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First glaciological expedition to West Kunlun Mountains 1985

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Abstract

This report summarizes the activities and observations undertaken by the first glaciological expedition to the West Kunlun Mountains, 1985. The geography, route of the expedition, glaciers, and preliminary results of our research are described.

1. Introduction

The first glaciological research was carried out in the summer of 1985 as the Sino-Japan Joint Scientific Expedition to the West Kunlun Mountains 1985, led by Prof. Zheng Benxing in cooperation of Lanzhow Institute of Glaciology and Geocryology, Academia Sinica.

The Kunlun Plateau, as shown in Fig. 1, consists of mountains and plains generally above 5000 meters in altitude. The West Kunlun Mountains of about 300 km long between the Tianshuihai and the Guliya pass, lie in a east-west direction with the highest peak of 7167 m, the Kunlun Peak. The entire Kunlun Mountain Range extends over a distance of more than 2000 km.

Until now, little information on natural environment of this region has been brought and, from a scientific point of view, it remains largely unknown.

Glaciers in the Kunlun Mountains play an important role as a water source for oases spread along southern border of the Takla Makan desert. How do glaciers act as a water reservoir in such arid climate? Are there regional characteristics in orographic precipitation processes in this area? In the present report we summarize some preliminary results from our studies of the numerous environmental problems posed by that remote environment.

2. Geographical and glaciological setting of the research area

According to the report of Zhang and Jiao (1987) the West Kunlun Mountains are covered by 262 glaciers, occupying an total area of 1277 square kilometers. The glacier distribution is shown in Fig. 2.

The snow lines lie between 5700 and 6100 m in altitude and glacier termini between 5300 and 6200 m. This altitude of the snow line is one of the highest found in the world.

As seen in Fig. 2, the glaciated area shows the following geomorphological characteristics : development of long glacier snouts (10－20 km) in the northern side, wide and flat accumulation basins in the central part and, in contrast to northside, shorter snouts (less than 10 km) with gentle slopes are more common in the southern side.

A few days temperature variations obtained at Base Camp 1 and 2 are shown in Fig. 3. According to Zang and Jiao (1987), very little precipitation is common in the surrounding valley and plain (37.7 mm of mean annual precipitation during 1963－84 at Kangxiwa, 3986 m) and it occurs mainly in summer (May-August). During the expedition, noctural precipitation was observed occasionally in the mountain area (e.g. 5－6 cm snow in the night of 25－26 July). It may indicate that the different precipitation processes over the glaciarized area (mountains) and the valley-plain are of a different nature.

