KHULA KANGRI & INVESTIGATION OF LAKE PUMA YUMCO

Tokai University and Tibet University Friendship Expedition *Yoshitsugu Deriha*

In the spring of 2001 a team from Tokai University stood atop the unscaled central peak (7418m) and eastern peak (7381m) of Khula Kangri in Tibet, China. We also made significant achievements in the scientific researches on Lake Puma Yumco located in Tibetan Plateau. The altitude of the lake is 5070 meters above sea level that is the highest in the world among the lakes of this size.
The Tibet University of China joined in the climbing expedition and the researchers from the Chinese Academy of Sciences (CAS) took part in the academic investigation.

The Academic Expedition Report

Lake Puma Yumco is located in south-central Tibet. It is an elliptical lake 32km by 13km. The following characteristics of this lake have been found through satellite image analysis and a preliminary investigation made in the fall of 2000.

1. It has changed in shape with the passage of time. It keeps making stationary growth in depth. Called a tectonic (fault trough) lake, it has a long history since its birth.
2. It is thought that the ecosystem in the lake exists in no smaller scale than that of a lake on level ground.

Since Lake Puma Yumco is under such geographical circumstances, it was expected to cast light on interesting biological phenomena, the study of which was made for the first time in the world. It was also expected to assist especially in earth-scientific, limnological, geo-scientific and biological research. The investigation was conducted with the following three points as the primary goal.

1. Elucidation of life activities in the high altitude lake, its native life and their ecological, physiological, morphological and metabolic scale characteristics.
2 Analysis on the change of the climatic environment recorded in the lacustrine sediments, topograph and the geological stratum.
   Examination of the hypothetical factors dominating the theory of a 100,000 year cycle of glacial and inter-glacial periods.
3. Examination of the plateau's possible role as a natural sensor and monitor for global warming and change in its related climatic environment.

Analysis on the change of the climatic environments recorded in the lacustrine sediments

A lake is a rich source of environmental information as it continuously records changes in the climatic environment. Particularly its lacustrine sedimentary records provide information on changes in the climatic environment from the Lake Puma Yumco.

We are in the glacial epoch that has a glacier period, (a cold period) and an inter-glacier period (a warm period) in a 100,000 year cycle for every million years. The cycle of the change of climatic environment is caused by the amount of insolation with the change of the 100,000 year cycle. It is a part of the Milankovitch cycle.

The controversial point of this theory is that the change in the amount of insolation as a dominant factor of the climatic environment does not seem to bring sufficient energy to directly determine the cycle of the change between a glacial period and an interglacial period. Therefore, the change in the amount of insolation appears to play a role of trigger to bring about a change in the climatic environment.

The transition from an interglacial period to a glacial period is explained as follows: as the amount of insolation decreases, the temperature drops locally. The local temperature drop activates a kind of natural device to amplify the temperature drop globally. That natural device is considered to exist somewhere on earth.

The theory of the Tibet Plateau ice sheet suggests that this device exists in Tibet . According to the theory, the decrease in the amount of insolation causes the Tibet Plateau to be covered with ice, as it is 4000 - 5000 meters above sea level. Then, a global temperature drop is triggered by the significant reduction in insolation due to the reflection on the ice sheet.

The history of the controversy over this theory dates back to the 1930s, but no conclusion has been reached. The primary reason is that the topography and the geological strata of the Tibet Plateau do not appear to have left evidences of the ice sheet.

Kobe University and CAS jointly attempted to find some evidence from lacustrine sediments of a lake in the central part of the Tibet Plateau. However, this attempt did not succeed. This time we have succeeded in obtaining some samples of lacustrine sediments of Lake Puma Yumco which may help to prove the theory of the Tibet Plateau ice sheet.

3.8-meter-long lacustrine sediments were taken from the bottom of the 46-meter deep lake. The sample was fractionated in 0.5 to 1cm lengths toward the bottom of the lake. The analyses conducted will provide information on at least the past 50,000 years' changes in the climatic environment including the glacial maximum for about 20,000 years.

Examination on the change of the climatic environment related to global warming

Global warming has greatly been affecting each region of the world in temperature, precipitation, and wind. A natural sensor that can accurately gauge changes is needed on a global scale, and lakes are being regarded as such. Lake Puma Yumco is expected to be a good candidate.

Lake Puma Yumco is influenced by the climatic system involving among others southwest monsoons in summer and northwest monsoons in winter. Therefore, it is thought that the various factors of Lake Puma Yumco would clearly reflect the change in climatic environment factors such as temperature, precipitation, and wind system.

