

# Some Latest Achievements in Research on Environment and its Evolution in Lop Nur Region

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*Lop Nur and its near region have been given attention again with implement of the Western Development Strategy of China by the united endeavors of concerned scientific researchers. Some latest achievements have been obtained in aspects of environment and its evolution in Lop Nur and its near region in recent years. In this paper, we briefly review some latest progresses.*

**Key words** Lop Nur lake, environmental research, achievement

The Lop Nur and its nearby regions are located at the eastern part of Tarim Basin belonging to Bayingole Mongolia Autonomous Prefecture of Xinjiang, adjacent to Gansu Province at the east, lower branches of Tarim River at the west, Juluotage mountain of the foothill belt in the southern slope of Tianshan Mountains, and the northern foot of Aljin Mountain at the south. Lop Nur was the terminus of every large river in Tarim Basin. Since the middle period of 19<sup>th</sup> Century, especially with implement of the Western Development Strategy of China, Lop Nur and its nearby regions have been becoming an interesting region once again for science circles to explore and investigate. This paper briefly reviews Lop Nur's investigation history and some latest progresses obtained from investigations in recent years.

## 1 Brief Scientific Investigation History on Lop Nur

In ancient literatures of China, there are many recordations about Lop Nur. Completed in Zhanguo period (403—221 B. C.), "Mutianzi's Biography" recorded the information that King Mu in Xizhou period visited Western Region in 985—980 B. C. . King Mu started from Hetao, passed through Hexi of Gan-

su province, climbed Kunlun mountain, crossed over Pamir plateau, came to Ximuwang's district (Persia), afterwards crossed over Tianshan mountain again, finally arrived at Lop Nur along Tarim River.

In Han Dynasty, Zhang Qian and Ban Chao went to Western Region on diplomatic missions, carved out two ways of Silk Road in the south and in the north passing through Lop Nur region, which as a result, made the relations between every nation in the Western Region and Han Dynasty closer. They brought back larger amount of information which was recorded in "Historical Notes" written by Simaqian and in "Han's Book" written by Bangu. In 339 A. D. of Dongjin period, together with Huijing and Daozheng, etc., Faxian went to India in order to obtain Buddhist sutra starting from Changan. The book of "Travel Notes on Buddha's State" written by Faxian not only recorded journey passing through Lop Nur, but also described the dangerous situation of Sandy River. In the book of "Annotation on River Classics" written by Lidaoyuan of Beiwei period in 518—524 A. D. there were more detailed records and narrations on Lop Nur, the recorded ecological and environmental information in that years could still be used for comparative analysis today. In 627 A. D. of Tang Dynasty, Xuanzang started from Changan, passed through Yiwu, Gaochang and Qiuzi, crossed over Tianshan, arrived at Suiye. Afterwards, he changed his direction to India. His return trip was along the northern foot of Kunlun mountain, passed through Qiemo, Ruoqiang and Dunhuang. Xuanzang's disciple, Bianji had written "Travel Notes on the Western Region in Great Tang Dynasty" that recorded the investigated situations on this travel. In Qing Dynasty in order to exploit Xinjiang, many times the investigations were organized, lots of persons with lofty ideals, including Amida, Xusong, and so on, had come into Lop Nur region. After over-

coming a series of difficulties and hardships, Amida had written "Brief Records of River Sources", Xu-song had written "Records on River Courses in Western Region", Taobaolian had written "Xinmao's Travel Notes". Especially the book of "Records on River Courses in Western Region" had creatively recorded the river system of Xinjiang that was divided by lakes-the body of receiving water on the features of arid region.