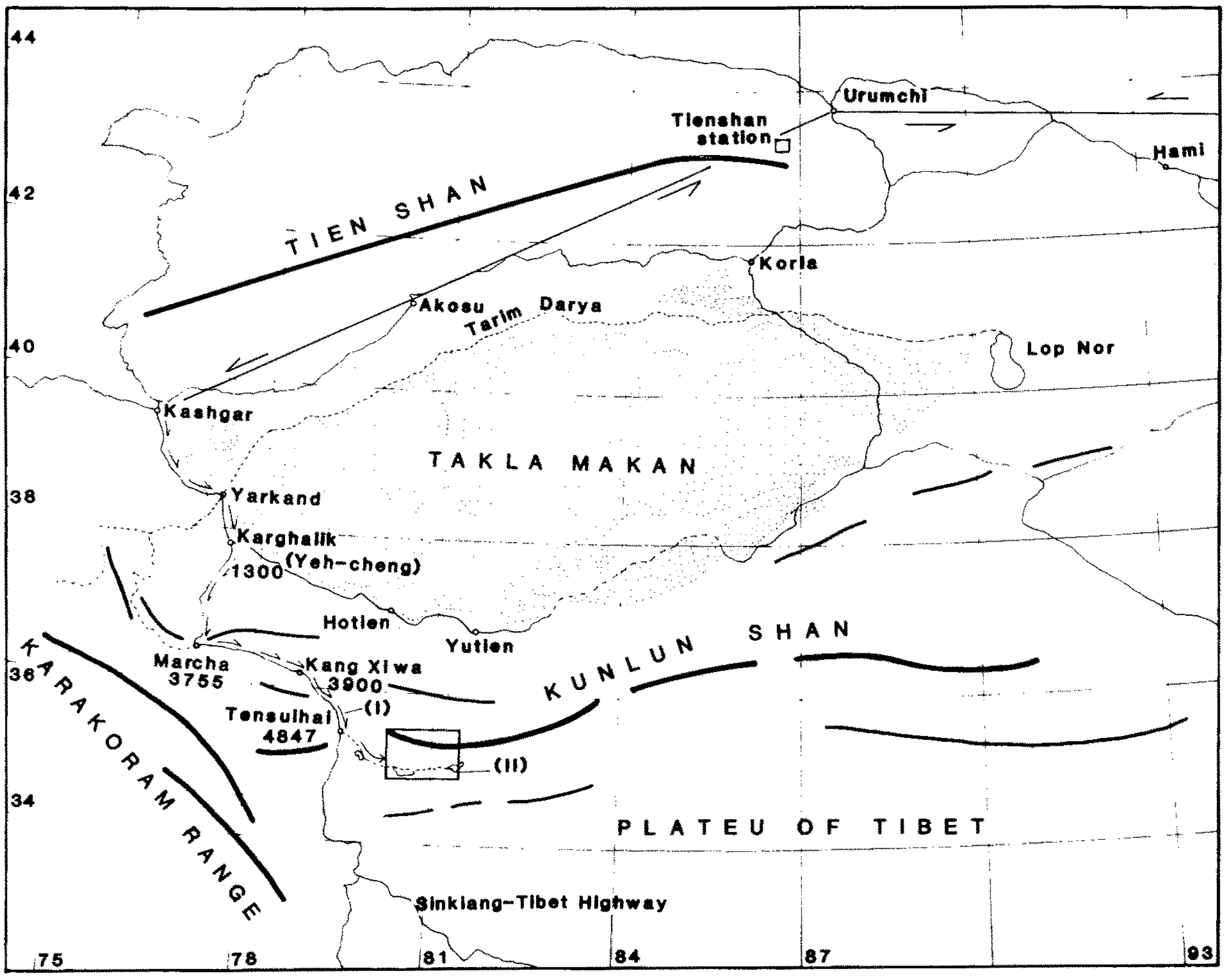

Fig. 1. Geography of the Kunlun Plateau and the surrounding area.
(I) Route of the expedition
(II) The research area

3. Members and itinerary of the expedition

The members of this expedition were :

Leader
- Professor Zheng Benxing ; Glacial geomorphology, Lanzhou Institute of Glaciology and Geocryology (L. I. G. G), Lanzhou, PRC.

Chinese members
- Mr. Li Shude ; Geocryology, L. I. G. G.
- Mr. Zhang Zhengshuan ; Glacial geomorphology, L. I. G. G.
- Mr. Zhang Wenjing ; Glaciology L. I. G. G.
- Mr. Shen Yongping ; Glacial Geomorphology, L. I. G. G.
- Mr. Kou Jizhong ; Administative officer, L. I. G. G.
- Mr. Hu Xingsheng ; Logistics, L. I. G. G.
- Mr. Wu Zhaozhong ; Logistics, L. I. G. G.
- Mr. Liu Huili ; Logistics, L. I. G. G.
- Mr. Su Yanbin ; Logistics, L. I. G. G.

Japanese members
- Dr. Okitsugu Watanabe ; Glaciology, National Institute of Polar Research, Tokyo.
- Dr. Masayoshi Nakawo ; Glaciology, Faculty of Engineering, Hokkaido University, Sapporo.

The itinerary of the expedition was as follows ;

1985, JUL. 11 Dep : Kashgar (1300m), Arr : Yeh-cheng (1300m)

12 Stay at Yeh-cheng

Fig. 2. Glaciers of the West Kunlun Mountains.

