The Second National Chinese Conference on Penicillin

Gargon, China, 12 - 16 October 1991

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The Second National Chinese Conference on Permafrost was attended by the authors and visits were made to two research institutes in Lanzhou, the Northwest Institute of the China Academy of Railway Sciences and the Institute of Glaciology and Cryopedology. Approximately 100 papers were presented at the conference and 180 abstracts were published. The papers were presented during three sessions: 1) Distribution, Characteristics, and Formation of Frozen Ground; 2) Basic Physico-Mechanical Properties and Processes in Frozen Soils; and 3) Engineering Design and Construction in Permafrost. Sixty-nine institutions conducting...
20. Abstract (cont'd)

Frozen ground research in China were represented. It was planned to present selected papers from this conference at the Fourth International Conference on Permafrost in Fairbanks, Alaska, in 1983.
PREFACE

This report was prepared by Dr. Jerry Brown, Chief, Earth Sciences Branch, Research Division, and Dr. Yin-Chao Yen, Geotechnical Research Branch, Experimental Engineering Division, U.S. Army Cold Regions Research and Engineering Laboratory. Funding was provided by CRREL for Dr. Yen and partial travel funding was provided by the Polar Research Board of the National Academy of Sciences for Dr. Brown.


The authors thank Chen Goudong, Vice Head of the Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica, for reviewing this report, and Andrea Ploss, a student at Dartmouth College, for her help with the Chinese translations.
CONTENTS

Abstract .................................................. 1
Preface .................................................... iii
Introduction .................................................. 1
Lanzhou ..................................................... 2
Conference organizations .................................... 5
Conference format and presentations ..................... 7
Participants in the conference ............................ 13
Visits to the Lanzhou institutes .......................... 15
  Institute of Glaciology and Cryopedology ............ 15
  Visit to Northwest Institute, China Academy of Railway
    Sciences ............................................. 19
Concluding remarks ........................................ 23
Potential topics of U.S.-China cooperative frozen ground research ............................................. 24
Appendix A. Titles of abstracts in published abstract volume ............................................. 25
Appendix B. Papers presented at concurrent sessions .................................................. 33
Appendix C. Participants in banquet ........................ 39
Appendix D. Participants and contributors, 2nd National Conference on Permafrost .................. 41
Appendix E. Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica ................. 51
Appendix F. Introduction to presentation by J. Brown - Permafrost investigations in northern Alaska .................................................. 55
Appendix G. Comments by J. Brown at the closing ceremony ............................................. 57

ILLUSTRATIONS

Figure
  1. Map of China showing types and distribution of permafrost and seasonally frozen ground .... 3
  2. View of Liujiaxia hydroelectric power dam .................................................. 4
  3. View looking downstream on the Yellow River and the discharge from the Liujiaxia dam .... 4
  4. Professor Shi Yafeng opening the Conference ............................................... 5
  5. Photograph of the Conference participants .................................................. 12
  6. Photograph at front entrance to the Institute of Glaciology and Cryopedology ............ 16
  7. Welcoming group in front of Northwest Institute ............................................. 19

TABLES

Table
  1. Organizing Committee for the Second National Chinese Conference on Permafrost ....... 6
  2. Revised Program ........................................ 8
  3. Number of papers and titles in each category .............................................. 11
  4. List of institutes contributing papers .................................................... 14
  5. Partial organization and staff of the Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica .................................................. 17
INTRODUCTION

The Second National Conference on Permafrost was held in Lanzhou, China, during 12-18 October 1981. It was attended by approximately 200 scientists and engineers from 69 organizations within China. The purpose of the meeting was two-fold: 1) to present and discuss results of frozen ground investigations that had been conducted since the first conference in 1978, and 2) to organize the Chinese contributions for the Fourth International Conference on Permafrost to be held in Fairbanks, Alaska, in July 1983. Several non-Chinese were invited. The authors from the U.S. Army Cold Regions Research and Engineering Laboratory, and Dr. Daisuke Kuroiwa (former Director, Low Temperature Institute, Hokkaido University) from Japan attended.

The purpose of this report is to make information available about the conference and some of the Chinese organizations involved in frozen ground research. In this report, frozen ground will be used to refer to both seasonally frozen soils and permafrost, since the conference dealt with both. In China the term cryopedology is used interchangeably with the "study of permafrost and seasonally frozen soil." Approximately 22% of China is underlain by permafrost and upwards of 73% has seasonally frozen soils.

