Natural Changes of the Region along the Old Silk Road in the Tarim Basin in Historical Times

By Mutsumi HOYANAGI*

Introduction

The first account of the beginning of official traffic and trade with the Western Regions (*Hsi-yü* 西域) in the time of the emperor Wu-ti 武帝 of the Former Han dynasty is found in chapter 123 (Ta-wan-ch'uan 大宛傳) of the *Shih-chi* 史記, the voluminous historical records by Ssŭ-ma Ch'ien 司馬遷.

The gifts which envoys from China bore with them were mainly money and silk. Envoys were grouped into caravan parties and made long and difficult journeys, many of them going to the oases of the Tarim Basin, but seldom, it seems, as far west as the Pamirs; no ancient Chinese records tell us of parties crossing the Pamirs. Historians generally agree that most of the trade was in the hands of Central Asian caravan traders and middlemen, and the overland trade between China and the West, particularly with Rome, was almost wholly indirect. For European historians, silk was the most important item, constituting at least 90% of China's exports, and, for Rome, the trade in silk and the trade with China were virtually the same thing.[1)]

Therefore, particularly from the European point of view it is right to refer to the trade between China and Rome as the silk trade, and it is appropriate that the route over which the trade was carried on should be called the "Silk Road".[2)] No one can say exactly when the silk trade along

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the Silk Road came to an end, because there are no surviving records on the subject. My own researches suggest that the Silk Road would have come to an end along with the decline of T'ang rule in the Tarim Basin, towards the end of the 8th century.

Many aspects of the history of the Old Silk Road have been studied in Europe as well as in Japan, but there remain some unanswered questions. Among these, the most interesting to me concerns the causes responsible for the ruined sites along the road, the main part of which ran, in antiquity, along the northern and southern edges of the Taklamakan desert, between the oases at the foot of the surrounding mountains. In this paper, I propose to discuss the problem with special emphasis on the natural conditions of the region along the road and the changes in them in historical times.

I. Ruined Sites and Shrinkage of Rivers

1) Discovery of ruined sites and supposed shrinkage of rivers.

Much interest was aroused among geographers and historians all over the world by the discovery in the latter part of the 19th century of ruined sites in the Taklamakan desert by such modern scientific explorers as N. M. Przhevalski and Sven Hedin,[3] and from the early 20th century scientific expeditions were sent to Sinkiang from several countries. New facts were brought to light in many fields, and the achievements of Sven Hedin (1894–97, 1899–1902, 1927–35) and Aurel Stein (1900–01, 1906–08, 1913–15) were particularly remarkable in the fields of geography, archaeology and cultural history. However, geographers are faced with difficult problems, especially in respect of the ruined sites on the edges of the Taklamakan desert, i.e. in the region along the Old Silk Road.

What were the main causes that led to abandonment? How could the ancient settlements have flourished in a desert of driven sand, where no water is available today? Why were many of the sites wholly or partly buried in sand and the surrounding areas changed into desert? No historical documents or archaeological remains give a clue to the solutions of these problems, yet the mere withdrawal of Chinese control from the Tarim Basin or the decline of the silk trade along the Old Silk Road cannot have been responsible for such effects. There seems to be some connection with changing natural conditions along the road, and it is therefore for geographical research to illuminate the question of the natural conditions under which the ancient settlements flourished.

During this period, plenty of water was available, irrigation canals were dug for the cultivation of fields, and Buddhist temples were built, as shown by Stein's excavations in the course of his archaeological researches in the Taklamakan desert. Statistics given in the *Han-shu* 漢書 suggest that a num-

ber of these settlements supported from more than one thousand to several thousand inhabitants. There are some peculiarities in the distribution of sites. The most remarkable is the discovery of a number of them along the northern foot of the Kunlun Mountains, which mark the southern border of the Tarim Basin, and some are far to the north of the present ends of rivers which disappear in the sea of sand. This suggests a general shrinkage of rivers descending from the Kunlun Mountains, and the following statement of Stein is memorable: "Within historical times a number of these terminal river-courses carried a greater volume of water, and hence permitted ground to be cultivated lying considerably further north than the corresponding terminal oases of the present day. This is conclusively proved by the ancient sites which I explored in the Taklamakan to the north-east of Khotan."[4]

Another peculiarity lies in the distribution of ruined sites at the southern foot of the Tien Shan, which border the northern edge of the basin. Many of them are not so very far from the present oases, an outstanding example being distribution around the Kucha oasis. Here, sites are in most cases in close proximity to the present oasis, and in some instances they are within the present cultivated area. Such distribution suggests that the shrinkage of rivers along the northern edge of the basin was not so great as that which occurred along the southern. Nevertheless, Stein concluded that the volume of water flowing to the Kucha oasis had diminished in historical times.[5] Thus a further problem is presented by the difference in the degree of shrinkage of rivers between the northern and southern edges of the basin.

2) Differences in shrinkage of different rivers.