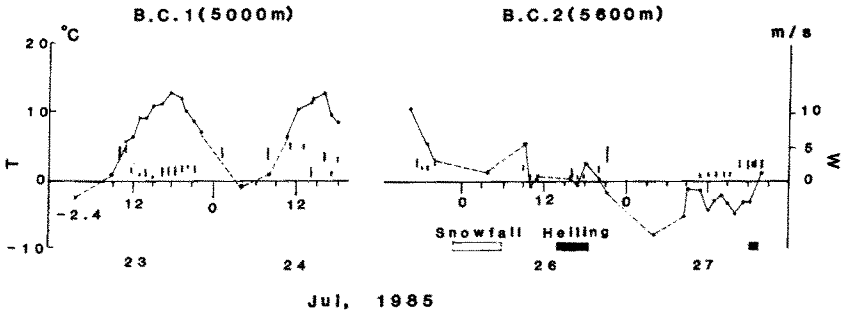

Fig. 3. Meteorological data at Base Camp 1 and 2.

13 Dep : Yeh-cheng, crossing the pass of the West Kunlun Mountains, Arr : Macha (3755m)
14 Stay at Macha for adaptation to the high altitude
15 Dep : Macha, Arr : Kangxiwa (3900m)
15 Stay at Kangxiwa for the adaptation
17 Dep : Kangxiwa, Arr : Tensuihai (4847m) near Aksayqin Lake
18 Stay at Tianshuihai for the adaptation
19 Dep : Tianshuihai, leaving Sinkiang-Tibet Highway, Arr : Base Camp 1 (5280m)
20−23 Stay at B. C. 1
24 Dep : B. C. 1, Arr : Base Camp 2 (5720m)
24−29 Stay at B. C. 2
30 Dep : B. C. 2., Arr : Guozha Co (Litian) Lake Camp (5120m)
31 Dep : Lake Camp, Arr : Tensuihai
Aug. 1 Dep : Tianshuihai, Arr : Kangxiwa
2 Dep : Kangxiwa, Arr, Macha
3 Dep : Macha, Arr : Yeh-cheng
4− 7 Stay at Yeh-chen
8 Dep : Yeh-chen, Arr, Kashgar

The altitudes given in parentheses after name of locations are taken from the official map (scale of 1 : 100,000), and beyond Tianshuihai from altimeter measurements. The route of the expedition and place names are shown in Fig. 1. A detailed map of the research area including the location of Base Camps and the coring site is shown in Fig.4.

4. Preliminary results

Preliminary research and reconnoitering for the topography of the glacier area were performed during 19−31 July, 1985. Some of results of these preliminaly studies are presented in separate reports in this volume (Bulletin of Glacier Research, **5**). The title of these reports are as follows :

Zhen Benxing, Preliminary Studies of Quarternary Glaciation and Palaeogeography on the south slope of west Kunlun

Zhang Zhenshuan and Jiao Kegin, Modern Glaciers on the south slope of West Kunlun Mountains

Li Shude, Permafrost and Periglacial Phenomena in West Kunlun Mountains of China

Nakawo, M. and Watanabe, O., Characteristics of Discharge from a Glacier, observed in West Kunlun Mountains, China

Additional preliminary results are summarized below.

4. 1. Isotopic and chemical composition of snow and glacier ice.

Falling snow, deposited snow on glacier and the surrounding area, and glacier ice were sampled for isotopic and chemical composition analyses. It snowed twice during our presence in the area. The analytical results are shown in Table 1.

For comparison, SO_4-Cl correlation in precipitation and glacier ice obtained from samples of this area and from Langtang Himal (the central Nepal Himalayas) and the Tien Shan Tienshan Mountains are shown in Fig. 5.