Chinese research and engineering concerning frozen ground was initially brought to our attention when a Chinese group visited Canada in 1975 and a Canadian delegation visited China in summer 1977 under a scientific exchange agreement between those two countries. The Canadians visited Northeast China (formerly Manchuria) by rail and described some of the permafrost conditions and problems. They also briefly visited the Lanzhou
Institute of Glaciology and Cryopedology, one of the organizing institutions for this Second Conference. Nine Chinese attended the Third International Conference on Permafrost in July 1978 in Edmonton, Canada. This provided the first major contact between U.S. and Chinese permafrost scientists and engineers. A U.S. delegation visited Harbin in 1978 as part of the U.S. Science and Technology agreement. Dr. Y.C. Yen was on that exchange and visited the Institute of Low Temperature Construction. Dr. Troy L. Pêwê, a geologist and permafrost specialist, Arizona State University, visited China in May and June 1980 to attend the Symposium on the Qinghai-Xizang (Tibet) Plateau, and he has prepared and published several reports on his trip*.

LANZHO

The conference was held in Lanzhou, China (see Fig. 1). Lanzhou is an industrialized city with a population of over 1,000,000. It is situated on the terraces of the Yellow River. Some 50 km or so to the west is the Liujiangia Hydroelectric Power Station on the Yellow River (Fig. 2 and 3). This dam is the highest in China, with a height of 148 m, and is 880 m wide at the top. The power plant has a 1,200,000-kilowatt capacity. The dam is in the process of being raised 3-5 m as a result of the summer 1981 flooding along the Yellow River.

A major branch or bureau of the Academia Sinica (The China Academy of Sciences) is located in Lanzhou. It consists of six institutes totaling about 4000 scientists, engineers, and support staffs:

1. Institute of Modern Physics (more than 1000 employees)
2. Institute of Chemistry and Physics (more than 1000)
3. Institute of Glaciology and Cryopedology (350)
4. Institute of Geological Sciences (300)
5. Institute of Desert Research (280)
6. Institute of Plateau Atmospheric Physics (150)

Another research institute located in Lanzhou is the Northwest Institute of the China Academy of Railway Sciences. Both the Institute of Glaciology and Cryopedology and the Northwest Institute are described in some detail later in this report.

Figure 1. Map of China showing types and distribution of permafrost and seasonally frozen ground. (Modified from map provided by Tong Boliang, Institute of Glaciology and Cryopedology, Lanzhou).
Figure 2. View of Liujiaxia hydroelectric power dam.

Figure 3. View looking downstream on the Yellow River and the discharge from the Liujiaxia Dam.
CONFERENCE ORGANIZATIONS

Apparently the conference was held under the auspices of the Geographical Society of China and the China Civil Engineering Society although neither society had a visible role. The former society is housed in the Academia Sinica's Institute of Geography on the outskirts of Peking but is apparently under the China Association for Science and Technology.

Table 1 contains the names and organizations of the Organizing Committee for the conference. Information in this table and all subsequent information concerning names of individuals and organizations were compiled from several translated sources and individual conversations. Therefore, there are likely to be errors throughout in spelling of names and accuracy of institutional affiliations.

The two main organizers of the conference were the Institute of Glaciology and Cryopedology and the Northwest Institute of the China Academy of Railway Sciences, both situated in Lanzhou. From the membership of the Organizing Committee it is obvious that the Institute of Glaciology and Cryopedology had the major role in organizing the conference, very likely under the direction of Mrs. Zhou Youwu, Vice-Director. Professor Shi Yafeng, Director of the Institute and Vice Director of the Lanzhou Bureau of the Academia Sinica, opened and closed the conference (Fig. 4).

Figure 4. Professor Shi Yafeng opening the Conference.
Table 1. Organizing Committee for the Second National Chinese Conference on Permafrost

Chairman: Shi Yafeng, Director, Lanzhou Institute of Glaciology and Cryopedology

Vice-Chairman: Wang Zhugui, Vice Director, Northwest Institute, China Academy of Railway Sciences
Zhou Youwu, Vice-Director, Lanzhou Institute of Glaciology and Cryopedology
Xu Shaoxin, Vice-Director, Heilongjiang Provincial Water Conservancy Scientific Research Institute

Secretary: Wang Zijung, Head, Division of Science and Technology, Lanzhou Institute of Glaciology and Cryopedology

