a lot of wells were dug (Fielstrup 1927, p. 104-105). Most of the wells after usage were buried by the owners themselves.

It is obvious that such place names as Ushorpa, Konyrorpa, Zhanaorpa, Aschyorpa, Terenorpa, Auyzorpa, Akorpa, Tororpa are connected with the well. In 1873, at the head of the well Auyzorpa, 30 km from the foothills of the Karatau in Mangistau, the detachment of N.I. Grodekov stopped, known as the “Khiva march” (Grodekov 1883, II).

### **Tanky well**

It is a type of shallow well dug by nomads in the pastures far from natural water sources in the north-western region of Kazakhstan. In the north-western part of the Kazakh lands, in the pastures of the Elek River valley, although the water comes from shallow water, wells are often dug even there is less water and called *tanky*. When the Mangistau and Ustyurt adais came to the northwestern Aktobe pastures, it became a tradition to purify the water from the tanky wells (Bokeikhanov 1995: 141). Tanky wells were often found in the valleys of the Zhem and Sagyz rivers, in the Aktobe pastures. The rims of the tanky wells were made of 0.5 to 1.25 arshin, the depth is 2.5 to 5 arshin depending on the outflow, the diameter is 0.5 to 1.25 arshin, and the height of the mouth is 0.5 arshin. At the wellhead of tanky carved stone or solid wood trays were installed in 3-4 wells (Fielstrup 1927, p. 104-105). M. Levanevsky gave definition to wells dug from gravel sand as “kum kudyk” (*sand wells*). Evidence of this refers to orpa dug in the sand or tanky well (Levanevsky 1894, p. 106). The name of the sand well was mentioned in the works of “Kazaki. Anthropological Essays”.

By raising the mouth of the well on sandy ground, the gravel prevented the sand from moving in the wind and blocking the mouth of the well. Tanky wells were sometimes buried and re-dug when needed. The types of tanky well was not preserved today.

### **3 Vegetable**

#### **Folk knowledge in the art of weaving plant branches into the walls of wells**

The Kazakh people have developed a unique example of the art of weaving, weaving and fixing the walls of wells. Although the traditional culture of strengthening, weaving and water

use was formed in the sandy, desert regions of the Kazakh land, today it is rare due to the development of technology, some species are even threatened with extinction. The strengthening of the walls of the well from plants such as willow, tamarisk, saxaul twigs is considered as a special kind of art weaving. And the traditional folk knowledge in the field of construction is the cutting, processing of wood and its integration into the walls of the well.

There were chosen plants to reinforce the well that do not rot in water, do not spoil the taste of water, and are useful for cattle and humans. Also, the plant chosen for the strengthening depends on the local vegetation. Vegetation protects against the collapse of sand in the walls of the well, strengthens the walls, acts as a natural filter for water sources and groundwater. The natural filter does not only trap the soil and allows fresh water to pass through, but also provides a large supply of water. The edges of wells, the walls of which are woven with plants, are also covered with the same plant. There was made a lid out of pieces of wood to allow air to enter the well. A special example of folk knowledge is to build a fence or weave a fence around the well to keep it clean.

### **Willow strengthening**

The tradition of fixing the wall of the well with willow was preserved in the west of the Kazakh land in the sands of Bokei Horde, Naryn [Yakubov 1955, p.78]. There are four types of willow in this region:

spiral weaving, wrapping a bundle of fibers or willow;

lock the fence from willow rods and fasten it at four angles;

a two-level well with a willow bundle at the edge of the well and a rectangular wooden board at the bottom;

sort with pine cuttings and mold into squares or pentagons.

Due to the fact that the sand in the Naryn sands was wet, the well was dug with a diameter of 4 meters. If the wall was dug narrow, the soil will be wet and the pit will be buried again. Once the sand layer is removed, a clay layer is formed. The guys inside the well take turns and throw sand with a shovel outside. The guys outside the well spread the sand around the well so that it would not be covered with weight. When the water source starts to flow, the main layer of the shegen (strengthening) is installed and a hole is dug in the shegen. The first impure groundwater is called “kaiyr water”. Wet soil before the water source is cleaned is called “dead soil”. After cleaning the bottom of the well, the shegen is trampled with the feet and fastened with a nail or a stake.