No definite conclusions can be drawn from this

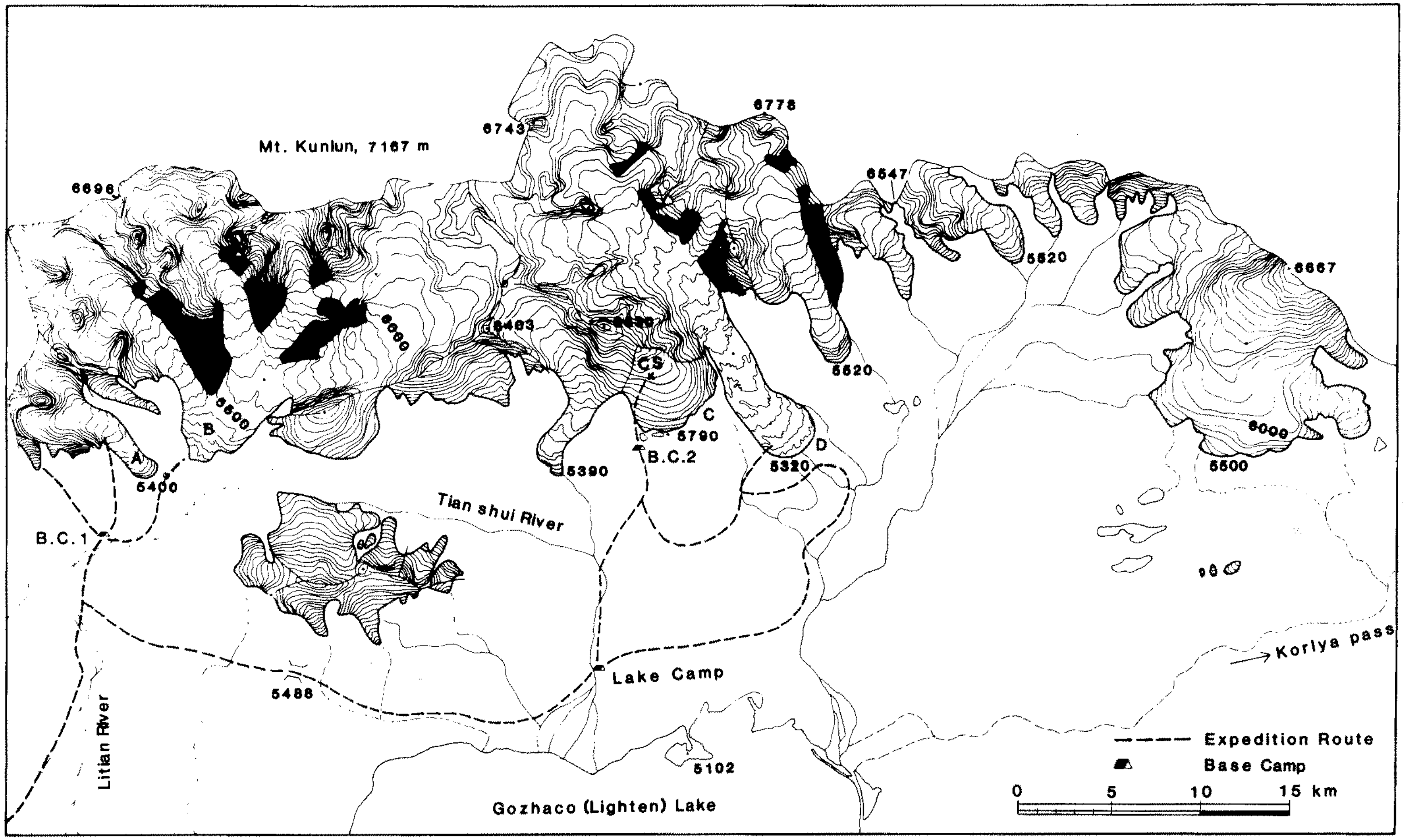

Fig. 4. Detailed map of the research area.
B. C. 1 and 2 : Base camp 1 and 2, CS : Coring Site on a flat-top glacier. A-D : Temporary name of Glaciers used in this report
Numbers of four figures : Altitude of peak and glacier termini.