Committee Members:
Ding Dewen, Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology
Wang Lian – Northeast Institute of Survey and Design, Ministry of Electricity
Liu Hongxu – Heilongjiang Provincial Low Temperature Construction Science Research Institute
He Xin – Editor, Lanzhou Institute of Glaciology and Cryopedology
Guo Hanbing – Vice-Director, First Highway Survey and Design Institute, Ministry of Communications.
He Changgeng, Third Institute of Survey and Design, Ministry of Railway
Tong Boliang, Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology
Lu Guowei – Yakeski Institute of Forestry, Survey and Design Ministry of Forestry
Ding Qingkong – Northwest Institute, China Academy of Railway Sciences, Ministry of Railway
Ji Lianwu – Northwest Institute, China Academy of Railway Sciences, Ministry of Railway
Wu Ziwang, Vice-Head, Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology
Chen Xiaobai, Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology
Xu Shuyin – Department of Geology and Geography, Lanzhou University
Huang Xiaomin – Vice Director, Northwest Institute, China Academy of Railway Sciences, Ministry of Railway
Cheng Guodong – Vice Head, Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology
Wang Zhugui, Vice-Director of the Northwest Institute, China Academy of Railway Sciences, played a major role in the conference, particularly with the foreign delegates. A large number of representatives attended from Northeast China; the spokesman of that group was apparently Xu Shaoxin. There is a Society of Glaciology and Cryopedology housed in the Institute of Glaciology and Cryopedology that totals over 450 members from throughout China. Yafeng, Zhugui and Shaoxin are officers of the Society. A Northeast China section was organized at the conference. Foreigners can join for 2 yuan (about $1.25) and receive the quarterly journal at no charge.

CONFERENCE FORMAT AND PRESENTATIONS

Table 2 is the revised conference program. The first two days of the conference were devoted to plenary sessions. State-of-the-art presentations were given by senior representatives. Each of the three foreign delegates was asked to give a 1- to 2-hour presentation. During the Chinese presentations a simultaneous translation capability in English was available through a tape recording system and ear plugs. Qiu Guoqing, a permafrost specialist, translated Brown's presentation into Chinese after a quick dry run to sort out terminology problems. Dr. Yen spoke in Chinese throughout, which greatly facilitated communications.

Two and one-half days of concurrent paper sessions followed the plenary sessions. There were three concurrent sessions. Although a program was available in advance in both Chinese and English, the sequence and actual titles of papers changed. Brown attended Session I and Yen attended Session II. Appendix A is the contents of the published abstract volume. Appendix B is a list of the papers actually presented.

There were a total of 185 abstracts and titles. Approximately 90 papers were actually presented. The abstracts are divided into four categories. The groundwater papers were not presented in Session I, and the Session IV papers on exploration and measuring techniques were in different sessions. Many of the field observations and papers were centered along the Qinghai-Xizang highway which has provided access to many permafrost features and problems. The permafrost of Northeast China was a focus for additional papers.

The titles of the 185 abstracts (App. A) are the best indicator of the scope of the meeting. Table 3 is a subdivision of the papers by specific topics as listed in the preface to the abstract volume. A total of 169
Table 2. Revised Program

The Second National Chinese Conference on Permafrost
12-17 October 1981, Lanzhou, China

11 October - Arrivals

12 October 1981
Morning: Chairman - Zhou Youwu, Vice Director, Lanzhou Institute of Glaciology and Cryopedology

Opening Speech - Professor Shi Yafeng, Director, Lanzhou Institute of Glaciology and Cryopedology

Dr. Kuroiwa, Japan
   Snow, ice, and frozen ground studies in Japan

Tong Boliang, General Cryopedology Section, Lanzhou Institute of Glaciology and Cryopedology
   Regional study of permafrost in China

Afternoon: Chairman - Xu Shaoxin, Vice Director, Heilongjiang Provincial Research Institute of Water Conservancy Science

Wang Zhugui, Northwest Institute, China Academy of Railway Sciences, Lanzhou,
   Railroad construction and scientific research in permafrost in China

Dr. Yin-Chao Yen - U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H.
   CRREL's structure, mission, and its major research and engineering activities

Wu Ziwang, Vice Head, Permafrost Division, Lanzhou Institute of Glaciology and Cryopedology
   Study on mechanics of permafrost in China.

Evening - Banquet (see list of participants, Appendix C).

13 October 1981 - Morning: Chairman - Professor Shi Yafeng

Lu Zhaojin, Professor, Chinese Academy of Railway Sciences
   Mechanisms of soil deformation and problems in soil mechanics

Xu Shaoxin (paper read for him)
   Cryopedology and its study and practice in hydraulic engineering in China

Ding Dewen, Lanzhou Institute of Glaciology and Cryopedology,
   Thermologic study of frozen ground in China

Wang Zhengqin - Harbin Architectural and Civil Engineering Institute
   Frozen soil construction engineering - a review
Table 2 (cont'd).

Afternoon

Dr. Jerry Brown - U.S. Army Cold Regions Research and Engineering Laboratory
Permafrost investigations in northern Alaska (Qiu Guoqing - interpreter)

Guo Hanbing - First Highway Survey and Design Institute, Ministry of Communications
Construction and maintenance of the blacktopped Tibet highway

Visit to Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica, Professor Shi Yafeng and staff (for foreign delegates only)

Evening: Banquet at Professor Shi's residence for foreign delegates.
Music Show: Gansu Provincial Youth Group for all conference participants at the hotel.