It is strengthened while the young twigs are being twisted to make it easier to bend and wrap the willow twigs. The stalks are flexible, very soft and grow in one place. The willow twine is prepared in a young, soft state without drying out for a long time.

Both willow twigs and osier twigs are inserted vertically into each other and filled up to 15-20 cm in diameter. The length of the branches is 30-50 meters, and sometimes even more. Two or three people twist their hands in one direction and tie them with a young twig of a willow or a young osier. Lately there has been using ready-made yarn. This is called a “tal buma” (willow wrap). There is no taste of willow or osier in the water. Nowadays, due to the deepening of the water, to use willows wraps require a lot of tree, and the willows are not compressed by sand and can not stand for many years. In addition, willow and osier trees are now protected, so new strengthening of willow wells are no longer in use (Fig.1)



Fig.1. Types of willow of the well. Naryn sands.

The edges of the willow wells are braided together with the wall of the well by twisting. For example, a bundle of willows is rolled up and raised above the wall of the well to a height of 80 cm – 1 m. Wooden pegs are driven around the edge of the well and a wooden cover is installed on the surface. Willow flange and wooden cover provide fresh air circulation inside the well.

Two-levelled shegen well – is a type of willow well or shegen well found in the Naryn sands. The method of digging a well is the same as a willow well. The difference is that the first part of the well wall strengthening is made of a rectangular wooden type, and the top layer is made of a spiral wire strengthening. The height of the timber planted at the bottom of the well is from 1.60 to 2 meters. The tree is cut from local pine.

One of the local names of willow wells in Naryn sands is *sheten kudyk* (rowan well). The method of placing a bundle of willow on the wall of a willow well is also called “*shetendeu*”. The name “Sheten” is used after the bundle is laid.

### **Fence shegen**

One of the most popular methods of settlement in the Naryn sands is the construction of a *willow fence*. The fences were placed in a shallow well dug at right angles. Willow fences were used in very shallow, but hard places. The wall of the well is fastened vertically with wooden pegs. There is put a fence between the wooden pegs and the wall. To do this, large willow twigs are cut evenly and pressed horizontally in a row. Number of wooden pegs are - 8. The peg serves as a hoop. To make the hoop strong, a horizontal column is installed inside the hoop from the wellhead. At the present time, due to the deepening of the groundwater source in the Naryn sands, the construction of willow fences has become obsolete. Only partial ex-fences can be found. The preserved species were bent by sand compression because the wellhead was not renewed.

Wooden shegen or sorted well – is one of the types of wells found in the sands of Naryn, in the north-western region of Kazakhstan.

Researchers and travelers who visited the Khan's Horde in the middle of the 19th century in the sands of Naryn described not only the construction of the Horde, but also the construction of wells. As the buildings of the Khan's Horde were built in harmony with each other, so the construction of wells was made of wood. Khan's well was an integral part of the construction of the Khan's Horde. M.Ya. Kittary, who was in the Khan's Horde during the reign of Zhangir Khan (1801-1845) tasted Khan's well water and it was likened to spring water (Kittary 1849, p. 16). The construction of a large tent over the Khan's well identifies to the fact that the population of that period mastered the complex construction work and hydraulic engineering. I. Kazantsev equated the freshness of groundwater with artesian water, saying that the water in the wells dug in the Naryn sands, dug under the leadership of Zhangir Khan, was clean and crystal (Kazansev 1867, p. 307).

Pine and oak trees are used to strengthen the wells, which do not rot in water. Dry forest trees are cut down or pre-cut and dried for several years. The branches of the tree are cut down and peeled. A piece of wood is cut to the size of the inner grade of the well. For example, 1.60 cm; 1, 80 cm; 2 m. It is cut and polished so that it can be integrated into each other. The walls of wells for drinking water are narrow, and the walls of wells, including livestock and drinking

water are wide. The size of the logs prepared for sorting also depends on the size of the well wall and depth.

In order to sort the walls of wells was cut the local Naryn pine in the sands of the Naryn in Bokei Horde. Timely pruning of dry pine protects other living trees in the forest from insects. Pine is useful for the human body, the Kazakh people describe the beneficial properties of pine as “*balkaragai*” (honeypine).

