

## RELATIONSHIP BETWEEN THE RISE AND DECLINE OF ANCIENT LOULAN TOWN AND ENVIRONMENTAL CHANGES

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**ABSTRACT:** Located in the central Asia, ancient Loulan Town was a place of strategic importance to the ancient Silk Road. According to the historical records, it was flourishing during the period from the second century B.C. to the third century A.D. However, it was disrecorded suddenly 1400 years ago. Until 1900 it was discovered by a Swedish exploration party. The ruins of Loulan is situated on the west bank of Lop Nur Lake and the delta of the Tarim River (40°29'55" N, 89°55'22"E), and occupies an area of 108 240 m<sup>2</sup>. Two main tributaries of the Tarim River passed by its northern and southern sides respectively and converged into Lop Nur Lake about 100 km eastward. Human civilization of the Loulan Town had been developed in the Stone Age, which was revealed by a lot of stone implements found in the region, and the discovery of the corpse of "Loulan Beauty" proved the continuity of economic development. During several centuries around the Christian era, Loulan had become a place of strategic importance on the Silk Road because its superior geographical position and natural conditions. The decline of ancient Loulan Town was caused by natural change of the river courses and rapid environmental deterioration.

**KEY WORDS:** ancient Loulan Town, ancient town's rise and decline, environmental change

Ancient Loulan Town was a famous town on the Silk Road in the history, but suddenly disappeared from the historical records 1400 years ago. Until the spring of 1900, Aierdeke, the Uygur guide of the exploring party led by Mr. Sveh Hedin, a Swedish explorer, discovered this mystery, which made a sensation in the world. Afterwards, a lot of explorers at home and abroad, E. Nuntingtrn from America (1905), Sir Aure Stein from England (1906, 1914), Coure Otani *et al.* from Japan (1908 - 1911) went there one after another and the last investigation of wide scope was done by an archaeological investigation team led by Mu Shunying in 1979 - 1980, they started from Dunhuang to there. Lop Nur scientific investigation team led by Peng Jiamu and Xia

Xuncheng from Xinjiang Branch of the Chinese Academy of Sciences also went there to make a survey in 1980 - 1981. All of these explorers and scientists have made a lot of reports about the history and environment of ancient Loulan Town. There are many explanations of the disappearance of ancient Loulan Town, such as, the hypotheses of a different race invasion, route change of the Silk Road, cutting off of stream, climate getting dry, and pestilence, etc. (Cheng, 1936; Huang 1962; Huntington, 1907; ISTLNL, 1987; Mu, 1987; Sven, 1934; Xinicun, 1955). When we investigated Lop Nur district during March to April in 1996, we studied the natural landscape and historical eco-environment of Loulan district.

## 1 HISTORY OF RISE AND DECLINE OF LOULAN

### 1.1 The Stone Age

According to the previous data obtained by the explorers from different countries, there were a great number of stonewares around the west and north of Lop Nur Lake. We also found many fine stonewares, a few of old stonewares, as well as potsherds and broken bronze mirrors. These findings indicate that there were human activities in ancient Loulan Town and its adjacent areas in the Stone Age 10 000 years ago. Thousands of rock paintings discovered in Kuruk Mountain northwest of Lop Nur Lake show many pines and animals such as peacocks, water birds, wild camels, wild horses, wild oxes, wild sheeps, dogs, etc. The cliff rock paintings, showing that the naked ancient Lop Nur men with bows, arrows and hounds were hunting in forest, verify obviously that the Lop Nur men lived on hunting, collecting and moving about in search of pasture in ancient Loulan districts in the Stone Age, and the Lop Nur men around the lake lived mainly on fish foods. It maybe inferred that there were plenty of water sources, many forests and large number of wild animals in the Stone Age, which were essential bases for the foundation of the ancient Loulan Town.

### 1.2 The Bronze and Iron Ages

In the first years of the Qin Dynasty (221 B.C. – 206 B.C.), Loulan was independent as a slave society living on agriculture and animal husbandry, and dominated by Yueshi King. The northern Xiongnu (an ancient nationality) defeated Yueshi King and dominated the country from 177 B.C. to 176 B.C. This is the oldest record in historical book about Loulan. Zhang Qian passed through the western region in 126 B.C. and opened a wide direct way of communication between east and west.

