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RESEARCH ARTICLE

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On the correlation between the formation of the "Maowusu Desert" and land use in Liuhu sub-prefecture in the Tang dynasty

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Abstract The historical changes of the "Maowusu Desert" can be divided into three phases: the late Tang dynasty phase, the Song-Yuan-Ming dynasty phase, and the late Ming dynasty to the present phase. Different parts of the desert were formed in different times, with the northwestern part being the earliest to form. As all evidence shows, the Maowusu Desert in its early stage is believed to have taken shape largely around the ancient site of the You state during the years of Tianbao in the Tang dynasty, which is nowadays the eastern half of the Etuoke banner and Prior-Etuoke banner. The formation of the initial Maowusu Desert is not attributed to the so-called over-cultivation from farming but to the long-time exceedingly quartered husbandry starting from the 4th year of the Zhenguan to the years of Tianbao in the Tang dynasty, which resulted in the destruction of the ecology of the natural grassland.

Keywords Maowusu desert, desert evolution, Liuhu sub-prefecture, Tang dynasty

The Maowusu Desert at present stretches from the area of the Etuoke banner, the Prior-Etuoke banner, and the Wushen banner in the Inner Mongolian Autonomous Region, and Shenmu county, Yulin District, Hengshan

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county, Jingbian county, Dingbian county and Jiaxian county in Shaanxi Province. The study of the formation and the historical changes of the Maowusu Desert began in the 1950s. There are three different theories on it: the first one is the theory of geological formation; the second is the theory of human historical formation; and the third one says that the Maowusu Desert is a result of the activities of the sandy-soil layer deposited during the geologic period after being influenced by human economic activities in history and strongly blown by the wind from the northwest. It is of great practical significance to study the origin of the Maowusu Desert. As Professor Zhu Shiguang put it, "the cause of the formation of the desert is a key and fundamental subject in the study of desertification and desert-control. When was the Maowusu Desert formed? What was the cause of formation? These are typical topics in the study sphere of the desertification in our country at present."[1] I tend to think that the Maowusu Desert was initially formed during the Tang dynasty.

However, I have my own viewpoint in terms of the specific time of its formation, its source area as well as the causes of its formation. For this reason, I shall particularly make a brief discussion.

I Three phases of the historical changes of the Maowusu Desert

To study the origin of the Maowusu Desert, we must first recognize the evolution of the desert in history. According to historical documents and data from the field observations as well as the time marks that human activities left in the ancient ages, the expansion of the Maowusu Desert can be divided into three historical phases.

1 The Maowusu Desert's spreading during the late period of the Tang dynasty

Historical records on the expansion of the prime "Maowusu Desert" from the northwestern to the southeastern part in ancient documents are first seen in *Xin Tang Shu*. It says: "In October of the 2nd year of Changqing, a strong wind was blowing over the district of the Xiazhou sub-prefecture. Flying-sands were accumulated and formed sandy hills. It is as high as the city wall."[2] When the people in the Tang dynasty wrote this weather event into files, it showed that people at that time considered the wind as a natural ca-

[1] Zhu Shiguang, 1986.
[2] Ouyang Xiu, Song Qi, 1975, Vol.35, Wuxin zhi, Changfeng 五行志・常风.

lamity, which had never appeared before. Therefore, we believe that it was a strong sandstorm appearing in the district of the Xiazhou sub-prefecture during October in the 2nd year of Changqing. During October, a strong prevailing wind blows from the northwest on the Erdos plateau area. Those powdery sands are blown up by the strong northwest wind and either settle down on the ground after traveling some distance or are hindered by the wall of the towns. The saying "Flying-sands accumulated and it is as high as the city wall" vividly portrays the situation at that time. There were two counties——Shuofang county (the location of the Xiazhou sub-prefectur where the white ancient city is in the present) and Dejing county (its ancient-location is placed at the Weijiamao village of the western part of the Yuyang division within the limit of the north district of the Xiazhou sub-prefecture), which confronted "flying-sands accumulating sand-hill" during that month. The two towns of Shuofang county and Dejing county experienced a sandstorm during that month while the moving sand dunes didn't occur in nearby towns. Therefore, both Shuofang county and Dejing county have suffered from the spreading of the prime Maowusu Desert during A.D. 882 year's winter for the first time. This is the first phase of expansion of the prime Maowusu Desert.

The sands of the sandstorm in the 2nd year of Changqing in the Tang dynasty came from the northwestern city of the Xiazhou sub-prefecture, which is also the earliest origin of the sands of the Maowusu Desert nowadays. During the Zhenyuan years of the Tang dynasty, Jia Dan, prime minister at that time, recorded the location of the early days of the Maowusu Desert. He wrote: along "the road between the Xiazhou sub-prefecture city and Da Tong Jun fortress, there were two deserts: one is called the "Kujiesha desert" that lay on the south bank of the Yellow River, i.e., the northern half part of 'the Kubuqi desert' at present; the other one is located in the northwest of Xiazhou sub-prefecture City, which is a nameless desert" (i.e., the site of the initial Maowusu Desert). Jia Dan wrote: "From Xiazhou sub-prefecture city going north, and passing the 'Hishui' River, going through the Helan Lake, the Baligan Lake, and going by a desert, a traveler will come across an inner crosswise entrenchment. Soon afterwards, going through the Wuyie Lake, the Chang Lake and the Baicheng Fortress, the traveler will arrive at the source of the Kezhuhunshui River after traveling 120 ***li***…And passing the Buzuoquan Old Fortress, then crossing the Wunashui River after walking for 88 ***li,*** then going through the Huluo Salt-pond, the Hefugan Spring, the traveler will come across the Kujie Desert or "Puna Desert" after traveling 48 ***li***. Moving onwards, the traveler will cross the Hengshui River after walking 28 ***li***, then arrive at Shiben Fortress after traveling 59 ***li***, and reach the Ningyuan