Slab contraction joints should intersect at least 2.5 m apart, and wooden pegs should be installed in the center and corners. The peg also serves as a hoop. When the well water becomes more, the base of the tree is planted, and the traditional method is to dig a hole in it. Each time the first kaiyr water and dead soil are removed, the strengthening can be put.

While strengthening the well with tree, there is built a wooden stairs by the order of the owner or master of the well. Wooden stairs act as an internal ladder when purifying well water. The edges of the wooden strengthening are connected with the inner strengthening and covered with a wooden cover.

In the valleys of the Karaozek, Zhanadarya, Inkardaria channels of the Syrdarya, the land is swampy. In this region, in the past, there were wells dug with a wall of about 2 meters and strengthened with oak. In ancient times, the people of Syrdarya carried oaks from the north, from Arka by camels. Oak does not swell in the water, so it was used to make strengthening of well. The oak was cut, rounded, and weaved by putting together, leaving a trail of water when it was reached the source. Due to the lack of local oak material, at present time oak strengthening are out of use in the Syrdarya region, and ancient oak wells have not been preserved.

### **Tamarisk shegen (strengthening).**

The soils of the ridges are hardening in the Zhanakala region of western Kazakhstan, in the region of Makhambet village of Atyrau region. In the steppes of this region, the local material is made of wood, so the method of weaving with wood has been developed. As soon as the bushes are cut in late spring, the branches are soft and strengthened in about 5 days at a young age. For strengthening timbers are made from 80 cm to 1 m, and they are fastened to the wall by twisting and twisting. It is stepped by foot on the strengthening and compacts it.

The timbers hold each other by the branches. The walls of the tamarisk strengthening are excavated in the form of a circle. The distance between the tamarisk wall and the wall of the well is 30 cm. The space between the two walls is filled with soil from the well itself by mixing small branches of reeds and willows. For the strengthening of a well with a depth of 5-6 meters, 2 trucks of tamarisk are cut (Fig.2).



Fig.2. Tamarisk wall. Zhanakala region of Western Kazakhstan.

### **Calligonum and Calluna shegen (strengthening)**

Wells of Karakum, Tapa, Tokabay, Shizhaga, Sazdy villages of Kyzylorda oblast, Aral district are strengthened with calligonum and calluna on the cattle farms of these villages.

The thick growing of calligonum also serves to stop the wetting of the sand. The locals people often use the calligonum to build barns.

In the Aral Sea region, there are also used the names as - duzgun, duzgin, kandym, tomar duzgen. It depends on the well owner to choose whether to put calligonum or calluna on the edge of the well. In order to strengthen a well, calligonum and calluna are dug in autumn with their root. It is 2 meters high, including the root of calligonum, and the largest is even higher. The calluna is chosen with the height of 50-100 cm. It has thin scaly four-sided leaves. The elderly people say that the calligonum and calluna have many healing properties, they are useful not only for humans but also for cattle. When you put calluna in a well, the water in the well is given its properties. According to scientific data, calluna contains arbutin, quercetin, starch, gum, catechin tannin, saponin.

The roots at the bottom of calligonum and calluna are not visible from the ground. In the past, it was dug out with a chisel, an ax and a shovel to get along with the root. Currently, it is being demolished by a tractor.

One well consumes 450 to 600 branches of calligonum or 500-650 branches of calluna. 2-3 machines were used to strengthen one well, and in ancient times 8-10 camels of calligonum and calluna were used for wells. The camel is covered with a thick blanket to carry. In the autumn, the dug out calligonum and calluna are dried for whole year, and the following summer they are put in a well. When dried, the taste disappears and dries. The root is not visible from the ground. The roots are also used for well strengthening.

The calligonum well can be made of six-winged house with a diameter. The well is dug so wide that it does not fall off. In Shizhaga, in Sazdy the depth of the wells is from 4 meters to 4.5, 5 meters, and the width of the wells is from 4.5 to 5 meters to 6 meters due to the loose sand.