The ancient Loulan Town lay in an important

position in the early Silk Road. On the dry lake beach of the southern and eastern Tuyin ruins, we found many pieces of broken jades. It is estimated that Tuyin was once a wharf by water way or a station by overland route for transshipping jade in Loulan Country outside of Yumen Pass. The Silk Road was the jade way to inland towns of China. In 77 B.C., the Han Dynasty garrisoned troops to Yixun of Loulan Country to open up wasteland, and change its name into Shanshan. From then on, Loulan became a town of Shanshan Country, which was a center of garrisoning and opening up wasteland in the western region in the Han Dynasty. In 53 B.C. Julu barn was built for providing foods to the envoys and caravans traveling along the Silk Road. The area of the Loulan ruins is 108 240 m<sup>2</sup>, which indicates that Loulan Town had been prosperous at ancient time. The last record of the reign title in Loulan ruins was the 18th year of Jianxin, which equals to 330 B.C.. Loulan district was called “dead place” in the book named “Buddhism Record” written by Faxian, a buddhist monk in the Eastern Jin Dynasty. During this period, the ancient Loulan Town disappeared due to desertification.

## 2 GEOGRAPHIC LOCATION AND PALAEO-ENVIRONMENT OF LOULAN DISTRICT

### 2.1 Geographical Location

Based on satellite images and field investigation, the ancient Loulan Town was situated in the central area of the delta of the Tarim River and Kongque River toward Lop Nur Lake. It is 28 km away from the western bank of modern Lop Nur Lake and 29 km away from the southern bank of the ancient Kongque River course, and its geographic location is 40°29′55″ N and 89°55′22″E. There were two ancient streams in the southern and northern parts of the ancient town, they were 20 – 40 m wide and 5 – 8 m deep. The administrative division of Loulan ruins belongs to Ruoqiang County, Mongolian Autonomous Prefecture of Bayingolin, Xinjiang.

## 2.2 The Palaeoenvironment During Geological Time

The climate of Loulan district was the same as that of Tarim Basin during the geological time. In the early Pliocene epoch of the late Tertiary Period, the climate in Loulan district was relatively humid since the altitude of the Qinghai-Xizang Plateau was only 1000 m, which did not exert serious effect on wind system circulation. At that time, Lop Nur Lake had been formed, and its range was from present Longcheng in the northwestern part to Akqi in the eastern part and the monadnock area east of Sanlongsha. Up to the early Pleistocene, Himalayan orogeny made the Qinghai-Xizang Plateau rise to 4000 m a. s. l., thus the southwestern humid monsoon from the Indian Ocean can hardly go into Tarim Basin. In addition, owing to the separation of huge mountains, which rose furtherly at the same time, in northern, eastern and western sides, the humid air was also hard to get into Loulan district and to form rainfall. In winter, under the control of Siberian-Mongolian cold high, climate became extremely dry. Because of the reasons mentioned above, arid climate condition had been formed in geological time. According to the study on the corpse of "Loulan Beauty" died  $3880 \pm 95$  a. B. P., discovered in the western bank of Lop Nur Lake by Xinjiang Institute of Archaeology, the lung of the corpse contained a great quantity of dust deposit, and the corpse had not been rottened. This discovery indicates that the climate 3800 years ago was as dry as that in modern time.

## 2.3 Palaeo-environment During the Formation of Ancient Loulan County

In the middle and end of the late Pleistocene, 30 000 – 20 000 years ago, Tarim River went to the east through the Kongque River, thus forming a delta in Loulan district. Up to the Holocene, Lop Nur Lake dried up again owing to the arid and cold climate, and wind-sand activity prevailed in the middle and lower reaches of the Tarim River. In the middle Holocene, there was plenty of water in Lop Nur

Lake, but the water surface of the lake shrank 9000 years ago. From 3000 a. B. P. to 2000 a. B. P., Lop Nur was replenished with water, and many river branches and depressions were formed. There were a lot of plants, such as *Populus diversifolia*, *Tamarix* sp., *Phragmites communis*, *Typha* sp., *Bolboschoenus popovii*, *Alhaga pseudahagi*, *Sophora alopecuroides*, *Glyrrhiza inflata* etc. The soil was mainly meadow soil and meadow-boggy soil. Human hunting and reclaiming accelerated the formation of the ancient Loulan County.

## 2.4 The Environment in the Period of Loulan Decline

From 100 B. C., owing to the periodic change of climate, strong wind-sand action and deposition of rivers, the courses of the Tarim River and the Kongque River had moved towards southwest, making the water quantity of the two rivers flow through the southern and northern parts of Loulan gradually decrease. Around 70 B. C., about one thousand soldiers stationed and opened up wasteland in Loulan district, however, they had to dig irrigation ditches to leap a bumper harvest. This indicated that the irrigation of farmland could not depend on natural slope at that time. Because of the course changes of the rivers flowing from plain to lake, the two rivers in southern and northern parts of Loulan district completely dried up around 350 A. D., making people had to abandon Loulan Town and its surrounding farmland. From then on, Loulan Town disappeared from historical records.