The earliest foreigner who had traveled in Lop Nur region and left over written recordations is Marco Polo who was a businessman of Italy. He started from Rome in 1227, arrived in China along the ancient Silk Road, and had gone back to Persia by sea in 1291. During this journey, the time of his expending in the road was for 3 years, the time of his living in China was for 20 years. The investigation achievements had reflected concentratively in two books of "The Travel of Marco Polo" and "The Description of the World", which have contributed importance to cultural exchange between China and the West. Since the latter half period of 19<sup>th</sup> Century the upsurge of exploration and investigation to Lop Nur began, which continued throughout a century. Main representative personage includes N. M. Przewalski, Sven Hedin, E. Huntington, Stain, Juruichao, etc.

In Modern times, there were 3 times of investigations carried out by Chinese scientific researchers in order to regionally investigate and study Lop Nur region. The first time was carried out by the Scientific Investigation Group of Northwest China from 1930 to 1934; the second time was carried out by Xinjiang Comprehensive Investigation Team of Chinese Academy of Sciences in 1959; the third time was carried out by Lop Nur Investigation Team of Xinjiang Branch of Chinese Academy of Sciences from 1980 to 1981. Hereafter many concerning departments such as the geological and mining, the archeological, the scientific research, as well as the educational had come to Lop Nur one after another for investigation and study.

From 2003 to 2004, Xinjiang Institute of Ecology and Geography of Chinese Academy of Sciences, inviting Prof. Liu Dongsheng, an academician of Chinese Academy of Sciences, to be a technical adviser, had organized scientific investigation on Lop Nur again. This investigation has received a series of new cognitions and achievements, which made the environmental research on Lop Nur reach a new level.

Prof. Liu Dongsheng generalized the significance of scientific investigation on Lop Nur as: Lop Nur is a geological laboratory, in which many scientific problems on Quaternary geology could find satisfying answers.

## **2 Some Latest Achievements Research on Environment and its Evolution in Lop Nur Region**

### **2.1 Formation of ring-like salt crust in Lop Nur region**

On the satellite image, the shape of Lop Nur lake basin dried up is much similar to the outline of a human's ear, thus the "Large ear" as an informal name of Lop Nur lake basin had been produced. In May 1980, when the Investigation Group of Chinese Academy of Sciences was visiting in USA, A. Bazi, a remote sensing specialist, asked: How to explain the "helixes" and "earlap" as well as "earhole" on the satellite image of Lop Nur lake basin hanging up on his own home wall? According to the investigated results, the "Large ear" is exactly a reflection of ring-like salt crust on the satellite image. The outline of the "Large ear" on satellite image is just the contour of 780 m above sea level, the range surrounded by which is 5,350 km<sup>2</sup>.

Through integrated analysis of surface level measurement, surface spectrum measurement, sampling analysis in serial, interpretation on the aerial image in 1958, and other relevant data, the following discoveries were found regarding the formation of the image of the "Large ear": (1) the formation of the image of the "Large ear" was controlled by the original lakeshore landform, especially the peninsula extending into the Lake; (2) the image of the "Large ear" had been formed rapidly with lake water shrinking within about 4—5 years in the early stage of the 1960's; (3) the image of "helixes" of the "Large ear" was yearly and seasonally rhyme line in the process of salt crust forming at the same of the lake water shrinking; (4) the color difference is caused by the change in depth of the saline water table, percentage of sand in the salt crust, and roughness of the ground surface.