In order to prevent the sand from falling into the well, the branches of calligonum and calluna were placed on the wall of the well, and the bottom, the root was throwing one on top of the other, in this way was weaved. The shegen was pressed with feet to keep it tight. Along with the placing of strengthening, the work was carried out to remove the muddy water and soil at the bottom of the well.

The surface of the well, which is strengthened with calligonum and calluna, can be raised with blueberry, weeds, boyalych, reeds and chingil. By using this type of vegetation on the strengthening, fresh air was allowed to enter the well and the soil between the strengthening was not drained. Local elders say that putting weeds on the edge of a well increases the properties and usefulness of well water.

The calligonum and calluna branches were trampled and fixed by wellmen. When the wall of the well was completely strengthened, the mouth of the well was sorted with wood or woven from pieces. Neither calligonum and calluna will not rot in water. The strengthening of calligonum and calluna last for 80-100 years. When the mud of the well wall grows and calligonum and calluna are completely pressed, the well is re-dug. The old strengthening is removed and replaced with a new one in the traditional way.

Abundant water collected from the natural filter of calligonum and calluna strengthening could irrigate 100 horses at the same time.

Families livestock breeding in remote areas use shegen well water to provide water for livestock. One cattle family has up to two wells.

Certainly, the construction of the calluna strengthening is more complicated than the construction of the calligonum strengthening. This is because the branches and root of calluna are thinner than calligonum (Fig.3-4)



Fig.3. Calligonum well. Aral Sea region, Sazdy villages.



Fig.4. Calluna well. Aral Sea region, Sazdy villages.

### **Saxaul shegen.**

Strengthening of the well wall with saxaul is found in the Kyzylkum sands of Kyzylorda region, on the border with Uzbekistan in Karmakshy district. White saxaul grows on dry loose or slightly sandy soils. The bark is light, sometimes even pale, the petals are slender, light green, thin and not watery, but with strong shoots. The taste is bitter-salty, light gray in autumn, sometimes even yellow. For strengthening, thin saxaul stalks are selected and cut to 70-80 cm. Saxaul branches are rounded, so they are often octagonal type of strengthening can be seen. In the sandy plains, such as the Kyzylkum, saxaul provided the wellbore because of the available material. The taste of white saxaul does not harm the freshness of well water. Kazakhs in the Zhizak region of the Kyzylkum covered the well with white saxaul, the depth of which reached 45 m (Pels 1912, p. 12-15).

If the soil is soft and loose, the well will be six feet wide and about the size of a house, and the inside of the well will be narrowed to the bottom. The walls of the well are woven step by step and saxaul is set with wooden pegs. At present time using saxaul strengthening are held together by wires.

In comparison, in the sandy plains of Turkmenistan, tamarisk and saxaul were used for strengthening wells, where shallow wells ranged from 3-5 inches, deep wells ranged from 9 to 18 inches (Orazov 1975, p. 211-213).

The type of traditional well which covered with saxaul branches in Kyzylkum is – *saxaul well* (fortified from the inside with log, stone). In order to cover a well inside, at the end of autumn, when it is dry, the saxaul (haloxylon) is picked up with the bottom and thrown on the

sand together with the root. The dew of saxaul comes out when it snows in winter, gets cold, and in spring when it rains on it. Blue, yellow saxaul, that is, *yellow zhiger* while breaking when the juice of saxaul comes out and the bark darkens becomes *black zhiger*. For saxaul covering are selected not too thick, thin logs, and the sticks (branches) are broken into 70-80 cm. Due to the fact that the saxaul rod is round, there are often used 8-10 sided types. Nowadays, the water of the traditional saxaul well has been drained in Kyzylkum, Karmakshylyk, bottom was buried, and dried up. Preserved species and samples were photographed and documented. (Fig. 5).



Fig.5. Saxaul well. Kyzylkum.

#### ***Torangyl shegen (Turanga)***

The well was strengthened with turanga in the places located on the right bank of the Syrdarya River, in the Kyzylkum sands (Shieli, Inkardaria, Karmakshy). The method of strengthening with turanga is similar to the method of strengthening with tamarisk or saxaul. In order to strengthen with turanga, the branches were cut, polished, cut into squares, and crossed at the top, as if sorted by a log. In Kyzylkum, the bottom of the torangyl well is not visible because of the deep water. The strengthening of wall with turanga of the well has been out of use for the last 40-50 years.