14 October - Concurrent Sessions (see individual lists of papers actually presented and list of abstracts - Appendices A and B)

Session I. Distribution, characteristics and formation of frozen ground
Session II. Basic physico-mechanical properties and processes in frozen ground
Session III. Engineering design and construction in permafrost
Luncheon at Mr. and Mrs. Tong Boliang's residence for foreign delegates
Dinner at Mr. and Mrs. Zhu Yuanlin's residence for Y-C. Yen and J. Brown
Movie at hotel - Glaciers in China

15 October - Continue concurrent sessions

16 October

Morning - Complete concurrent sessions

Afternoon - Discussion Groups

Session I. General Cryopedology: Orientation and task of cryopedology in China,
   Chairman: Zhou Youwu
   Secretary: Cheng Guodong and Guo Dongxin

Session II. Physical, mechanical, and thermal characteristics and process in freezing ground: Orientation and task of cryopedology in China
   Chairman: Wu Ziwang
   Secretary: Ding Qingkong and Zhang Changqing
Table 2 (cont'd).

Session III. Engineering Cryopedology: Orientation and task of cryopedology in China
Chairman: Huang Xiaomin
Secretary: Chen Xiaobao and Yang Hairong

Visit to the Northwest Institute by Brown and Yen, followed by a banquet at the Institute

Evening Session: J. Brown briefed representatives of all organizations on Fourth International Conference on Permafrost and the Third International Symposium on Ground Freezing.

17 October - Trip to Liujiangxia Hydroelectric Power Station for visitors
Group discussions continued in Lanzhou

18 October, A.M. - Visits to White Pagoda Mountain and Fire-Spring Mountain
P.M. - Summary and Closing Ceremony
Chairman: Wang Zhugui

Summaries:
Session I - Zhou Yawu
Session II - Wu Ziwang
Session III - Huang Xiaomin
Instructions to the authors - Yuan Yuan Rong
Comments by Y.C. Yen
Comments by J. Brown (see App. C)
Comments by Xin Wenyen on railway needs
Comments by Kung Guinguan on northwest China problems
Closing Address - Professor Shi Yafeng

19 October - Visit to Lanzhou Institute of Glaciology and Cryopedology for detailed discussions and presentations.
J. Brown - Organization and conduct of permafrost research in the United States
Y.C. Yen - Selected cold regions topics including the author's own research

20 October - Departure

papers were received by the organizers. Each of the two Lanzhou institutes presented more papers than any other organization represented.

The authors generally used overhead projectors with handwritten acetates or glass plates. Several authors presented well-illustrated 35-mm slide talks. A modified poster session approach was used by many authors during their presentations. Several English-speaking scientists and interpreters assisted Brown during individual presentations. This type of
Table 3. Number of papers and titles in each category (based on abstract volume).

I. Distribution, Characteristics, and Formation of Frozen Ground (55)

1. Regional permafrost studies (19)
2. Historical aspects of permafrost (3)
3. Groundwater in permafrost regions (6)
4. Regional factors and permafrost (3)
5. Cold action and underground ice (14)
6. Frozen ground region environment and ecology (3)
7. Upper and lower boundaries of frozen ground and methods of determination (7)

II. Basic Physico-mechanical Properties and Processes in Frozen Soils (58)

1. Methods of measurement and calculations of physical, thermal, acoustic and dielectric properties of frozen ground (8)
2. Theories on migration of moisture and heat in frozen ground (8)
3. Frost-heave action in the processes of soil freezing (29)
4. Frozen ground strength, deformation and flow (13)

III. Engineering Designs, Construction and Damage Prevention in Frozen Ground (61)

1. Road construction engineering (10)
2. Bridge and tunnel engineering (6)
3. Water supply and discharge engineering (6)
4. Foundation and buildings (23)
5. Water conservation (11)
6. Integrated problems (5)

IV. Exploration and Measuring Techniques in Frozen Ground (11)

1. Application of geophysical methods in frozen ground (2)
2. Application of remote sensing in frozen ground (2)
3. Measuring and testing methods (6)
4. Instrumentation (1)

assistance, plus a partial set of English abstracts, helped the foreign delegates in following most of the technical presentations. Preprints of most Chinese papers were available but unedited. A number of draft papers from Sessions I and II were obtained and are available at CRREL.