Table 1. Isotopic and chemical composition.

I. Oxygen isotopic composition

Classification of sample	Range of value (‰)		
(1) Noctural precipitation (19-20 July)		−17.6	
(25-26 July)	−19.5		−18.0
(2) Glacier Ice	−12.1		−10.0
(3) Deposited Snow	−21.6		−10.0
(4) Spring Water at glacier terminus		−14.8	

II. Chemical composition

(mg/l)

	Sample	Cl^-	NO_3^-	SO_4^{2-}	Na^+	Ca^{2+}	Mg^{2+}
(1)	(25-26 July, two samples)	−	0.02	0.09-0.16	0.02-0.04	0.36-3.7	0.04-0.27
(2)	(Glacia B, terminus)*	1.6	0.22	0.54	1.4	13	0.68
	(Glacier B, terminus)*	0.64	0.39	0.53	0.45	7.0	0.50
	(Glacier C, Acc. Area, Dirt horizon)	0.52	−	0.66	0.36	21	1.0
	(Glacier C, Acc. Area, Clear ice)	0.18	0.16	0.12	0.13	1.4	0.14
	(Glacier D, terminus)*	0.04	0.01	0.04	0.02	3.2	0.23
(3)	(Deposited snow, surface)	0.27	0.03	0.40	0.21	4.4	0.58
	(Deposited snow, lowest layer)	0.35	0.28	0.68	0.31	8.0	0.54
(4)		473	0.32	43	641	3.2	52

* Glacier A-D as shown in Fig. 4

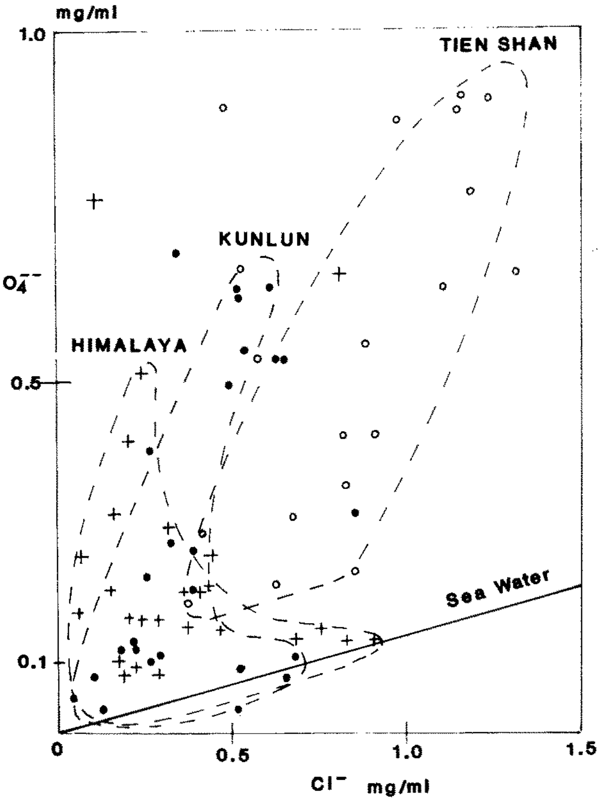

Fig. 5. Regional distribution of SO_4-Cl correlation in the Asiatic highlang region

limited amount of information, but it appears that there is a gradual transition of the SO_4-Cl correlation between the Langtang Himal and Tien Shan Mountains.

4. 2. Some results from a shallow core

A shallow core was taken in the accumulation area of a flat top glacier, situated to the north of Guozha Co lake. The aim of this sampling was to obtain some information on the structure of the annual layering, snow metamorphism, and vertical distribution of isotopic and chemical composition.

Stratigraphic diagram and measured values are shown in Fig. 6. A well developed dust horizon could have resulted from loess deposition during the dry season. If a layer bounded by dust horizons is an annual layer, the annual amount of precipitation on the glacier would exceed 600 mm. H_2O. This is much more than in the surrounding area.