Zhen Town after walking 10 ***li***."[3] That road, which is from the Xiazhou sub-prefecture to Fengzhou state (the Wuyuan county of Inner Mongolia at present) and Tiande Jun Fortress (Datong Fortress) northwards, after passing through the Wushui River (currently known as the Nalin River), the Helin Lake and the Baligan Lake, then crossing a nameless desert at that time until reaching the "inner crosswise entrenchment" located in the southeastern edge of Qiwushan Mountain. The distance between the Qiwushan Mountain and Xiazhou sub-prefecture city is 70 ***li***. There is a nameless desert, which is distributed over an area northwest of the Xiazhou sub-prefecture city. Just because the desert, which was about 60–70 ***li*** away from Xiazhou city didn't have a formal name, it proved to be newly formed. The years of Zhenyuan (A.D. 785～805) had been in the late Tang dynasty. The prime "Maowusu Desert" had existed at that time. Therefore, we think that its formation was even earlier than these years. What is worth noticing is that this area is located in the Qiwushan Mountain and its western part used to be the place of the "Liuhu sub-prefecture" or the "Youzhou State" during the early Tang dynasty. Therefore, we assume that the western part of the prime Maowusu Desert should be in the area of the "Liuhu sub-prefecture". It is impossible that in the 30 years from the 15th year of Tianbao (A.D. 755) to the 1st year of Zhenyuan (A.D. 785) that the whole primitive Maowusu Desert could be formed, and therefore, we suggest that its formation should be in the middle years of the Tang dynasty.

According to these historical data, the prime Maowusu Desert had formed in the middle Tang dynasty (the middle eighth century A.D.). It had a southeastwardly spread to the southeast border of the Qiwushan Mountain up until the years of Zhenyuan; its flying-sands seriously influenced the area between the Xiazhou sub-prefecture city and Dejing county. Since then, the natural environment of the area ranging from the Qiwushan Mountain to the Xiazhou city and Dejing county was continuously worsening and finally turned into a desert.

2 The southeastward spreading of the Maowusu Desert from the Song dynasty to the Ming dynasty

In the period between the Northern-Song and Southern-Song dynasties, the desertification of the area within the middle part of the Xiazhou sub-prefecture became even more serious. The "Youzhou state" (its location is in the ancient fortress named 'Chengchuan' of the Prior-Etuoke banner)

[3] Ouyang Xiu, Song Qi, 1975, Vol.43, Dili zhi 地理志.

area was threatened by flying sands and moving sands. The Maowusu Desert gradually extended up to the southern side of the Wudinghe River.

From the Yuan dynasty to the Ming dynasty, the Maowusu Desert was slowly extending southeastward. Up to the years of Wanli of the Ming dynasty, the Maowusu Desert was enlarged to the line of the Great Wall of the "Yanshui district". It was re-built by Zhang Shuzhong-magistrate of Yanshui district. He said: "The Great Wall is high and meandering, and it stands like a giant functioning as a great obstruction so as to protect the city from being invaded."[4] But this situation didn't last long and sands brought by strong winds reached the area soon afterwards. In the 38th year of the Wanli (A.D. 1610), more than 2000 soldiers and farmers were summoned by the Yanshui governor to level off the sand dunes that had piled up on the exterior of the Great Wall. According to Tu Zhongjun's work: in the 37th year of the Wanli (A.D. 1609), "Two officers checked more than 240 ***li*** protective walls along the Great Wall in the middle zone of the Yanshui district, its total height is 2.5~2.7 ***zhang*** (1 ***zhang*** =3.33 meters)". And "along the middle road zone of Yanshui from the eastern end of Changle fortress up to the western-tip of Qingping fortress are many sand hills whose height reaches up to the top of the Great Wall, or whose height is 5~7 ***chi*** above it, some sand-hills' height is even higher than 1 ***zhang*** at the top." During the period from March of the 38th year of the Wanli up to September in the same year, the whole sand dunes were leveled, and were transported to other places.[5] This shows that the Maowusu Desert had been gradually expanding southeastward during this historical phase, and worsening from the Song dynasty to the Ming dynasty. In the second year of the Changqing (A.D. 822) during the Tang dynasty, the prime "Maowusu Desert" had firstly expanded to the Xiazhou City and Dejing fortress; up to the 38th year of the Crown Title of Wanli (A.D. 1610) during the Ming dynasty, the moving-sand dunes reached straight to the belt of the Ming Great Wall, which was the area between the Changle fortress (the northeast of Yuyang division at present) and Qingping fortress (the southwest of the Hengshan county at present). Within 800 years (A.D.822~A.D.1610), the Maowusu Desert was extending southeastward on a large scale. This is the second phase of the desert's evolution.

3 The continuous spreading of the Maowusu Desert from the late Ming dynasty up to the present

The removal of those sand dunes in front of or above the Great Wall by the

[4] Ai Chong, 1990, p.34.
[5] Chen Zilong, et al.,1965, Vol.447.

Yanshui government during the 38th year of the Wanli didn't work. Thereafter, moving sands and wind-blown sands poured over the Ming Great Wall and extended southeastward continuously. Liu Minkuan who lived in the Ming dynasty said: "In the 80 ***li*** between the Baoning fortress and the Poluo fortress,…and from the Changle fortress, which lay in the east top of middle zone to Poluo fortress on the western side, the height of the piled sands reached the top of the Great Wall. Though the sand hills had been removed by people from time to time, the sands clogged up again quickly. Human force is not comparable with the sand wind."[6] Because the wind-blown sands had covered the surface of the ground of the inner side of the Great Wall, that triangular area between the Yuxihe River and the Wudinghe River had been quickly turned into a desert. An example is that "the nearby Baoning fortress used to have many lakes before and now they are disappearing slowly this year. Therefore, many military horses didn't have water to drink in this fortress."[7] The old site of the Baoning fortress is in the Baoning village of the Qinhe town of Yuyang region. During the late years of the Wanli in the Ming dynasty, the Baoning fortress area changed gradually because of the effects of the wind-blown sands. In the southern side of the Baoning fortress, there used to be six small lakes, including the Yangguan lake, the Fangjia lake (also named Lake Sang), the Suanli lake (also named Lake Suanlin or Lake Suanchi), the Tian-e lake (their old sites are in the south of Qinhe town of Yuyang division), the Caojia lake and the Tudi lake (their old sites are in the northeast of Hengshan county).[8] Up to the 12th year of the Kangxi (A.D. 1673) in the Qing Dynasty, these lakes could only be found in the *Records of Yan Shui Zhen***.** But after that year, they were gradually covered by sand dunes. In the early part of the twentieth century, there were only some clues found on the names of villages there. These names publicly indicated the location of those ancient lakes.