### **2.2 Environmental evolution in Lop Nur region in recent about 10,000 years**

In 2003, Mr. Wang Fubao, a professor of Nan-

jing University, on the basis of the differences of magnetized ratio, granularity, trace element (the ratios of C/N, Rb/Sr, Sr/Ba, fh/L and Ni/Co), and micro-paleoorganism fossils of the sediments in lake central profile, has divided the environmental evolution of Lop Nur in recent 11,000 years into 7 stages: (1) in the period of 11,000~9,500 years before today, the climate was relative dry, but the lake was stable, the content of Sulphate in sediments was higher, Lop Nur was a salt water lake; (2) in the period of 9,500~4,700 years before today, the climate was relative humid, but the lake water was desalted, Lop Nur was a slight salt water lake, the content of Carbonate in sediments was higher, the fossil amount of micro-paleoorganism had increased; (3) in the period of 4,700~3,700 years before today, the climate was similar to that in the previous stage, but the climate had been changing toward the dry direction; (4) in the period of 3,700~2,500 years before today, it was an important event for its drying in the evolution of Lop Nur, in that time both East Lake and West Lake were dried up, especially the East Lake had been dried all the time from then on; (5) in the period of 2,500~1,200 years before today, the climate became better, water filled into the West Lake, water area of Lop Nur was ever larger on one occasion, and reached to about 2,000 km<sup>2</sup>, Lop Nur was also a slight salt water lake; (6) in the period of 1,200~700 years before today, the climate and environment were the best of all stages, which was called as a warm stage in Middle Ages, Lop Nur was a fresh-slight salt water lake, water area of Lop Nur reached to about 2,500 km<sup>2</sup>; (7) in the past 700 years, the climate had been becoming dry gradually, among this time in about 1930 water area had enlarged once, the East Lake water area even reached to 1,900 km<sup>2</sup>. Because of summer flood from Tianshan mountains in 1958, both the East Lake and the West Lake were full of water at one time, water area of Lop Nur was 5,350 km<sup>2</sup>, but it dried up again in 1965. The research results show Lop Nur had the process of water dried up in history.

### 2.3 Tamarix Cone Age Layer and its application

Establishing age series of stratum is one of the most important ways to rebuild the paleo-geographical environment. The dating methods from Lacustrine laminated clay to <sup>210</sup>Pb, <sup>137</sup>Cs, and <sup>14</sup>C have also been used to estimate the age of different geological materi-

als. But different methods require different testing materials and are applicable to different ranges of geological age. In the modern desert areas with strong windy and sandy actions, it is more difficult to find the dating material for those methods mentioned above. In the area surrounding Lop Nur the unique Tamarix cone with clear stratification consisting of windy sand layer and fallen Tamarix leaves and twigs that makes up of Tamarix Cone Age Layer. It not only is a better dating materials, but also provides abundant environmental information<sup>[1]</sup>.

The comparison between the counting results from Tamarix cone and the <sup>14</sup>C (AMS) as well as the archeological studies has verified the accuracy of the Tamarix Cone Age Layer method. Tamarix Cone Age Layer contains abundant environmental information, for example through the analysis on thickness, granule and mineral composition of sand layer materials one could study the changes of wind condition and sand sources; through measurements on the features such as C, H, N and stable isotope such as (<sup>13</sup>C of fallen Tamarix leaves) one could study the changes of climatic factors. By this method to study environmental change in Lop Nur region in the last 132 years, and the analyzed result is more satisfactory.

The study of Tamarix Cone Age Layer method has appeared promising, but to make Tamarix Cone Age Layer method become a perfect way for studying environmental change one needs more systemic research. The establishment of Tamarix Cone Age Layer method is an innovation in geological and environmental dating methods in arid desert regions, it plays an important role in the study of ecological environmental change in arid desert region. Engaged in Quaternary environmental research for 60 years, an academician of Chinese Academy of Sciences, Prof. Liu Dongsheng gave a very high praise to Tamarix Cone Age Layer method.

### 2.4 Cause and age of Yadan landform, sand and dust sources

A large scale of Yadan landform distributes extensively in the northern, eastern and western regions of Lop Nur in Xinjiang, the area of which reaches to about 3,000 km<sup>2</sup> that is slightly less than that in northwest department of Chaidamu Basin, is the second largest distribution region in China.

The word of "Yadan", originating from the inflexion of "Yaldang" in Uygur language, means steep

cliff. In the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century, some researchers coming from China and foreign countries had investigated in Lop Nur region. They named the landforms with mounds and valleys distributing in alternation forms on a large scale as "Yadan landform" in their papers. Hereafter it has been gradually accepted and adopted by geographic circles.