#### **4 Ceramic strengthening**

##### **Ceramic shegen or ceramic well**

It is known from history that the location of ceramic wells was found in the early central cities. In other words, the ceramic well is a provention of urban civilization. The bricks used to weave the walls of the well are fired in a special oven to prevent them from rotting in water. Hard fired ceramics are insoluble in water. All types of ceramic wells were dug in the form of cylinders, and the source of water was left between the bricks. The man coming out of the well made a footstool, putting the bricks on other side. The ceramic strengthening is placed in a well

dug in the hard ground. Brick wells dating back to the first half of the XIX - XX centuries, preserved in the city of Kazaly and Kyzylorda gives opportunity to determine the technology of strengthening ceramic wells. The depth of preserved ceramic wells in the Kazaly region is 7-9 meters, the inner diameter is 80 cm - up to 2 m. Because ceramics are made of soil, they do not affect the fresh taste of water. The laying of ceramic tiles on the walls of the well is closely connected not only with the well-being profession, but also with the aspects of construction and architecture. The result of folk knowledge is not only the combination of pottery, but also the weaving that will serve for centuries (Fig.6).

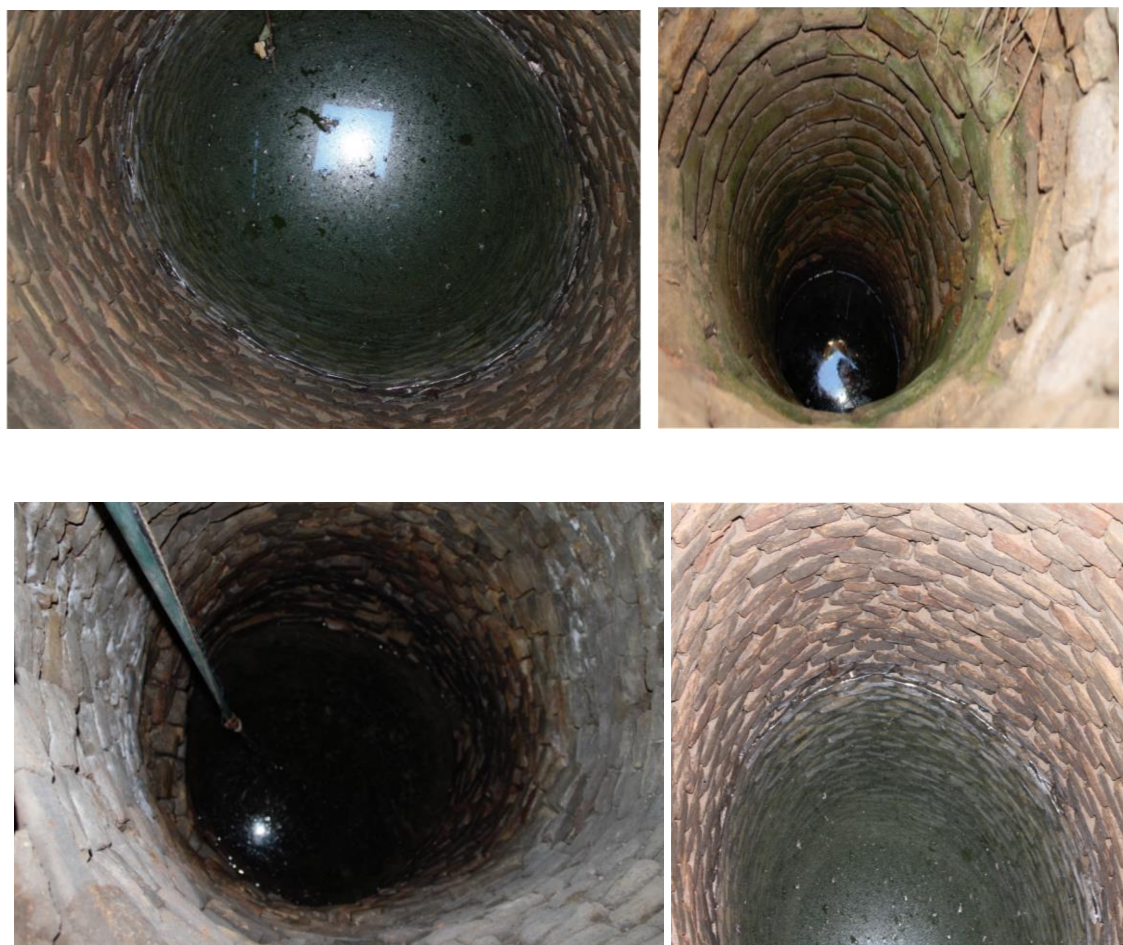


Fig.6. Types of ceramic wells. Kazaly region.

The Aitbai Mosque was built at the expense of Aitbai Haji by the masters of Aulieata - Iskak and Kamal that founded in 1878 in Kyzylorda and included in the category of monuments of republican significance. Before the walls of the mosque were built, there was a dug well. The well was dug before the mosque, the building was built with water from the well and provided the builders with water. In 1980, on the upper wall of the well, the upper 2 meter layer was renovated and replaced with new bricks. Its baked red old bricks were remained 2.5 m below. The newly constructed upper part of the well was reduced by 15 cm in diameter, and new

brick strengthening were rarely laid. Before the renovation, worshipers drank water from wells, prayed and performed religious rites. Nowadays, this ceramic well is preserved, but despite the fact that the water is still inside, it is out of use, the lid is closed and covered with carpet. According to the locals, in 1878, for the construction of a church in Kyzylorda, first there was dug a well strengthened with bricks, and the church was built with well water. Later, the ceramic well was buried.

Medieval ceramic wells had stairs that were used to clean the bottom of wells. The stairs were built by weaving one brick vertically between the horizontal layers of ceramics. The stairs were usually placed in wells with a narrow diameter. The wells with stairs were common in Central Asia and the Middle East. The chronicle “Baburnama” describes the structure of such a well in Kabul city and there was written that it called “vain” in the local language [Babur-name 1993, p.297].