From the standpoint of studies of snow stratigrapy and environmental change, origin of the loess

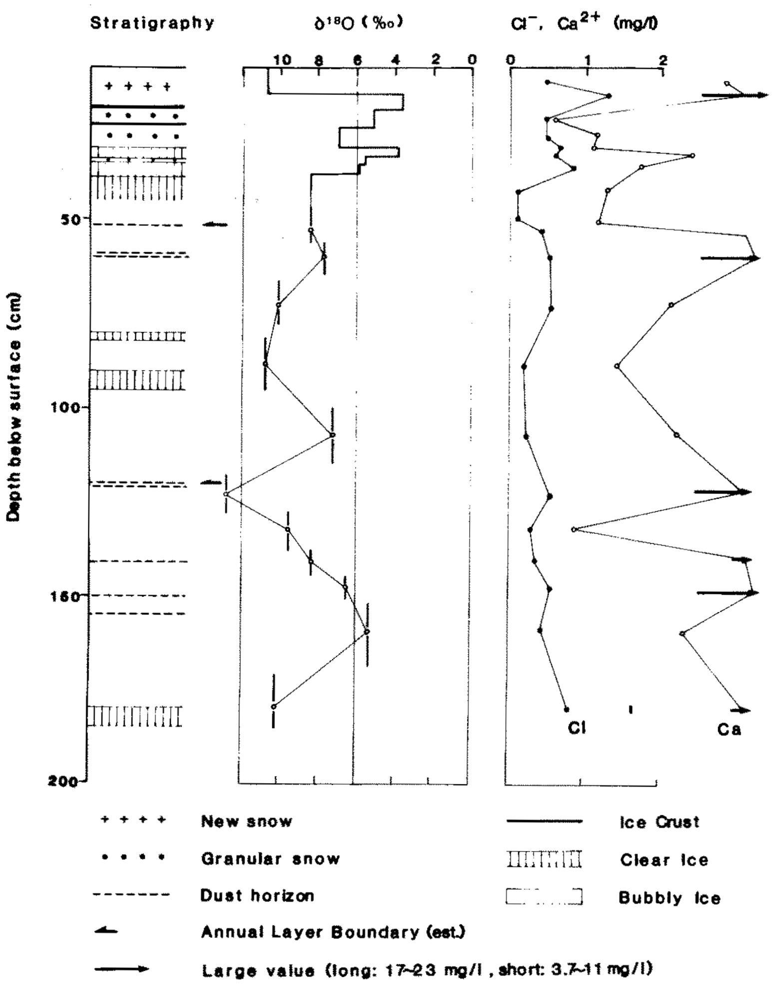

Fig. 6. Stratigraphic diagram of shallow core.

Table 2. Chemical composition of loess.

Chemical composition of loess (mg/l)

	Al	Si	Fe	Mn	Ca	Na	Mg	K	P
(1)	6.85	29.7	2.79	0.0844	5.50	1.66	0.828	2.39	0.0649
(2)	6.54	26.1	3.50	0.0797	5.93	1.68	1.53	2.15	0.0954

(analyzed by T. Suzuki, Hokkaido Univ.)

(1): Sampled at terminus of Glacier A
(2): Sampled at Sai-tu la (3470 m a.s.l) along the Kara Kash river

and the process of its transportation and deposition will deserve particular attention in future studies. Some example of the chemical composition of the loess sampled from various places in this area is shown in Table 2.

Acnowledgments

We would like to express our thanks to Prof. Xie Zichu, Director of Lanzhou Institute of Glaciology and Geocryology, Academia Sinica for this special consideration given to organizing this expedition. Our particular thanks are due to the Chinese logistic members.

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Reference

Zhang Zhenshuan. and Jiao Keqin. (1987) : Modern glaciers on the south slope of West Kunlun Mountains (in Aksayqin Lake and Guozhaco Lake drainage areas). Bulletin of Glacier Research, **5**, 85–91.