Yadan landform had formed and developed on the basis of loess-like sediments, and under three essential conditions: (1) loess-like sediments must contain better level stratification; (2) alternated strata consist of the softer one and the harder one; (3) there are directional exogenic forces such as wind, water, etc.

The cause of Yadan landform formation was considered to be aerial erosion in the past, belonging to aerial erosion geomorphologic type. Through investigation on the spot, together with the data analysis of aerial survey, we think that the paroxysmal rainstorm and flood from surrounding mountains also play an important role in forming Yadan landform besides of wind force.

According to the cause of Yadan landform formation, they could be divided into 3 types: (1) Yadan landform type caused by main wind erosion. This type distributes in plain region far away from mountain regions. The rainstorm and flood from the mountain area are uneasy to arrive the area as above, and obviously the wind erosion is the most important force in forming it. The trend of long axes of ditches and valleys of Yadan landform formed by wind erosion is consistent to the main local wind direction. This Yadan landform mainly distributes in the region nearby Loulan Ancient City in the south of Kongque River; (2) Yadan landform type is caused mainly by running water erosion. This type of Yadan landform is adjacent to mountain region and nearby lakeside, for example, in the northern region of Longcheng and in Sanlongsha. The trend of long axes of ditches and valleys of this Yadan landform is inconsistent with the main local wind direction, while it is consistent with the flood flowing direction from surrounding mountains. This type of Yadan landform has kept the pluvial trace on the mound of Yadan landform. Those as above show Yadan landform in this region was formed mainly by flood erosion; (3) Yadan landform type is caused mainly by wind erosion on the basis of running water erosion. This type of Yadan landform distributed in plain region where the running water erosion is not very obvious at the present time. But in

the initial stage of this Yadan Landform forming and developing, it was related to the running water erosion. Firstly the flood eroded the flat ground surface, formed a lot of ditches and valleys, made loess-like strata exposed to ground surface directly, then the original formed Yadan Landform was reformed by wind erosion. Sometimes Yadan landform has been formed by alternative functions both wind erosion and running water erosion. This type of Yadan landform was formed by wind eroding and reforming function on the basis of running water erosion. Yadan landforms in Lop Nur region consists of 3 types formed in difference phases, i. e., Higher Yadan Landform (with the height more than 10 m), Middle Yadan Landform (4—5 m in general), and Lower Yadan Landform (1—2 m in general).

If Yadan landforms are formed by wind erosion, where did the dust eroded out go? This is another scientific problem. Prof. Liu Dongsheng had connected Yadan landforms in Lop Nur region with the Loess Plateau of China for the first time, scientifically interpreted the relationship between loess and dust formed by eroded sediment, according to which the loess comes from the dust.

Sandstorm actually is mainly dust but not sand. Kuluks desert in the southwest region of Lop Nur, and Sanshalong with "drifting sanddunes by 400 km" could be interpreted as the end-result of "the sand", but where the dust coming from eroded Yadan landform had gone has been given a close attention. This problem needs to be studied further.

## 2.5 Whether or not Lop Nur is a vacillating lake

The person led to disputation on whether or not Lop Nur is a vacillating lake is N. M. Przewalski, a military officer of Russia. In 1826, when investigating in the lower branches of Tarim River, he mistook that Kalaheshun Lake located in the south of Lop Nur is actually Lop Nur. Its location is slanting to the south against the indications on Chinese map, the difference is about 1° of latitude in comparison with the map on the spot survey in Qing Dynasty, but the water of Kalaheshun Lake was fresh. According to his wrong viewpoint, he maintained that Kalaheshun Lake is the Lop Nur recorded in Chinese ancient books, and concluded that the Chinese map is erroneous. His student, P. K. Koslov supported his viewpoint completely.