In the early period of the Qing dynasty, the Maowusu Desert was advancing southeastward constantly in the inner side of the Ming Great Wall. For this reason, a large part of the desert ground appeared between the Yuxihe River and the Wudinghe River. As a result, it is given the regular name "the Shilisha desert". It covers an area of about more than ten ***li***, which stretches from the northern Ming Great Wall to the southern Blackshan Mountain. The consequence of the spreading of the Maowusu desert is that the Yulin City was suffering from the same wind-blown sands as the Xiazhou sub-prefecture city did a thousand years ago. The strong wind blew the sand over the wall of the Yulin City. Having no choice, local officials dug up

[6] Zhang Lide et al.,1929, Vol.21.
[7] Ibid.
[8] Li Xiling, 1832, Vol.4.

those sand-dunes outside the north wall of Yulin City several times, but finally gave up the old north wall of the city and built another north wall after moving southeastward. According to historical records, "The second year of the Tongzhi (A.D. 1863), an official whose surname is Chang received news that the Hui nationality bandits launched a riot and he was so worried about the north-wall of the Yulin City that had been damaged by sand dunes that he proposed to build another…Hence, people abandoned the old north-wall, and constructed another new north-wall after moving southeastward. This new north-wall's length was 438.7 ***Zhang***, its height was 3 ***Zhang***, and its width was 1.8 ***Zhang***."[9] And in another record: "During the sixth year's summer of the Tongzhi, the bandit troops was running wild for a time, the people of Yulin City discussed how to strengthen the defense of the city, proposed that officials and people repair it together. At that time, people rooted out these sand dunes along the northeast wall of the Yulin City, drained the moat outside the southwest wall, built the military camp, and repaired battlements on the Yulin city wall. Before completing those projects, funds were not enough to cover such expenses."[10] It is obvious that the new north-wall of the Yulin City was stricken continually by the natural disaster of wind-blown sands after it was rebuilt, thus they dug out again the piled sand-dunes outside the Yulin City's north-wall during the sixth year of the Tongzhi of the Qing Dynasty.

Up until the 1970s, the Maowusu Desert had already marched to nearby Maogoukou of the Yuhezhen town within the Yulin prefecture.[11] The wind-blown sands are constantly expanding southeastward along the valley of the Wudinghe River. Because of the meeting of winds from the northwest, causing a strong wind along the Yuxihe River valley and the Wudinghe River, the power of the wind is greatly strengthened. Up to the end of the twentieth century, the moving sand-belt had stretched 60 kilometers long, ranging from the Ming Great Wall in the northwest to the nearby Shangyianwan town. This is the farthest reach that the Maowusu Desert extended during the three phases of its evolution. Within the area between both the upper reaches of the valleys of the Gushanchuan River and Kuyiehe River, sands further reached the area 3 km away from the northwest of Shenmuxian county. Within the area between the Kuyiehe river and the Touweihe river, sands had already spread 20 km southeastward along the valley of the Bolinhe river from the Ming Great Wall. Wind-blown sands in the west of the Touweihe river had already expanded to the north bank of the Kaiguangchuan river, which is situated in the eastern part of the Yuyang pre-

[9] Zhang Lide et al., 1929, Vol.21.
[10] Ibid.
[11] Shaanxi Province Civil Administration Office, 1971.

fecture. This sand belt is 20 km in length, and about 2 km in width. The sand belt in the east side of the Changle fortress and the south side of the Ming Great Wall had already reached the Dahuodian village of Jiaxian county southeastward along the valley of the Jialouhe river with its length stretching more than 40 km, appearing in the form of sand-piles and sand-dunes like a crescent moon. Within the district of Hengshanxian county, shifting sands subsided in the valley of the Louhe river and turned the latter into a desert because the sands were stopped by the Louhe river flowing from the southwest to the northeast with the Hengshan mountain extending in the same direction. Within the area of both Jingbian county and Dingbian county, the Baiyushan mountain stands to the south. Some parts of the mountain jut out to the middle part of both counties straight northward. The Hongliuhe river flows northward and then turns to the east. The wind from the northwest blows over the three sandy beaches (Dingbian, Anbian and Jingbian beach) of the middle part of both counties, and then becomes a west wind, because of the Baiyushan mountain obstructing its path, thus producing a wind-pipeline effect. This became a huge screen against the southward extension of the Maowusu Desert. The shifting sand belt turned its direction to the north part of both counties and expanded eastward. Hence, there is a shifting sand area of 30 km long from the Mengjia sand-pit of the Dingbianxian county in the west to the Gaojia ditch in the east, with a width of about 1 to 3 km, and height of about 3 to 15 m, where check pattern sand-dunes and crescent moon pattern sand-dunes parallel to the Baiyushan mountain appeared. Under the driving force of the west wind, sands on the Threebian Sandy beaches are constantly advancing eastward, but do not move on southward. The moving sand belt turned to extend to the southeast and reach the Shuangcheng town of Hengshan county with the obstructing effect of the Baiyushan Mountain being reduced slowly after stretching across the Ming Great Wall and the Louhe River. This moving sand belt stretches 27 km in length, and more than 15 km in width.[12]

According to the above discussion, the present Maowusu Desert was not formed in one historical phase, but went through several historical stages of evolution. Since the prime Maowusu Desert constantly expanded to the southeast, the desert fields of different sections of this area are formed in different periods. On the basis of the three phases of its evolution, we deduce that the prime Maowusu Desert is situated in the district of the Youzhou sub-prefecture to the northwest of the Xiazhou sub-prefecture during the Tang dynasty.

[12] Du Zhongchao, Xi Zhenjiang, 2003, pp.66–74.