In this section I will review the results of research in the Tarim Basin since the Second World War. This shows that shrinkage of rivers has been the result of recession of glaciers, itself caused by the shrinkage of snowfields on the high mountains surrounding the basin. Investigation of snowlines should, therefore, provide an answer to the problem dealt with in this section.

There is a striking difference between the Tien Shan and the Kunlun Mountains in respect of the altitudes of their snowlines, which affect the permanent snowfields and glaciers, the main feeders of rivers descending from the mountains. The diàerence is caused primarily by the altitude together with the latitude of the mountains.

The average height of the Tien Shan, which consist of several narrow parallel ranges, with a culminating massif, Khan-Tengri, of 6,995 metres, is under 5,000 metres; this is noticeably lower than that of the Kunlun Mountains, even at the northern extremity of which many peaks rise to more

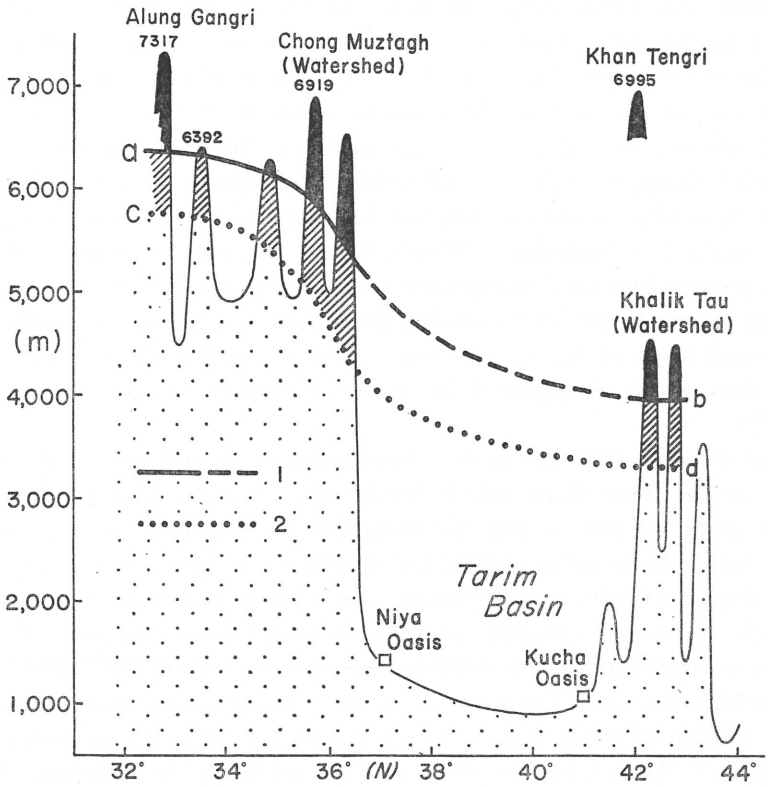

Fig. 1. Profile of snowline around the Tarim Basin along the longitudinal zone of about 81°~83° E.
1. Present climatic snowline
2. Approximate snowline during the last Ice Age

than 6,000 metres. The crest line of the Tien Shan decreases in height towards the east, until it merges with the barren, plateau-like range of the Pei Shan or Northern Mountains. On the southern face of the Tien Shan, overlooking the Tarim Basin, the snowline is at about 4,200 metres, falling gradually to about 3,600 metres at the eastern end of the range. The snowline is thus much higher than that of the Alps (about 3,000 m) or other mountains of the middle latitudes, which demonstrates the effect of the dry climate of Central Asia. The southern edge of the mountains stretches eastwards, to form the hilly chain of the Quruk-tagh, with peaks of 2,000 to 2,800 metres. It has no snowfields and not even any permanent streams, as its Turkish name, meaning the Dry Mountain, implies.

In contrast with the Tien Shan, the Kunlun Mountains combine with the Karakorum to form a mightier body with many prominent massifs. The southern edge of the Tarim Basin is skirted by the Altin-tagh (Lower Mountain), the northernmost of the Kunlun, with its highest peak Muz-tagh (7,282 metres according to a recent survey carried out by the government

Basin he observed ruins on the prolongations of ends of the rivers, as they were at that time, and areas of dead or dying vegetation around the Taklamakan desert. He also concluded, from an examination of historical records, that Lop-nor had changed size several times. Being informed of the results of the scientific and archaeological researches of Hedin and Stein up till that time, and lacking evidence of any other cause for the abandonment of settlements at various periods, he proposed a theory of long-term fluctuations of rainfall in the Tarim Basin, i.e. alternations of long periods of dry and wet climate, as the simultaneous answer to a number of questions.[14] However, his theory did not find favour among many geographers or historians, because he was such an enthusiast for climatic influence on human activity, and also because a number of defects were found in his historical analysis. He was further mistakenly understood to be claiming the theory, already recently put forward by other scholar, of the progressive desiccation of Central Asia.[15]