The report of N. M. Przewalski had been given a close attention in international geography circles. It was firstly opposed by F. V. Richthofen, the chair-

man of German Geography Association, he thought that the lake investigated by N. M. Przewalski was not the Lop Nur indicated on the map in Qing Dynasty of China, but the true Lop Nur was located in the northern department of the lake investigated by N. M. Przewalski, and the China's map was correct. Afterwards, a Englishman, Stain, and a Swede, Sven Hedin, etc, early or late investigated in Lop Nur region, they considered that both argumentative sides have no mistake, but Lop Nur had vacillated to Kalaheshun Lake, and thus a statement that Lop Nur was a vacillating lake had been emerged. This statement was endorsed by many researchers, and was cited in many publications one after the other. At the same time, Sven Hedin still put forward that the vacillation cycle is 1,500 years for Lop Nur to vacillate from the north to the south and from the south to north again. The reason for Lop Nur's vacillation in his opinion is that lots of silt held by river water entered into the lake, and accumulated in lake basin, in result the height of the lake bottom was lifted up, led the lake water to flow into the lower places. After this period, the lake bottom had become the ground surface because of silt sediments, it had been eroded by wind, and the lake bottom had been lowered, as a result the lake water flowed back into the original lake basin again, thus Lop Nur completed a vacillation from the north to south and from the south to north just like a pendulum of big ancient clock. Now further opinions on the basis of investigation on the spot are: (1) in height above sea level. Both Lop Nur and Kalaheshun Lake are small locally subsided depressions in plain, the former is still lower than the later, the height above sea level at lowest site of Lop Nur is 778 m, but of Kalaheshun Lake is 788 m, the difference between two sites is 10 m, because water flows from higher place to the lower, it is impossible for the water to flow backwards from Lop Nur with lower elevation down to Kalaheshun Lake with higher elevation. (2) in relationship between river and lake. Located in Lop Nur region, Taitema Lake, Kalaheshun Lake and Lop Nur are the subsided depressions not intersected each other, but contact and link as a string of beads by Tarim River course. The stream in general entered Kalaheshun Lake at first and entered Lop Nur finally. Kalaheshun Lake was not the terminal lake, and still was a freshwater lake; (3) in sediment and aerial erosion degree. At the mouths of Tarim River and Kongque River entering into the lake, silt content in river water was less. In a short term, it is incapable to produce a large

quantity of silt sediment to lift up lake bottom, and lead water to flow into lower place. The investigation also found that the dried up lake bottom is hard salt crusts, not easy to occur aerial erosion to lead lake bottom to be lowered again; (4) in lake bottom sediment rate. On the basis of  $^{14}\text{C}$  dating result on drilling samples at the lake bottom, sediment age at 1.5 m in depth is 3,600 years, not similar to the conclusion that within 1,500 years over 10 m in thickness of lake sediment had been formed, which was guessed by Sven Hedin; (5) in sediment pollen analysis. There are pollens of *Typhaceae* and *Cyperaceae* in lake sediments. In nearby regions of the profile of No. 4 in Lop Nur grows these plants. In sediment of profile of No. 4 in Lop Nur there are all hydrophyte's pollens such as *Typhaceae* and *Cyperaceae* distributing in difference layers, which shows that there is often water stagnating in Lop Nur in recent about 10,000 years.

According to investigation and survey on the spot and analysis data on modern aerial image, the statement that Lop Nur is a vacillating lake moving from the north to south and from the south to north again put forward by Sven Hedin is not suitable to actual situation. In historical period, the water of Lop Nur had never flowed backward from Lop Nur into Kalaheshun Lake.

Lop Nur and its nearby regions is a wide and shallow depression, the height difference is very small. The surveyed result of a horizontal line by 50 km in autumn of 2003 shows the largest height difference is only 3.02 m. Additionally because of frequent change of river's course of river system of the lower branches of Tarim River and Kongque River, the objective facts that the locality, size and shape of Lop Nur-terminal lake have changed obviously, are existent.