II The primitive Maowusu Desert was shaped in the years of Kaiyuan and Tianbao of the Tang dynasty

Evidence shows that the original Maowusu Desert was located in the northwest of the Xiazhou sub-prefecture in the Tang dynasty, that is, the district of the Youzhou sub-prefecture (also called Liuhu sub-prefecture) and the area of the Qiwushan Mountain. Its formation was in the years of Kaiyuan and Tianbao of the Tang dynasty (A.D. 713–741, A.D. 742–756)

1 The records of Jia Dan on "the road from Xiazhou sub-prefecture city to the Datong Jun fortress" in *Xin Tang Shu*

This nameless "desert" along the road from the Xiazhou sub-prefecture city to Datong Jun fortress northward was located in the southeastern edge of the Qiwu Mountain, which is about 35 km away in the northwest of Xiazhou sub-prefecture city. This has been mentioned in the previous part of this essay, so we will not narrate it again here. This nameless "desert land" was precisely the primitive Maowusu Desert in the historical documents because it was then a main road of traffic in its eastern part. Because the nameless "desert ground" lacks a formal name, its time of formation cannot be very early, but through a slower shaping process. According to this view, the formation time of the primitive Maowusu Desert was before the years of Zhenyuan, but it wasn't necessarily in the short period from the final year of Tianbao to the first year of Zhenyuan. The primary Maowusu Desert appeared in both phases of the early and the middle of the Tang dynasty, that is, before the 15th year of the Tianbao.

2 The transfer of the location of You sub-prefecture shows a degeneration of the ecological environment in the district

During the Tang dynasty, the city of the You sub-prefecture was moved twice. For this reason, the You sub-prefecture had three locations. The transfer of the You sub-prefecture location for several times reflect that the natural environment in the district undertook a huge change, which was unfavorable to residents. The You sub-prefecture was first established in the 26th year of the Kaiyuan (A.D. 738). According to historical records: in the ninth month of this year, "the You sub-prefecture was set up on the original area of the Liuhu sub-prefecture."[13] The first location of You sub-prefecture

[13] Liu Xu, 1975, Vol.38.

was at the old location of Kuang state, which had been abandoned. It lay adjacent to the Adutan village of the eastern part of the Prior-Etuoke banner. Moreover, there were three counties under the administration of the You sub-prefecture including Yan-en county (its location is in the You sub-prefecture city), Huaide county (its location was at the old city of Saimen county, which had been given up) and Guiren county (its location was at the old site of Changchuan county under the old Lanchi state, which had been abandoned, i.e., the east side of the Prior-Etuoke banner location at present). Then, a state and three counties were set up to manage those Sute nationality population who had already migrated back to the Liuhu sub-prefecture area from the region of the upper reach valley of Huaihe River. Their administrative division covered the eastern half parts of the Etuoke banner and the Prior-Etuoke banner, the western edge of the Wushen banner and the northern part of Yanchi county, which belonged to the Ningxia Hui Nationality Autonomous Region.[14]

But, after 17 years (A.D. 738–755), the You sub-prefecture moved away from the first location, and migrated out of its district further, lodged with the Jingluo Jun fortress, i.e., "in the final year of the Tianbao, the You sub-prefecture had lodged at the Jingluo Jun fortress". We must pay close attention to the word "lodge" which narrated the event of the movement of the You sub-prefecture location in historical records. "Lodge" or "board" here refer to the fact that the administrative organ of the You sub-prefecture was moved out of its district and stationed at the Jingluo Jun fortress.[15] The Jingluo Jun fortress was first called "Yuduole fortress", and its old site was 60 km east of the Etuoke banner's present location. The "Dafeiku Salt Pond" was at the east of the fortress during the Tang dynasty, and the "Shiziling Mountain" was on the south. The second You sub-prefecture location lasted about 32 years (A.D. 755–787) up to the 12th year of the Zhenyuan (A.D. 787). In December of that year, "the population of Sute under the administration of the You sub-prefecture moved their residence eastward to the Shi area", which belonged to the jurisdiction of the "Hedong Jie Dou Shi" official. Then, in pace with the herdsmen of the Sute race coming into the districts of both the Yun state and Suo state, the organizational system of the You sub-prefecture had been revoked.[16] In the next 27 years, the Xianzong Emperor of the Tang dynasty decided to set up the You sub-prefecture and Yian-en county at the Jingluo Jun City again, and about ten thousand people have been moved there gradually.[17] However, lasting six years only, the

[14] Ai Chong, 2003a.
[15] Li Jifu, 1983, Vol.4.
[16] Sima Guang, 1956, Vol.232.
[17] Wang Fu, 1955, Vol.70.

location of the You sub-prefecture was again moved to the location of Changze county, which belonged to the Xia sub-prefecture south of Jingluo Jun City (the Changchuan ancient fortress located in the southeastern part of the Prior-Etuoke banner) during the 15th year of the Yuanhe.

The question then is, why was not the You sub-prefecture moved again to its former district after having been transferred out of the Liuhu sub-prefecture area? From the year of its founding up to its move out of the district, the Liuhu area did not experience serious wars. In addition, there were no serious natural disasters. It can be deduced that the cause was due to dramatic changes in the natural environment of the grasslands in the Liuhu sub-prefecture area, which affected the local residents. As a result, the administration of the You sub-prefecture and the Sute herdsmen under its jurisdiction moved slowly northeast to the northern part of the Xiazhou sub-prefecture because people could not survive there. What was the true reason that caused the huge change of the natural environment and resulted in the migration of the population of the Liuhu sub-prefecture eastward into the Xiazhou area? After eliminating other possibilities, a serious degeneration of the grassland and natural environment within the You sub-prefecture can be designated as the only reason. The area could not support a large population and animal husbandry. The degenerated grassland environment forced part of the herdsmen and their animals to gradually move eastward to the region of the Qiwushan Mountain, which is at the northwestern fringe of the Xiazhou area, to find new ranges. The local government of the You sub-prefecture moved to the Jingluo Jun fortress to govern those Sute herdsmen in the neighborhood.

To sum up the above argument, the transfer of the You sub-prefecture out of its district was caused by the aggravation of the local natural environment. This disproves the idea that the primitive Maowusu Desert was located in the district of the current You sub-prefecture and the northwestern part of the Xiazhou area and that its initial formation was in the years of Kaiyuan and Tianbao of the Tang dynasty.