A series of discussions and business meetings followed the 4-1/2 days of sessions. Results of these discussions were presented at the closing session. Zhou Youwu in her summary remarks appealed for more cooperation among organizations and less duplication, problems which seem to be creating some difficulties. The inconsistencies in terminology, classification
and methodologies were also indicated as problems. To overcome this, Professor Shi announced that a meeting would be held in Northeast China next year to discuss testing and methods. A second meeting will be held in October 1982 to discuss questions of Quaternary glaciers and periglacial phenomena. It is our understanding that Professor Cui Zhijui of Peking University is organizing that conference in Huang Shan (10-17 October 1982).

By invitation, Brown briefed leaders of the major institutions on the Fourth International Conference on Permafrost (Fairbanks, July 1983) and the Third International Symposium on Ground Freezing (CRREL, June 1982). Professor Shi had translated the Permafrost Conference Bulletin No. 1 into Chinese and all delegates received a copy. Brown described the paper and panel sessions, the field trips, and general logistics. The Chinese estimated that $3000 would be required for each delegate. This will be a major problem and could limit attendance, although the Chinese are still estimating 20 to 30 participants. As a result of the conference, a method was set up to select representatives to the Fairbanks conference. All technical representatives are expected to speak English. A selection board was established. Papers presented at the Lanzhou conference were to be submitted by 31 December 1981. A voting scheme will be used for selection. Mr. Li, of the Railway Academy, suggested that Professor Shi chair the selection committee. During the plenary session, an editor provided details on how to prepare the manuscripts according to accepted international standards.

Both Yen and Brown spent considerable time discussing the Ground Freezing Symposium to be held at CRREL in June 1982. Many Chinese would like to attend and asked that their abstracts be considered even though the deadline has passed. Upon return to CRREL, the Symposium organizers provisionally accepted upwards of 10 abstracts that were discussed in China.

PARTICIPANTS IN THE CONFERENCE

A total list of participants was not available to us by the close of the conference. Figure 5 is the official photograph of the conference participants. A good cross section of attendees can be obtained from the program (Table 2), the Organizing Committee (Table 1), the banquet attendees (Appendix C) and the list of participants and contributors in Appendix D. In addition, the abstract volumes (English and Chinese) contained the
Table 4. List of Institutes Contributing Papers.

Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica
Changchun Institute of Geography, Academia Sinica
Northwest Institute, China Academy of Railway Science
First Institute of Survey and Design, Ministry of Railway
Third Institute of Survey and Design, Ministry of Railway
Research Institute of Qiqihar Railway Bureau
Northeast Institute of Survey and Design, Ministry of Electricity
First Institute of Survey and Design, Ministry of Communication
Research Institute of Water Conservancy Science, Heilongjiang Province
Research Institute of Water Conservancy Science, Jilin Province
Research Institute of Water Conservancy Science, Liaoning Province
Northwest Research Institute, Ministry of Water Conservancy
Water Conservancy Institute of Survey and Design, Heilongjiang Province
Water Conservancy School, Heilongjiang Province
Research Institute of Water Conservancy Science
Water Conservancy Bureau, Gansu Province
Low Temperature Construction Research Institute, Heilongjiang Province
Fourth Construction Ltd., Heilongjiang Province
Survey Institute of Construction, Qinghai Province
Institute of Hydrogeology and Engineering-Geology
Institute of Geology, Jilin Province
First Geological Team, Qinghai Province
Institute of Coal Mining, Anhui Province
Harbin Architectural and Civil Engineering Institute
Northeast College of Agriculture
Department of Geography
Yakeshi Survey and Design Institute of Forestry
Fenglin Forestry Bureau, Yichun City
Department of Geology and Geography, Nanjing University

Affiliations of the participants. A list of organizations is presented in Table 4 based on papers presented. We were told that 69 organizations were represented. About 20 of them are located in northeast China, i.e. Heilongjiang, Jilin and Liaoning Provinces. The major research institutes are the Third Institute of Survey and Design, Ministry of Railway; the Low Temperature Construction Research Institute, Heilongjiang Province; and the
Water Conservancy Institute of Survey and Design, and they submitted 20, 10 and 11 papers respectively. The Lanzhou Institute of Glaciology and Cryopedology definitely occupies a very important role in permafrost research in China. This institute alone prepared 65 papers (about 1/3 of the total papers submitted for the conference). The Northwest Institute, which also performs basic and applied permafrost research and is under the supervision of the China Academy of Railway Sciences, contributed 17 papers to this conference. Three of the papers were prepared by the Chinese Revolutionary Army (stationed in northwest China, based on the material contained in the abstract). It is interesting to note that in China research and site investigations are also conducted in the Army. On the basis of the number of papers presented, the main institutes are:

- The Institute of Glaciology and Cryopedology
- Third Institute of Survey and Design, Ministry of Railway
- The Northwest Institute, China Academy of Railway Sciences
- Low Temperature Construction Research Institute, Heilongjiang Province
- Water Conservancy Institute of Survey and Design

VISITS TO THE LANZHOU INSTITUTES

During and following the conference, the foreign delegates were taken to the two hosting Lanzhou institutes and were briefed on the history, current organization and programs, shown the library and laboratory facilities, and had opportunities to discuss activities with individuals. The following contains some detail of these visits.