The water-temperature distribution in the lake and the change in the quantitative and qualitative aspects of the various chemical constituents in the lake water are comprehended through the change of water-flow, water-circulation and stagnancy, and the increase and decrease in biological productivity. Lake Puma Yumco is located in a unique environment at 5,000 meters above sea level and at a latitude of 30 degrees

north.

The analysis of the old environmental change recorded in the lacustrine sediments will produce important data, but their actual verification will be made through continued observations after determining the current situation of the lake.

Summary of the Investigation for Research

The expedition leader was a professor of Tokai University, Mitsugu Nishimura. Ten members including those from other universities went with him. With the cooperation of CAS and China Mountaineering Association (CMA), the investigation started on April 4. However, many of the expedition members had previously suffered from serious high-altitude sickness in Lhasa (3700m) and then, Lake Puma Yumco BC (5000m). The sickness continued to trouble us until the end of the investigation. Probably because spring in the Tibet Plateau was yet to come, we were constantly faced with ice covering the whole lake and strong cold wind. The following is an itinerary of the investigation.

April 4: Set up BC at the shore of Lake Puma Yumco
5: Started assembling the operation base boat; checked and adjusted equipment
6: Started collecting plants in the lakefront
7: Launched the operation base boat; also launched the three inflatable boats; started collecting fish
8: Adjusted the geophysics exploring equipment; reviewed the lateral line for investigation; started quantitative-measurement of the ultraviolet and visible rays on land; investigated the river terrace in the east of the lake
9: Installed and adjusted the geophysical exploring equipment on the operation base boat; collected algae in the excurrent river in the east of the lake; started quantitative-measurement of the cosmic rays
10: Started collecting benthos and plankton samples; quantitative-measurement of underwater ultraviolet rays; topographical survey of the area of the excurrent river in the east of the lake
11: Collected aquatic purple bacteria and green algae; caught three kinds of fish in the area of the excurrent river in the east of the lake; started checking water by CTD at nine fixed points of the lake
12: Caught a sort of shrimp on the lake front; collected aquatic life such as fish, plankton, benthos; started collecting water samples for investigation; started investigation of the topographical features of the glacier near the excurrent river to the east of the lake
13: Started geophysics exploration aboard the operation base boat; measured six lateral lines.
15: Conducted geophysical exploration, measuring three lateral lines; completed the geophysical exploration.
17: Conducted investigation of the topographical features of the glacier near the excurrent river in the east of the lake; started collecting samples for dating
18: Conducted water-clarity and hydro-illumination measurements at six fixed points of the lake, CYD observation, exploratory drilling for columnar sediments with a piston corer
20: Succeeded in a 3.8 meter exploratory drilling and collected samples of columnar sediments from a 46 meter deep spot with the piston corer
21: Topographical survey of the area near the excurrent river to the east of the

lake
22: Gave up on collecting the samples of the lake-bottom surface sediments by gravity-corer due to wind and ice
23: Completed the academic investigation; descended to Puma Yumco Lake BC.

Investigation Items, Samples and Data

The following samples and data have been collected.

1. Main forms of life and their distribution in the surrounding areas and in the lake: fish, plankton, bacteria, life in the lower lacustrine parts, water-weeds
2. Sunlight effect on bio-morphological, physiological, ecological activities of plankton, moss/lichen, fish, etc.; sunlight spectrum and ultraviolet rays, the physiological and morphological aspects of each form of life
3. Study on the bio-scientific circulation concerning the elements such as C,N and P in the lake: water composition (dissolved matter, suspended matter), clarity of water, quantity of photosynthesis, analytical speed, pH, Eh etc.
4. Investigation of the characteristics of the accumulation of sedimentary layers; distribution of the lake's water depth and sedimentary layers' thickness
5. Collected samples of columnar sediments with 40,000 to 50,000 years' records; analysis of the climate using various kinds of organic molecules and the environmental change; columnar sediments (3-4m) and their characteristics

6 Topographical features of the peripheral area of the lake and the study of the fourth geological era; topography of the surrounding areas, geological strata, rocks and geological chronology

Mountaineering Expedition Report

The expedition team succeeded in the first ascents of both the central peak (7418m) and the eastern peak (7381m) of Khula Kangri massif. The team consisted of 19 members from Tokai University and Tibet University. The Japanese part consisted of leader Yoshitsugu Deriha and 10 members while the Tibetan part consisted of leader Tseden Jigmy and 7 members. There were over 30 members in all including supporting people.