## 2.6 Reasons for Loulan Ancient Civilization declined and died out

In ancient days Loulan Ancient City was an important regional center in politics, economy and traffic, but in present days it has become a scene of wasteland, a huge change from the prosperous to the died had taken place. There are many statements on the reasons for Loulan Ancient Civilization's disappeared, which could be merged to a few main viewpoints as follows: The first. Since the Quaternary Period the climate of Tarim Basin has been becoming dry, as a result the geographical environment has also changed. E. Huntington, an American, put forward

that Lop Nur originally was a large interior sea, under the impact of the climate becoming dry, Lop Nur had been shrinking gradually. He established a theory on the relationship between climate change and population migration on the basis of Australian data. In the theory when rainfall decreased over 35%, cultivated sheep amount reduced over 80%, and the climate became dry, the pressure on population would increase, finally it would make population migrate on a large scale; The second. The reason for the decline of ancient cities in Tarim Basin is not relative to precipitation, but is related to river water amount reducing, with glaciers in high mountains shrinking; The third. Irrigation systems and lakes in arid and desert regions are unstable. Water systems appear seasonal change under the influence of alternative erosion and deposition. Chen Zongqi put forward the theory of "Alternative Lake", in which owing to river course changing, water amount decreasing, salt content of irrigation water accumulating in soil, as well as unsuitable to culture agricultures, the population had to migrate and Loulan Ancient City was abandoned; The fourth. Human activity was the main factor to cause environmental change in Lop Nur region. The reason for all previous changes of Lop Nur, especially the changes in modern times, certainly neither is natural factors, and nor has equal importance both natural factors and human's factors, but mainly is human's factors. The wordings as above emphasizing on the function of a certain factor are not complete. We think that the reason for Loulan Ancient City declined and died out is a result of comprehensive function by both social economy and natural condition changes.

The variety of the transportation route is the most direct and impressionable factor for Loulan Ancient City to change. In the period of West Han Dynasty, there was a road passing through Yumenguan. The southern road passing through Shanshan was relative stable; One line of the northern road passed through Cheshi (Tulufan), another line passed through Loulan Ancient City. The line passing through Loulan Ancient City was the most convenient, but there was a short of water and grass, and much windy sand along the line, especially there are three drifting longitudinal sanddunes and a salt desert, but because Cheshi was close to the Xiongnu, the line was harassed frequently, and was turbulent and instable. Therefore Loulan Ancient City had become the most important traffic center, which had undertaken the important task of "transport water

and grain, and meet and see off Han's diplomatic envoys". In order to protect the passage, stationed farmlands had been built, as a result Loulan Ancient City was becoming prosperous. With the situation of Gaochang (Tulufan today) becoming stable, the central government had established its solid reign, which led it to become the door of West Region. The road passing through Loulan Ancient City had been replaced gradually by the road passing through Gaochang to Yanji directly along the southern foot of Tianshan. The road change made Loulan Ancient City unconsciously lost the status as a traffic relay station, namely "the broken road led the city to be emptied". Another reason was that because Loulan Ancient City was located in the lower branches of Kongque River, larger changes of river system had given an important influence on human's production and living. People had to find other habitable area for living, namely "the water loss led the city to be emptied".

## 2.7 Harmonious development between human and nature

Lop Nur Region is one of the earliest regions of human's activities in Xinjiang. As early as the New Stone Age, there already were human's activities in Lop Nur region where it was a gate for the ancient well-known Silk Road, but the southern way of the Silk Road was still to have developed from the road of the "Jade Road". Therefore, by Han Dynasty, Lop Nur region had already actually played the important role in land transportation between the hinterland and Xinjiang. In Han Dynasty, because the Silk Road was being gradually prosperous, for insuring the Silk Road's unimpeded, Lop Nur region had become important stationed farmland center in Western Region additionally, and had possessed the special strategic position in fact. Since the beginning of the 5<sup>th</sup> Century, because the passage of the ancient Silk Road and natural environment had been increasingly worsening, Lop Nur region was desolating.