Institute of Glaciology and Cryopedology (12-19 October 1981)

We had two sessions at the Institute of Glaciology and Cryopedology. The late afternoon visit on 13 October was a general briefing and tour (Fig. 6). An all-day session on 19 October involved briefings by Yen and Brown, informal discussions and a visit to the library. The general history and organization of the institute, contained in Appendix E, is the same report that was available to Dr. Pêvé in June 1980.

The Institute totals about 350 people of which 240 are research professionals. The personnel include one professor (senior researcher); 10 associate professors (associate researchers); one senior engineer, 52 assistant researchers, and 33 engineers. The Institute is housed in a 4- to 6-story building which is located in one of a series of buildings
directly across the thoroughfare from Lanzhou University. The Desert Institute shares the building with the Institute of Glaciology and Cryopedology. The Permafrost Division, with its labs located behind the main building, has over 60 staff and support members. Academia Sinica apartment buildings for the staffs of the various institutes are located behind and adjacent to the institutes.

Table 5 is an abbreviated organization chart for the Institute of Glaciology and Cryopedology and is based on various sources available at the conference.

On our first visit to the institute, the director, Professor Shi Yafeng welcomed us in the conference room, introduced us to key staff, and provided copies of an atlas of China and several beautifully illustrated books on glaciers and mountains of China. We then visited the exhibit room which consists of a series of photographic wall displays on each division and its activities. Heads of each division described the work which included glaciers, debris flows, and instrumentation. The vice director, Wang Wenying, who has already visited the U.S. and CRREL, showed us the institute's mapping capability which includes stereo and ortho-photo plotters (Topocart brand) and a large camera for map reproduction. The
Table 5. Partial Organization and Staff of the Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (compiled by J. Brown).

**Director, Professor Shi Yafeng**

**Vice Directors (total of four)**
- Zhou Youwu - Associate Professor, Permafrost
- Wang Wenying - Senior Engineer, Mapping
- Wang Zhunai - Assistant, Research

**Glaciology Division (Staff of 51 with seven sections and one field station)**
- Xie Zechu, Head, Associate Professor

**Permafrost (Cryopedology) Division (staff of 65 with six sections)**
- Wu Ziwang - Vice Director, Associate Professor
- Cheng Guodong - Vice Director, Assistant Professor

**General Cryopedology Section**
- Tong Boliang - Associate Professor
- Guo Dongxin - Assistant Professor
- Qiu Guoqing - Assistant Professor

**Frozen Ground Mechanics Section**
- Cheng Xiaobai - Associate Professor
- Zhu Yuanlin - Assistant Professor
- Zhang Changqing - Assistant Professor

**Thermophysics Section**
- Ding Dewen - Associate Professor
- Xu Xiaozu - Assistant Professor
- Zhu Linnan - Assistant Professor

**Geophysical Section**
- Huang Yizhi - Assistant Professor

**Division of Glacial and Debris-Flow Sedimentology (staff of 24)**

**Survey and Mapping Service (staff of 20)**

**Analysis Laboratories of Material Composition, Wu Xiao-ling (staff of 15 with three sections)**

**Research Laboratories of Remote Sensing and Telemetry (staff of 27 with three sections)**
- Zeng Ounzhu - Head
- Cha Meisheng
- Luo Xianrui
- Liang Fengxian

**Library and Information Service (staff of 15 with three sections)**

**Editorial Board (staff of 11)**
- Interpreter-Gao Jenen
chemistry labs under Wu Xiso-ling's supervision include a clean room, gas and ion chromatographs, a hydrogen enrichment system and liquid scintillation for carbon-14 analyses.

The Permafrost Division has a coldroom complex containing six coldrooms, one of which contains individual insulated cabinets. Tests on frost heave, road-bed models, and creep deformation were ongoing. A 200-point data logger is available to monitor the coldroom tests. Xu Xiauzu described the thermophysics labs. There were three different instruments for thermal conductivity measurements. Instruments for measuring unfrozen water, diffusivity on unfrozen and frozen samples, and specific heat were also observed. A constant temperature room (+20°C) is used for calorimetric measurements. The mechanics lab has uniaxial and triaxial testing machines, a Japanese consolidation apparatus, and frost heave field testing equipment.