April 1: We set up BC in Monda at the foot of the mountain at 4,250 meters. Then they practiced mountaineering for acclimatization and visited the villages and an elementary school to give medical checks to the children.
April 4: Using 85 pack animals (donkeys and horses), we set up ABC (advance base camp) on the glacier moraine at 5,400 meters. ABC was the place that best suited the base camp where we could have a good view of the north side of the Khula Kangri mountain group.
April 7: We started moving toward C1. Immediately we commenced examining the climbing route and simultaneously carrying gear and supplies to the upper camp.
April 9: We set up C1 at 5,900 meters.
April 12: We started substantial climbs. First we paved a route in an icefall zone. We crossed the glacier from C1 and went up the icefall with a 500-meter precipitous drop. We followed a route on a gentle slope closer to Karejiang (7221m) and got through a complicated seracs zone. We installed an aluminum ladder on steep slanting icy rocks en route and climbed up toward

the upper area bypassing a large crevasse. It took eight days.

April 19: We set up C2 on a flat ground at 6,350 meters. We placed 1,500 meters fixed ropes to ensure safe ascent.

April 23: We started climbing up the north side leading downward to the north side of the glacier. Panting, we climbed up the steep slanting icy wall. Our motion became extremely slow above 7000 meters. This steep slant was much longer than foreseen. Even though we started an initial route finding early in the morning, it was not until the evening that we could reach the upper area of this slant. It was really hard climbing.

April 30: We used up the remaining 1500-meter fixed ropes. We could not reach the point that was planned for C3. As a result, we went around the steep slant on the east peak side to set up C3.

April 30: The team of six members left C1 to attack the central peak.

May 1: The team gathered in C3.

May 2: Under the clear and sunny sky and no wind, the team departed for the central peak. Two members from Tibet University were first to reach the summit and two from Tokai University did so in succession.

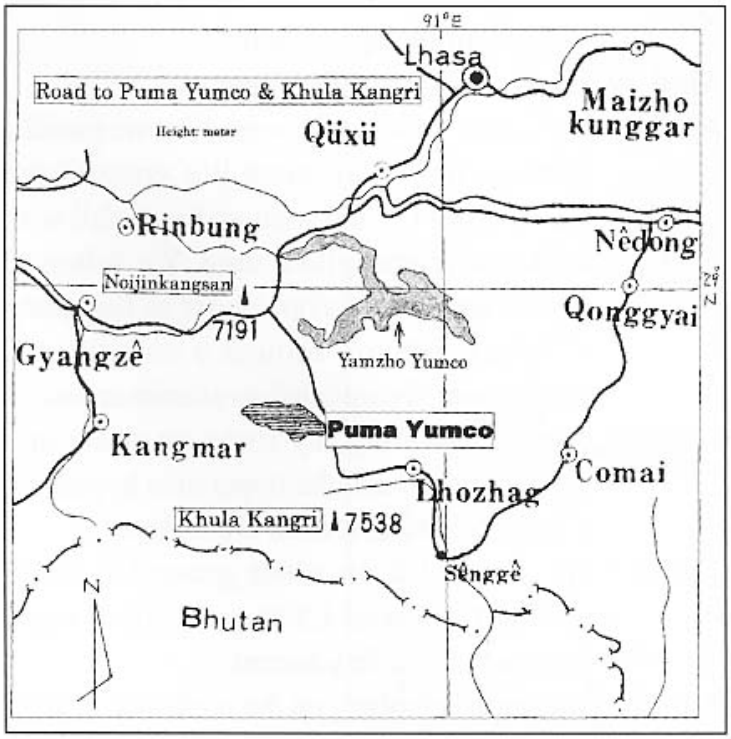
May 3: The east peak attack team of nine members reached C3.

May 4: The team turned to the east peak under a blue sky but strong wind. Three members from Tibet University first reached the peak and six from Tokai University followed. The weather changed periodically as the monsoon started. On the same day, the main peak party of three, who planned to climb along the ridges, reached C3.

May 5: The team left for the main peak, but gave up and returned to C3 due to bad weather and poor visibility.

May 6: As the weather turned better, the main peak team again got started. They reached the central peak. But the weather turned bad and they had to give up attacking the main peak. Nevertheless, we can say, it was fortunate that 17 members, a majority of both teams, could reach the top. Although two members got frostbitten while climbing, they have been recuperating well. We are quite satisfied with the outcome of the expedition.

Khula Kangri – East, Central and Main Peak from left to right



Lake Puma Yumco 5070 meters above sea level