3 Descriptions on the prime Maowusu Desert in poems and articles written by the people of the Tang dynasty

In writings by poets who lived in the late Tang dynasty, there were some lines describing the scenery of that nameless “desert” that lay in the northwestern part of the Xia area. For example, at the 2nd year of the Jianzhong (A.D. 781), poet Liyi wrote: “children of Liuhu speaking languages of six tribes, riding sheep to chase after sand-mouse. A herd-horse is chirping on

the top of the sand-dunes, and a single wild goose is flying above the blue sky". Another poem reads: "endless wilderness keeps me from seeing the home country, winds all over the sky make me feel even lonely, tombs covered with grass can never be seen, the scene might make humans heart-broken." When writing the poem, the author was giving a send-off party for a friend who is going to travel to the Yinshan mountain region. He saw the scene on "sand-mouse", "the top of sand-dunes", "wind-sands" etc., to the northwest of the Xiazhou city. It was the scenery that the author observed while he and his friends looked into the northwestern distance from a high tower holding wine cups and standing on the city-gate tower of Xiazho city.[18] The landscape of the primitive Maowusu Desert was just the grazing land of the Sute tribes herdsmen in the area of the Qiwushan Mountain. At that time, the earth surface appeared with "sands moving by the driving whirlwind when the wind blows from the northwest, humans didn't know a time when wild grass grew throughout the year." There were only six years from then to the second year of Zhenyuan (A.D. 787) for the Sute herdsmen to migrate eastward to the Shizhou state.

In the period of Xiantong (A.D. 860–874), Xu-tang wrote: "I walked in the unnamed desert that was so boundless and vast, went far away from the He-lian town gradually", in "On the road of the Xiazhou area". The unnamed desert landscapes describe the primary Maowusu Desert of the northwest of Xiazhou. The poet wrote: "going far away from He-lian city gradually", he was marching northward on the road between the Xia state city and the Fengzhou city, and also on the place there in the northwest of Xiazhou city, because there existed only one large sphere of desert, and coupled with the artistry of touching scenery to produce emotion and compose poems to express his feelings.

During those years of the Huichang and Xiantong of the Tang dynasty (A.D. 841–874), Mazhai wrote: "looking around with my lonely heart, the northern desert appears. When day breaks, a north wind draws these withered bitter grasses to dance in the air". In the poem "Stop at the Xia during one's travel", the description showed scenery of the north wind blowing up flying-bitter grass near the Xiazhou city. These poems and articles indirectly reflected the appearance of the primary Maowusu Desert's creeping—expanding phenomenon, making it clear that the formation of that original Maowusu Desert was certainly before the second year of the Jianzhong of the Tang dynasty.

[18] Peng Dingqiu, et al., 1986.

4 The physical geography of the Maowusu Desert area at present make known that the original desert was situated in the region of both the Etuoke banner and the Prior-Etuoke banner

The Maowusu Desert at present extends from the Etuoke banner, the Prior-Etuoke banner and the Wushen banner in the Inner-Mongolia Autonomous Region to Shenmu county, the Yuyang region, Hengshan county, Jingbian county, Dingbian county and Jiaxian county in Shaanxi province. Its physical features show that the latitude of the northwestern part is higher than that of the southeastern part. These north side tributaries originated in the Wudinghe River, such as the Nalinhe River, the Hailiutuhe River and the Yuxihe River, all of which stem from the Qiwushan Mountaim in the northwestern area of the Maowusu Desert and flow southeastward; besides, they roughly flow in the same direction (the Jialuhe River, the Tuweihe River, the Kuyiehe River). The desert is located in an area of converging, advancing or retreating air-masses, one of which is the southeastern sea's hot air-mass and another is the northwestern cold air-mass coming from the polar region, a strong wind from the northwest during winter and spring, which resulted in the flying-sand, flying-dust, dust-storm or sand-storm weather. In accordance with such factors as river systems, locations and wind directions, we analyze that the primary Maowusu Desert can only originate in the northwest part of the present Maowusu Desert area, i.e., the east half part of both the Etuoke banner and the Prior-Etuoke banner, and the west frontier of the Wushen banner.

Such analysis is identical with the three-phase theory of the evolution of the Maowusu desert, which has been presented in the first part of this article. Within the desert of the eastern half of the Etuoke banner and the Prior-Etuoke banner, there were some former sites that consisted of the location of the You sub-prefecture and the Huai-en county (the former Kuang state's location, which is near the Adutan village now), the second location of You sub-prefecture (Jingluo Jun Fortress, which is in the Etuoke banner's eastern part now), the location of Lanchi state (the Aolezhaoqi town of Prior-Etuoke banner) and the location of the Guiren county (at the former Changquan county, i.e., the middle part of the Prior-Etuoke banner now) during the Tang dynasty. These suggest that the relationship between the shaping of the primitive Maowusu Desert and the use of animal husbandry land in the "Liuhu sub-prefecture" area should be intimately related.[19]

Evidence from these four angles fully demonstrates that the primitive Maowusu Desert was formed in the years of the Kaiyuan and Tianbao of the

[19] Ai Chong, 2003b.

Tang dynasty, and its original site is located in the district of the You sub-prefecture, but an excessive use of the land for animal husbandry by the Sute tribes herdsmen in the area of the You sub-prefecture was a direct contribution that caused the grassland to turn into a desert.

III On the characteristics of land use by the Sute people in the Liuhu sub-prefecture during the Tang dynasty

The purpose of studying the characteristics of land use by the Sute residents in the Liuhu sub-prefecture area is to express the forming causes of the original Maowusu Desert. According to the discussion, the origin of the primitive Maowusu Desert was directly caused by settlement–raise type of animal husbandry carried out by Sute herdsmen in the Liuhu area. Here is our argument:

1 The range of the Liuhu sub-prefecture area

Based on historical documents, the administrative organization in the Liuhu sub-prefecture area during the early stage of the Tang dynasty underwent a complicated evolution, which was first named as the "Liuhu sub-prefecture" (that is, the Lu, Li, Han, Sai, Yi and the Qi states, to hold six tribes), and then named as the Kuang state and Chang state, and later belonged to a three-state administration that included the Lanchi state, the Kuang state and the Chang state, and finally the You sub-prefecture. But its governing area didn't change. In the light of a result of document research, the former district of the "Liuhu sub-prefecture" and the You sub-prefecture, amount to a general area that consists of the eastern half of both the Etuoke banner and the Prior-Etuoke banner (not including the Changchuan town in the southeast part of the Prior-Etuoke banner), and the western edge of the Wushen banner, and the northern side of the Ming Great Wall in the Yanchi county belong to the Ningxia Hui Nationality Autonomous Region. On the basis of changes in the area of these banners and counties, the You sub-prefecture's administrative district covered an area of 17,988 km^2 in the Tang dynasty.[20] The southern border of the You sub-prefecture roughly located at the same site as the northern boundary of Dingbian county in Shaanxi province and the "Second Great Wall" of Yanchi county in Ningxia Hui Nationality Autonomous Region; its northern boundary was dispersed along the