Stein expressed a contrary view, saying, "had not conditions of extreme aridity already prevailed in ancient times, it would be impossible to account for the survival in almost perfect preservation of a multitude of objects, very perishable by nature, in places so exposed as mere refuse heaps outside houses. Exactly corresponding observations are furnished by what archaeological explorations at other ancient sites of the Tarim basin have taught us. The climatic conditions of the periods immediately preceding abandonment must have been practically as arid as they have been since and are now."[16] He thus denied the occurrence of any wet periods in historical times, but he could not account for the shrinkage of rivers together with the long dry periods, the longest being about sixteen hundred years, calculated approximately from the abandonment of ancient Niya and ruins at and around the Chinese station of Lou-lan. According to Stein's interpretation of the dated documents, occupation continued at both sites until about the close of the 3rd century, since when there had been no cultivation at either site. So he postulated the process of reduction of "fossil ice" left behind by the last Ice Age on the high mountains around the Tairm Basin, slowly continuing throughout historical times. This hypothesis was put forward by S. Burrard, late Surveyor-General of India, and Von Ficker, who had noticed the large size of the glaciers still in being on the northernmost Kunlun and the enormous masses of detritus overlying and surrounding these glaciers.

Stein was very cautious in attempting to account reliably for the abandonment of the sites, on the basis of his observations and conjectures as to natural conditions, but his view of the prevalence of extreme aridity in the basin during historical times seems satisfactory.[17] Less satisfatory are his view of slow but continuous reduction of glaciers and his supposition of glaciers left behind by the last Ice Age.

Firstly, climatic change, *i.e.* long-term fluctuations of climate which have

taken place in many parts of the world, is now the object of research on the part of many geographers. No one now supposes that climatic change has proceeded in a single direction, such as from cold to mild since the last Ice Age, and some patterns of climatic fluctuations have been tentatively established for some parts of the world even during historical times. Unfortunately, no geographers have yet investigated climatic fluctuations around the Tarim Basin, so that no definite suppositions can be made. Huntington's original idea of fluctuations of climate, "the Pulse", to use his term, is not to be rejected. In other words, the tendency of slight rise or fall of the snowline means that there must have occurred, even in historical times, several long-term fluctuations in the size of the snowfields lying on the high mountains around the Tarim Basin, and shrinkage or extension of rivers must have resulted in the basin, where a climate of extreme aridity has prevailed.

Secondly, in Stein's time, the occurrence of the post-glacial "Climatic Optimum", the warm period which immediately followed the last Ice Age, had not yet been noticed. During that period, almost all snowfields and glaciers lying on the high mountains of Europe, America and Asia, except the continental ice sheets of Greenland and Antarctica, melted. The present snowfields and glaciers are those that have been reborn since the deterioration of the earth's climate.[18] Stein's view is, therefore, now out of date, and the present condition of glaciers on the high mountains around the basin should be examined in the light of modern glaciology.

2) Provisional presumption of extension and shrinkage of rivers.

The next step is to estimate the periods during which extension of rivers occurred in the Tarim Basin. Fig. 3 shows many ancient sites along the northern foot of the Kunlun Mountains. Among them, the Niya site, which lies to the north of the present end of the Niya Darya, is commonly identified with the Ching-chüeh 精絶 of the Han itineraries, and its occupation, according to Stein continued until about the end of the 3rd century. Kara-dong, in the desert at the northern extension of the Keriya Darya, was a frontier guard post which had a small agricultural settlement during the first century of the Han period.

At the site of Dandan-oilik, in the desert between the Khotan and the Keriya Darya, Stein found manuscript fragments, with dates ranging from 781 to 790. Chinese copper coins found here bear dates up to 760. These facts prove that occupation continued until at least the close of the 8th century, in the latter half of the T'ang period. Remnants of a temple at the Rawak site near Dandan-oilik are in the same style of construction as those at Dandan-oilik but it was impossible to ascertain the final date of the site. The terminal dates of the sites of Khadalik and other small ones near

Fig. 6
(Ch. 21)

Fig. 7
(Ch. 18)

Fig. 7-a
(Ch. 18)

Fig. 8
(Ch. 25)

Fig. 9
(Ch. 24)

Fig. 10
(Ch. 20)

Fig. 11
(Ch. 19)

Fig. 11-a
(Ch. 19)

Fig. 12
(Ch. 28)

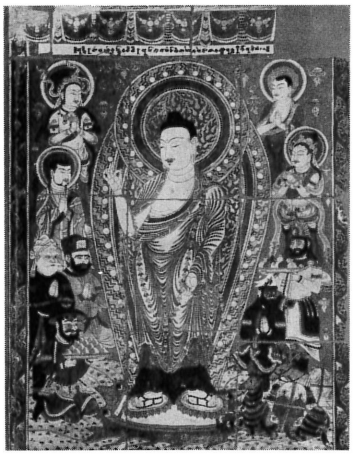

Fig. 12-a
(Ch. 28)

Fig. 13
(Ch. 22)