Ceramic strengthening of the well was also common among the Kazakhs of Bukhara. The size of the ceramic strengthening of our compatriots in Bukhara was 1.20-1.5 m. The use of ceramic strengthening by the Kazakhs of Bukhara was connected with the local civilization, the development of ceramic culture in the local architecture.

The oldest example of a cylindrical ceramic well in the Syrdarya valley was the well of the mausoleum of Hodja Ahmed Yassawi. Before the mausoleum, there were dug two wells, the mausoleum was constructed by well water, and the architects and builders were provided with water. Today, one of the wells has been restored, which is a museum exposition called “Kudykkhana”.

The well of the Arystan Bab mausoleum is an example of a ceramic's strengthening. This well is also older than the mausoleum. First, a well was dug and a mausoleum was built with well water. Depth is – 14 m, inner dm is – 1.1-1.2, inner dm of the mouth is – 0.67 m, rim of dm is – 1 m. The water has a high salinity.

The lids of traditional ceramic wells were made of wood. The wood provided fresh air circulation inside the well.

### **Conclusion**

There was required to determine the depth of wells used in ancient times, buried or depleted of water, the strengthening of well out of use, type of used wells, geoarcheological analysis of the taste of water; hypometric analysis to determine the equilibrium of the source of water; influence of strengthen materials to water of well that strengthened with plant and stone, such as saxaul, calligonum calluna, tamarisk willow and others, methods of the Natural Sciences

to identify the impact of strengthening plant to the taste of water, laboratory analysis, using methods of sciences as Geography, Geodesy to determine peculiarities of soil, ground.

The method of strengthening is various depends on the type of soil and the local material.

Individual monuments of cultural heritage that is not materials inherited from generation to generation can be changed in traditional ethnical sphere, because of nearby or mixed population or society, related to the development of modern life. The effects of modern globalization are different from those of the topic we are studying, that is, from the traditional system of water use and water supply. For example, there are regional differences in the system of beliefs, prohibitions, knowledge and skills associated with the use of water, water treatment, well, shygyr, water tools.

From ancient times, the Kazakh people have mastered the complex technology of drilling wells, groundwater and a system of folk knowledge.

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