[20] Civil Administration Department of China, 2001.

north-side watershed of the Dusitu River; its western border was close to the west mountain, i.e., the south-north directional ridge, which is situated in the middle part of both the Etuoke banner and the Prior-Etuoke banner. It extends to the southern bank of the Dusituhe River; its east fringe was distributed along the Qiwushan mountain and stretched obliquely in 62.5 km to the northwest of Xiazhou city.[21]

2 The migration of the Sute people into the "Liuhu sub-prefecture" area and their demographic changes

An epitaph during the Tang dynasty that was unearthed in the 1980s shows that the Sute people had come under the jurisdiction of the Tang dynasty in the fourth year of the Zhenguan (A.D. 630), when the East Tujue had been destroyed, and was helped to settled down in the middle-western part of "Hequ" region (the Erduos highland at present). With different tribes, this group of Sute people was divided into six states, that is, the Lu, Li, Han, Sai, Yi and the Qi states. They were called the "Liuhu sub-prefecture" as a whole at that time. Up to now, those former locations cannot be specified on the ground. According to the epitaph in the Tang dynasty that was unearthed at the Linzi ridge in the Subujing township under Yanchi county, we only know that the Lu state and an unknown state were located in the north of Yanchi county and the south of the Prior-Etioke banner.[22] The district of the You sub-prefecture was also close to the former area of the "Liuhu sub-prefecture", because the district of the "Liuhu sub-prefecture" was under the Lanchizhou government.

The Sute people still went in for animal husbandry, since they had immigrated into the "Liuhu sub-prefecture" of the "Hequ" region in the fourth year of the Zhenguan of the Tang dynasty. Because of the stable life and the rise of living standards, the population increased more rapidly than before. There was no definite figure of population of the Sute people at the very beginning. The population of Lu state was made up of about 5,000 people; therefore, the whole number of the population of the Liuhu sub-prefecture were reckoned at about 30,000 people. Up to the ninth year of the Kaiyuan (A.D. 721), the Sute population (i.e., Lanchizhou Governor Prefecture) increased to about 100,000 people. Because of the chaos caused by wars and the population's emigration out of the area later, the Sute population was reduced to about 30,000 people. Up to the end of the year of Kaiyuan, the Sute population in the You sub-prefecture district increased again to about

[21] Ai Chong, 2004.
[22] The Local Records Compile Committee Of The Yanchi County, 1986, Vol.7.

80,000 people. The data exclude the number of the Dangxiang Qiang tribe population having migrated into the south of You sub-prefecture to seek pastures at that time. The Sute population of over 100,000 required a large amount of materials from livelihood, such as food, clothing, houses, fuel, etc., and their resources for living well relied on the settlement-raise type of animal husbandry, and their living conditions were decided by seeking natural grassland, a fundamental resource for animal husbandry.

3 Land use of the Sute people in the "Liuhu sub-prefecture" —a settlement-raise mode of livestock husbandry

(1) A settlement-raise mode of animal husbandry in the "Liuhu sub-prefecture" area

When the Sute herdsmen settled in the area of the "Liuhu sub-prefecture", the place appeared to be very natural of the typical northern temperate zone grassland. Broadleaf trees (including the Yang, Yu, liu, and Huai trees) grew up in the river valley, the mountain areas, and the lake banks. There were many wild animals. Grass grew up on the dunes and low hillsides flourishingly, and water resources were plentiful. This place was suitable for raising livestock. For this reason, the Sute came for animal husbandry in the upper reaches of the valley around the Dustuhe River and south of it.

The Sute people's social custom developed when they lived in the area between the Amuhe River and the Xi-er River within central Asia and kept it after they had moved into the "Liuhu sub-prefecture". This made animal husbandry the common way of livelihood for the Sute people whenever they moved. This pattern of economic activity was unlike "following the flourishing grass and water to herd". They always raised livestock in a "settlement-raise" type around where the herdsmen settled, though they also carried out rotation grazing. Hence, their room for movement and grazing land were limited and were roughly distributed in an area of the "Liuhu sub-prefecture". The emperors of the Tang dynasty treated the Sute herdsmen who settled down as common residents of the Tang dynasty on an equal basis. It is said that "the whole six-tribe herdsmen in the district of Lanchi state had obeyed the administrative organization and submitting to the authority within a long time, and they were all common people who are honest and gentle. They were thought of as a part of the four major nationalities of the Hua Xia (China)." This shows that the Sute herdsmen have already settled at that time, and their animal husbandry economy was of a settlement-raise type, because they always put out livestock to a specially appointed range on the grassland.

In the second year of the Chang-an of the Tang dynasty (A.D. 702), the "Liuhu sub-prefecture" area was invaded by the "Later Tujue". After that, Li-qiao, an official from the Imperial Court, was ordered to supervise the establishment of the location-fortress of the "Liuhu sub-prefecture" in accordance with the emperor's instruction. Li-qiao composed a poem titled "the poem of building the location-fortress in accordance with the instruction." When they had completed the project, he wrote: "going up on the high wall by riding the horse-drawn cart, standing at the top of the tall-wall and looking into all directions, how scarce the population was within an area of a thousand ***li***, the trees and grass feel sorrowful for such a lonely wild landscape." This poem reflected the scenery within the district of the "Liuhu sub-prefecture". In the next year, the six states were merged into two states, that is, the Kuang state and the Chang state. Before the merge, each of the "six states" had its own location-fortress. It indicates clearly that there existed an animal husbandry of settlement–raise type at that time in the area.

In the fourth month of the ninth year of the Kaiyuan (A.D. 721), various tribes of herdsmen within the district of Lanchizhou state rebelled against the heavy burden of labor and the taxes. They attacked the location-city of the Xia state. From this we know that the Sute population within the "Liuhu sub-prefecture" area also undertook labor service and military service, and needed to pay heavy taxes to the state and the administration organization.