Brown met several times with the remote-sensing group. It is currently mapping terrain, glaciers and snowline with Landsat color products provided by the USGS for the glacier inventory. We discussed a cooperative effort using digital data analysis similar to our current work in northern Alaska with the USGS-Ames group. We tentatively agreed on areas in northwest and northeast China for preliminary evaluation. The group has also used satellite imagery (NOAA) to evaluate snowmelt and runoff.

The Institute library is extremely impressive. In addition to the Chinese periodicals it has a wide variety of journals in English and other languages. The total number of journals exceeds 250. The institute promised us a list of its periodicals. A two-floor stack contains bound journals and books. Total accessions exceed 23,000. A reprint file is also maintained. Brown went over the Chinese indexing system for natural sciences and reviewed the card catalogue system. While in Peking the Institute of Geography provided Brown with its current non-Chinese bibliographic publication. It is our distinct impression that we do not have a comprehensive bibliography of Chinese permafrost and glaciological literature in the U.S., although the IGY Data Center in Boulder, Colorado, has initiated a bibliographic effort in these fields. We indicated to Professor Shi Yafeng that development of bibliographies should be an element in our joint U.S.-Chinese exchanges. The Institute of Glaciology and Cryopedology is an excellent starting point for such a compilation. There are six staff members in the library. We have since received a bound bibliography of frozen ground research covering the period 1938 to 1979.
Drs. Yen and Brown were warmly welcomed by Li Jia, Director of the Northwest Institute, key staff members and Li Yusen, Vice Director, Academy of Railway Sciences (Fig. 7). Li Yusen led the Chinese delegation to Canada in 1975 and to the 1978 Third International Permafrost Conference in Edmonton. We were evidently the first foreigners to visit the institute and it was a special occasion for everyone. We were welcomed by Li Jia in English and then briefed by him in Chinese. The institute is just 20 years old, having been established in 1961, the same year CRREL was established in Hanover, N.H. The Northwest Institute specializes in geologic engineering investigations for the Ministry of Railways and probably conducts studies for other transportation ministries such as Communications (which includes roads). There are 380 staff of which 160 are technical. The institute occupies a number of buildings and we toured through several, observing mainly the laboratories and library.

The Northwest Institute covers a wide range of geographic regions. The desert work includes problems of blowing sand, which buries railway tracks and requires techniques for removal. The plateau conditions at

Figure 7. Welcoming group in front of Northwest Institute. Front row from right to left: Wang Zhugui, Li Yusen, J. Brown, Y.-C. Yen, Li Jia.
5000 m ASL include snow and permafrost problems, including the study of thermokarst. The loess problem involves stability and strength.

The institute is divided into the five technical divisions: 1) Landslides, 2) Permafrost, 3) General Research Laboratory, 4) Central Test Laboratory and 5) Library and Technical Information. The institute's major research topics are 1) prevention of landslides, 2) prevention of sand hazards to railways, 3) railway construction in loess regions, 4) railway construction and maintenance in permafrost regions, 5) construction of roads in salt lake regions, and 6) geophysical exploration and civil engineering surveying techniques.

More than 1000 landslide sites along the railroad have been investigated. Studies of landslide mechanics, residual strength and antislide piles were conducted. A great number of studies were conducted concerning the development of technology for building railroads in permafrost regions. The subjects of these studies included foundation engineering on thick underground ice, application of insulation material on frozen soils, development of engineering designs for buildings, bridge sites and foundations, examination of the physics, thermophysics and mechanics of frozen ground, determination of the natural and artificial limits in building bridges and houses, and prevention of frost heaving by chemical means.

In respect to the work on sand control for railway lines, studies on the mechanism of sand transport, solidification of sand mass by chemicals, and mechanical and general sand prevention methods were conducted. As for railway construction in loess regions, slope stability of the road base and the bearing strength of the loess foundation have been studied. Studies for construction of railroads in the salt lake regions, using shallow earthquake instrumentation to determine the upper limit of permafrost and employing electrical methods to explore the resources of underground water, were also undertaken. In civil engineering surveying and measuring techniques, studies are being conducted on the variation of the soil water content of foundations, automatic recording of the ground temperature, and laser holography to determine soil displacement under a concentrated or uniform load.