## 3 ENVIRONMENTAL CHANGE FROM DISAPPEARANCE TIME OF LOULAN TO MODERN TIME

### 3.1 Environmental Changes in the Disappearing Period of Loulan Town

In April of 1996, we entered Lop Nur Lake through Tuyin ruins from the north, then explored

from the lake center to the west and went into the ancient channel situated in the north of Buddha Tower, 2.5 km away from Loulan Town, and finally reached to Loulan ruins along the channel. It is found that there were seriously eroded yardang landform both in the eastern and northern parts of Loulan, the relative height between modadnock and erosion gully, with the direction of NNE – SSW, was 3 – 8 m. We discovered some pieces of pottery, fine stonewares and broken bronze mirrors in the ancient channel and erosion gullies in the western part of Loulan ruins. The findings show that Loulan district was once a flat and fertile area for farming, stock raising and fishing in 350 B. C. From the analysis of remaining *Populus diversifolia* it can be seen that the environment had deteriorated obviously before the Loulan Town disappeared. There were a few of dead *Populus diversifolia* in local areas in the both sides of rivers, with an maximum area of 1.0 ha, average tree height of 5 – 6 m, and maximum diameter of 20 cm. On some monadnockes, sparse *Populus diversifolia*, with maximum diameter of 30 cm, still survived.

These *Populus diversifolia* have gone through more than one thousand years from the fact that the tree skins look like fish scales by strong erosion. At that time, Loulan Country had made an earliest and most severe forest law which stipulated that one would be punished a horse when one cut down a tree, and a cow when one cut a branch. This indicated that the environment was seriously deteriorated in Loulan district at that time.

In the ruins of Loulan official place, the longest timber was 6.4 m, and around the Buddha Tower in the north part of ancient Loulan Town, we also found tens of timbers 4.65 – 5.3 m long. From weathered features, it was proved that these timbers were *Picea asperata* which were carried from the upper reaches of rivers. These finding indicated that there were no higher *Populus diversifolia* when Loulan Town was prosperous. From the analysis of remaining houses, canals and dead *Populus diversifolia* and *Tamarix* sp., it can be shown that yardang landform had appeared in ancient Loulan Town in the period of hu-

man residence.

### 3.2 Environmental Changes in Loulan District in Modern Time

Because ancient channels passing through Loulan were finally dry up in 350 A. D., and groundwater table had been down gradually, aquatic plants, animals such as fish and snails, meadow herbs, *Populus diversifolia* and *Tamarix* sp. successively died, thus making the area barren. At present, a few of halophytes, such as *Halogeton glomeratas* can grow in the area only in spring or during torrential rain.

Owing to long-term drought and the effect of prevailing wind, eroded monadnockes and depressions were interdistributed with a direction being the same as prevailing wind of NNE-SSW. On the so-called yardang landform, summits were formed, under the action of aerodynamics, in the areas where *Populus diversifolia* and *Tamarix* sp. grew, so these plants remained well. Though the plant surface cracked as fish scales through a thousand years of wind blowing and sun shining, most of plants still stood in open field. Some hillockes were 4 – 5 m in height, and some depressions were 100 m long, 20 – 40 m wide and 3 – 4 m deep.

In the channel passing through the Buddha Tower, we found that some terraces about 2 m high were unevenly distributed on the both sides of river bed, where some dead yong poplars 1.0 – 1.5 m high stood. From this fact, it can be deduced that a small amount of water was supplied to the ancient channel since the Tarim River went northwards, then flowed into the Kongque River and entered into Lop Nur Lake finally in the modern time. Seen from the yong poplars on the river terrances and sand deposit in part of the channel, it can be explained that the time of water supply to the ancient channel coincided with the time of the Tarim River changing its course northwards in 1992. Since that time, no water flowed through the ancient channel in Loulan district.

### 3.3 Present Situation of Ancient Loulan Town

The ancient Loulan Town was an irregular square town, with east wall 333.5 m long, south wall 329 m long, and west and north walls 327 m long. Many buildings have been ruined by strong wind erosion in the town, but three storehouses of government have been still solid and kept well because of its thick walls. Buddha Tower was still 10.4 m high in spite of wind erosion, it can be used as the mark of the ancient town. There were many weaved walls with *Populus diversifolia* and other ruined walls in the ancient town. We also found some ancient coins, decorative articles and many pieces of pottery on the ground. Clumsy timbers for house building fell in all directions, dead *Populus diversifolia* and *Tamarix* sp. still stood by the ancient channel. The ancient Loulan Town was kept well because yardang landform made automobiles hardly get into the area, and human being could not do damage to the area. In addition, most of investigators went to the ancient ruins only by camel-riding or on foot.

Due to the conditions of special landform, the recent archaeological teams and touring teams have to walk 27 km from March Bridge at the bank of the northern Kongque River to the Loulan ruins. It is terribly hard to make archaeological tourism to ancient Loulan Town because of walking difficulty and no fresh water for camels and horses.

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