(2) An estimation on the livestock number in the area of the "Liuhu sub-prefecture"

In the livestock breeding economy of the settlement-raise type of the Sute people, the domestic animals mainly included horses, cattle, sheep, and a few mules and camels and others. There were no exact data on the livestock number of the "Liuhu sub-prefecture", but indirect information may serve as a resource for my argument.

In the third year of the Chang-an (A.D. 703), Liqiao wrote in a poem: "How scarce the population is within the area of a thousand ***li***, trees and grasses are sorrowful for such a lonely, wild scenery." "Horses and cattle are covering the road sides…" It shows the booming scenery of horses and cattle in the grassland and on roads, and livestock husbandry was prosperous in the district of the "Liuhu sub-prefecture". This proves a fact that the number of livestock was numerous at that time.

In the ninth month of the second year of the Kaiyuan (A.D. 714), the Tang imperial government was short of horses. An official named Jianghui suggested: "to send an envoy to the 'Liuhu sub-prefecture' area to buy horses with a blank-named certificate of appointments, about 30 horses was rewarded as a guerrilla general." It is said that the quantity of blank-named certificates of appointments took by the special envoy amounted to three

hundred, which can buy nine thousand horses then. In view of the above, the total number of the horses in the "Liuhu sub-prefecture" was quite large. They not only met the daily' need of the Sute herdsmen, but also have surplus horses for sale to other areas.

On the seventh month of the second year of the Yonglong during the Emperor Gaozong of the Tang dynasty, an official of the managing Xia state colony-herd reported that a Sute man named An-yuanshou, "in the period from the first year of the Diaolou to this year, the number of horses that were dead and lost is about 184,900 ***pi***, and the number of cattle dead and lost came up to 11,600 ***tou***". The colony-herd official of the Xia state managed eight Imperial stock farms. They immigrated to the place from the Longyou region within the years of the Linde, and were arranged for the use of the "Hequ" where the water-grass was luxuriant and area was wide. The Suofang stock-farm was situated 75 km southwest of the You sub-prefecture city, i.e., the northwest part of the Yanchi county in Ningxia.[23] Government-owned livestock husbandry in the area of both the Xia state and the You sub-prefecture developed quickly, hence a number of Sute herdsmen were gathered to provide service within ten years.[24] But in the next three years, a total of 196,500 horses and cattle were taken by surprise because of a revolt of the Tujue tribes. The data did not mention the total number of horses and cattle belonging to the imperial stock farm that were taken. Suppose that the number of dead and lost livestock breeding at that time was roughly a half of the total of livestock breeding, then the total amount of horses and cattle belonging to the eight imperial stock farm should be 393 thousand bolts (or head).

According to this estimation, the number of horses and cattle the Sute folks owned should be more than the above data in the area of the "Liuhu sub-prefecture". It should be equal to the above data at least. If the amount of the sheep was again computed to the above data, the total livestock including horses, cattle and sheep in the area of the "Liuhu sub-prefecture" should not be less than 400,000. Up to the third year of the Chang-an (A.D. 703), the settlement-raise type of animal husbandry had been developing continuously. The total number of livestock increased rapidly, which presented a scene as written in the poem quoted above as "roads covered with horses and cattle herds". Up to the second year of the Kaiyuan (A.D. 714) came such a flourishing animal husbandry in the "Liuhu sub-prefecture" that a special envoy of the Tang emperor came to the place to buy almost 10,000 horses for the Imperial palace's horse-shed. Even though 400,000 is a con-

[23] Du You, 1984, Vol.173.
[24] Liu Tong, 1998, pp.68-69.

servative estimation, it shows that there was a highly developed livestock husbandry in the "Liuhu sub-prefecture". But the above data is not a direct statistics of livestock in the area of the "Liuhu sub-prefecture", because it is only an estimated data for reference. According to the amount of average owned livestock of those nomadic people during the ancient ages of China, (that is, 2–4 horses for each person, 1.9 heads of cattle per person, 9.1 sheep per person) the herdsmen population in the area of the "Liuhu sub-prefecture" reached 100,000 persons owning 300,000 horses, 190,000 heads of cattle and 910,000 sheep altogether. Even if the amount can be turned into a unified "sheep unit" (rate: horse 1:6, cattle 1:4, sheep 1:1), 300,000 horses would be equal to 1.80 million sheep-unit, 190,000 heads of cattle would be equal to 0.76 million sheep-unit and 910,000 sheep would be equal to 9.10 million sheep-unit for a total of 3.47 million sheep-unit.[25] The population was more than 100,000, but even based on 100,000, the number of livestock per person owned should be 34.7 sheep-unit.

Even though livestock husbandry does not destroy the green vegetation the same way as agriculture by turning over the field surface-tier soil, it would also damage grassland vegetation in some other ways. Especially, settlement-raise type animal husbandry could destroy the grassland vegetation through the moving routes, resulting in deterioration of the feeding capacity of the grassland. In the years of the Kaiyuan, there appeared early signs of deterioration and even desertification, and the situation of the grassland worsened with the passage of time.

4 Influence on the grassland's ecology by settlement-raise type animal husbandry

(1) An analysis on the area of the natural grassland in the "Liuhu sub-prefecture" and its livestock feeding capacity

In the north of the "Liuhu sub-prefecture", the Dustou River originates from the Qiwushan Mountain and flows to the Yellow River from the east to the west. In the valley area of the Dustou River, the water resource condition was good and grass-type vegetation grew up vigorously, but the hillside was steep, mountain valleys were deep, and the capacity of open space was limited. In the southern part, the topography was hillocks and gentle mountain slopes, but there was no out-flowing river system and some sites of water resources were separately distributed in the region, such as salt ponds, lakes, and springs. Even if the growing grass was a little inferior to the north river

[25] Wang Shangyi, 2001.

valley, it was still highly qualified grassland suitable for herding cattle.

It is obvious that the difference between the south and the north in the "Liuhu sub-prefecture" area was quite clear for the amount of grass and livestock feeding capacity. When the feeding capacity of a grassland is quite low and the quantities of cattle is very large, it will certainly result in a decline of the natural recovering ability of grassland vegetation. Therefore, the natural vegetation could gradually become scarce and sparse with soils being open to the air and sun, and moving-sands being blown over by a strong northwest-wind. The animal husbandry of the settlement–raise type in the "Liuhu sub-prefecture" could speed the process of deterioration of the natural grassland and the desertification could become worse with the lack of rotation grazing.