From 1979 to 1980, in the lower branches of Kongque River and the ruins of Loulan Ancient City, archaeologists of Xinjiang had unearthed a series of ancient carcasses conserved in good condition and lots of funerary objects which provided the strong evidences for studying the mankind's living in Lop Nur region in ancient times. One of the graves was named as Sun-like Grave, surrounding which there are 7 circles of wood stakes with regularly circular arrangement on the ground surface, from the inner to the

outer the wood stakes were arranged in order, in the outer circle there are arranged wood stakes to be scattered to four directions in good order and luxuriant grand sight, that is very similar to Sun's light.

There were more than 100 of diversiform-leaved poplars felled to build only one Sun-like Grave, which devastated the forest and brought evil consequence unable to be estimated for locally regional ecology and environment at that time. Thereafter, in Shanshan kingdom's period of the 3<sup>th</sup> Century A.D., their posterities had issued a series of decrees such as "Whoever felled a tree with root would be punished by a horse", and "In tree's growing season, the felling is prohibited, if felled tree or large twigs, would be punished by a yak". Those conservative measures had to be adopted in the face of the seriously desertificated environment. Those decrees maybe are the earliest of forest conservation laws. For modern persons, the lesson that ancient Lop Nur person was punished by the nature cannot be forgotten actually.

### 2.8 Quicken the development of Sylvite resources in Lop Nur region

Investigation on Sylvite resources in Lop Nur region organized by Wang Mili, a Professor of Chinese Academy of Geology, shows: Lop Nur is a salt accumulated center of Tarim Basin, Sylvite resources is very abundant. The reserves amounts to  $2.99 \times 10^{10}$  t, the value is about  $5.0 \times 10^{11}$  yuan RMB. Published "Sylvite Resources in Lop Nur Region" plays an important role in exploration and development of Sylvite resources in Lop Nur region. Recently the government had list the Sylvite product line with annual production amounting to  $1.2 \times 10^6$  t in important support term (at present the annual production is  $2-4 \times 10^4$  t). After the Sylvite product line with annual production amounting to  $1.2 \times 10^6$  t put into production, the essential water sources can be solved by transferred water from Cheerchan River's harness and river system in Aljin mountains.

### 2.9 Recover historical brilliance of Lop Nur region

In September 2002, the academician consultation item group of "Ecology and environment construction and sustainable development in northwest arid region" directed by Prof. Zhang Xinshi, an academician of Chinese Academy of Sciences, had investigated Lop Nur region and the lower branches of Tarim River on the spot, put forward "Tentative idea of Xinloulan project—Ecological reconstruction and development of the lower branches of Tarim River

and Lop Nur region" aiming at lots of regional problems existed in social economy and ecological environment<sup>[2]</sup>.

The investigation group also put forward a series of constructive suggestions in structure adjustment of oasis farming and animal husbandry, industry and mining and traffic, ecology and tourism, bio-project of salt-tolerance plants in the lower branches of Tarim River, and also suggested to plan and construct a new Loulan City, which will become a central city of regionally economic development and promote the whole development of regional economy. The specialists believe that by combining modern high and new scientific techniques with systemic ecological project measurcs, and establishing scientific management system, the ecological reconstruction and social and economic development of the lower branches of Tarim River and Lop Nur region must actually be realized.

## 3 A Few Impressions

In the history, Lop Nur and its nearby regions ever had a glorious page. In the past about 5,000 years, the experienced vicissitudes of Lop Nur region left us an exploitation history of arid region. Among them, there is not only successful experience to be referred, but also failed lessons to be drawn. For a century, Lop Nur had become a dried up "Large ear" from an expansive large lake. Human being by his own bands not only had created famous Loulan civilization, but also thoroughly changed Lop Nur's visage. What appearance will Lop Nur's future be? It is worthy for us to earnestly consider that Lop Nur is still dried, or is developed vigorously again?

Although there are still a lot of scientific problems to be quested further, we have the firm confidence for human being to scientifically know Lop Nur, to use historical experience as reference, to prospect for the hopeful future, as well as to recover historical brilliance of Lop Nur region!

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