The whole area amounted to 17,988 km^2. Except the un-grazed ground including rivers, salt pools, lakes, stone-hills, alkaline-land etc. (accounting for about 30%), the grassland suitable for grazing was about 12,591.6 km^2. The capacity of the river valley in the north was limited. The topography of hillocks and hillside region in the south was wide and gentle, and space was larger. Hence, more livestock was in the north. In the years of the Kaiyuan, the total livestock in the "Liuhu sub-prefecture" district was approximately 3.47 million (sheep unit). In that case, the amount of average livestock was 275.6 sheep unit/km^2, and the loading-stocks capacity of the south grassland certainly surpassed the number. Because of this, an excessive size of herds necessarily brought a huge pressure on the grassland's ecological environment. If a sheep eats about 5 kg fresh grass a day, it eats 1,800 kg fresh grass/per year (360-day year based on the lunar calendar). The amount of grass per ***mu*** natural grass land is 150–180 kg, which is regarded as a standard. If we choose the 180 kg/***mu*** as the pastoral area to calculate, then tending a sheep unit needs 10 ***mu*** area of grassland, or 0.0067 km^2/sheep.[26] Therefore, an area of 3.47 million sheep-unit herding should be 34.70 million ***mu***. As a matter of fact, the area of the suitable grazing ground was 12,591.6 km^2. Even if we calculate it according to 1 ***mu*** converted into 0.0067 km^2, the total area should be 18.7934 million ***mu***. This data is far less than the 34.70 million ***mu*** required, thus we can imagine how huge the pressure of livestock colony looking for food on the grassland was. In the same period, the food requirements of about 100,000 local people should also be taken into consideration.

(2) Destruction of the economic activities of settlement-raise type of animal husbandry on the grassland vegetation

During the Kaiyuan and Tianbao period (A.D. 713–755), the normal eco-

[26] Wang Hengsheng, 1982.

logical system of the grassland in the "Liuhu sub-prefecture" finally collapsed because of the heavy toll of both over-grazing and booming population. This shaped the primitive Maowusu Desert in the district and the Qiwushan Mountain to the east from the process of the northwest-wind erosion of the ground during winter and spring. The demands of more than 100,000 Sute folks varied, including food, firewood, clothing and housing, etc., all of which should be obtained from natural resources (agricultural production and animal husbandry) in the area. The increasing population demanded more natural resources. This directly caused the destruction of the natural ecology system in the area. If a person uses at least 333.3 ***jin*** firewood per year for instance, the total amount of firewood requirement of more than 100,000 Sute herdsmen should be at least 33.33 million ***jin***. This was in an area with only trees and bushes in the Liuhu sub-prefecture. Man's demand for natural resources becomes one of the main reason of the ecological system collapse in "Liuhu sub-prefecture".

The livestock feeding on the grassland in the "Liuhu sub-prefecture" overburdened the grassland capacity and over-grazing resulted in a deterioration of the grassland's ecological system. Because the grassland could not recover easily, grass for foraging became sparse and dead in large areas. Thus, the sandy soil was laid bare and the ground surface turned into a desert. The large number of livestock, such as horses, cattle and mules, etc., eats much more green grass and also requires a large area of grazing-land. The increasing number of livestock caused a sharp disparity between the livestock and availability of forage grass. Even though small livestock, such as sheep etc., eat fewer fresh grasses, the sheep's mouth is sharp-pointed and narrow, and they always eat short grass down to its roots. Because the sheep can dig up the grass roots by its feet, the natural grass-surface is seriously damaged. The district of the "Liuhu sub-prefecture" lay in the highest place in the "Hequ" region. In the winter season, a strong northwest wind blows from the wide space between the Langshan Mountain and the Helanshan Mountain. The wind's strength and speed are enhanced bye the wind-pipe effect of the Dustouhe River valley, then after passing the Yellow River, the wind directly blows into the region of the "Liuhu sub-prefecture". This caused wind erosion on the ground while the grassland ecological system was destroyed by human activities.

On the basis of the above analysis, we believe that the primitive "Maowusu desert" originated in the "Liuhu sub-prefecture" during the Tang dynasty, and existed in the east half of both the Etuoke banner and Prior-Etuoke banner. At the earliest, it was formed in the years of Kaiyuan and Tianbao (A.D.713–755). The particular cause of formation is attributed to over-grazing from the settlement-raise type of animal husbandry by the Sute people.

IV The conclusion and suggestions

To sum up the above exposition, the evolution of the Maowusu desert can roughly be divided into three historical phases, that is, the late Tang dynasty phase, the Song-Yuan-Ming dynasty phase, and the phase from the end of the Ming dynasty to the present. The time varies on when the desert was gradually formed in different locations. Thus, we know that the desert of the northwestern part in this area appeared first. As every piece of evidence suggests, the initial state "Maowusu desert" was shaped on the old ground of the You sub-prefecture during the Kaiyuan and Tianbao in the Tang dynasty, covering the eastern half of both the Etuoke banner and Prior-Etuoke banner at present. The formation of the original "Maowusu desert" was not attributed to over-cultivation, but to the long-term over-grazing because of the settlement-raise type of animal husbandry from the 4th year of the Zhenguan to the years of Tianbao of the Tang dynasty, which resulted in the destruction of the local ecological system.

To conclude, we believe that controlling the "Maowusu desert" and restoring the green mountains and rivers at present should be based on a new notion of all-around management and afforestation. We should mainly adopt a systematic method of recovering the vegetation including trees, shrubs and grasses, construct some necessary wind-protection facilities, and carry out a scheme to re-shape the ecological system of the source area of the desert. We must stop the moving sands from going forward, and divide the waist of the Maowusu desert with lines of green vegetation defense of trees, bushes and grasses from the Baichengzi village to the Weijiamao village, and the line from the "Dabian" Great Wall to the front fringe of the desert belt. We must continually check the expansion of the Maowusu desert and improve the natural environment we live in. To achieve the aim, we should establish a cooperative mechanism between related counties in Shanxi Province and neighboring banners in Inner Mongolia Autonomous Region and adopt concerted measures to afforest the area with integrated efforts.

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