The Central Laboratory is divided into four sections, i.e. physics, mechanics, chemical analysis and mineral analysis. In the physics laboratory, determination of various physical property indices, such as the grain size distribution, volumetric weight, specific gravity, water content and
plasticity of soils, are made. This laboratory is equipped with various kinds of specific gravity meters, electrical furnaces, vacuum pumps, etc. The mechanics laboratory determines the shear strength, compressive strength, and the coefficient of compressibility of soils using triaxial, vertical-shear, solidification and universal test machines. In the chemical analysis laboratory, tests for determining salt content, water quality, and the amount of volatile components in soils have been conducted with various kinds of precision analytical balances, chemical analysis instruments, and flame photometers. The mineral analysis laboratory determines the principal mineral and chemical element contents with the use of a differential heat calorimeter, an X-ray, a spectrometer and a new Varian model 475 atomic absorption spectrophotometer. We asked for and were given several kilograms of loess on which the CRREL labs will conduct unfrozen water content and thermal measurements for comparison with the institute data.

Most of the instruments are Chinese-made, and though some are quite old and others are very recently manufactured, they all seem to be in good working order. The experiment that impressed us most was the use of a laser to determine the strength field of the soil affected by an imbedded pile. The landslide testing setup included a ring-type shear test apparatus which is Chinese-made and is used to predict conditions of landslides and soil residual strengths. The pile stability test apparatus involves a 3-day duration and measures deflection along the pile shaft, moment around the pile and the pressure strength. This institute has pioneered research on slope stabilization employing 10- to 20-m-long reinforced concrete piles.

The Northwest Institute has just completed a 3-story coldroom facility this year. The basement contains the refrigeration system: there are five compressors with Freon-2 as the working medium. After it is compressed, Freon-2 is cooled through a heat exchanger and becomes a low temperature and pressure liquid, which is subsequently passed through boxes containing CaCl₂ solution. During this process, liquid F-2 absorbs heat from the CaCl₂ solution, and once again becomes gas and is recycled to the compressor. The cooled CaCl₂ solution is pumped to the air-chiller in the coldrooms and also recycled. The temperature in the coldrooms can be lowered to -50°C. The first floor of the facility houses four coldrooms of identical size (6 x 9 m) and is surrounded by an insulated outer corridor. There
is an overhead hoist to the coldrooms which is capable of moving large carts of prepared samples and large-scale model tests. All the wires from the test samples lead out of the coldrooms to a central data collection room on the third floor. The third floor also contains the control room equipped with a large instrument display panel for remote control of operations and monitoring the coldroom complex; the coldrooms can be maintained at ±0.5°C.

After the tour and discussions, a special banquet attended by about 24 of the senior staff and administration was held in the conference room. All food was prepared in the institute by the staff. It was a particularly friendly and warm reception. Unfortunately we did not obtain a list of the people present or of the staff. However, we were given a number of books and unpublished papers which contain names of those involved in the research. A partial list of subjects is presented at the end of this section and a complete list will be available as soon as the material is cataloged.

Our overall impression of the Northwest Institute is that it is well-equipped, has some excellent geotechnical people who are highly motivated, and it conducts both basic and applied investigations. Although there were many "preprints" of papers, apparently the Chinese system has not, until recently, encouraged journal and other publications. Therefore, a great deal of information is contained in institute files and apparently is not easily accessible. We were given specific permission to take this unpublished information out of the country, in addition to several comprehensive design books. The following is a partial subject listing of the unpublished information:

1. Prevention of landslides
2. Collected works on landslides
3. Road design and construction over deep ground ice
4. Determination of the railroad embankment critical height in the permafrost region of Qinghai-Xizang plateau
5. Calculations of depth of thaw for tunnel foundations in permafrost
6. Determination of the upper limit of an empirical formula for the tunnel foundations in the permafrost region of Qinghai-Xizang plateau
7. Design of various types of foundations of roadway structures in permafrost
8. Basic studies in using explosives for pile foundations in permafrost regions of Qinghai-Xizang plateau
9. Testing of anchors (in plate form) in frozen soil
10. Long-term study of the withdrawal resistance of anchor rods in permafrost
11. Geological problems of road construction in permafrost regions of Qinghai-Xizang plateau
12. Large-scale vertical-cutting field tests in thawed and thawed-frozen soil interfaces
13. Field testing of tangential heave forces
14. Studies of horizontal heave force
15. Development of methods for determining the permafrost table and its application in road building engineering
16. Methods for calculating permafrost tables
17. Variations of the artificial permafrost table of road embankments in the permafrost region of Qinghai-Xizang plateau
18. Bearing capacity of concrete piles in permafrost
19. Permafrost tables after the construction of bridge foundations in the permafrost regions of Qinghai-Xizang plateau
20. Determination of an empirical formula for calculating the thickness of an insulating layer for road construction in the permafrost region of Qinghai-Xizang plateau.
21. Minimizing tangential heave force with physical and chemical methods.

CONCLUDING REMARKS

No attempt has been made in this report to analyze the technical aspects of the Conference. However, a few general comments are appropriate in a way of conclusions.

It is apparent the Chinese have been and are continuing to be involved in research on both the basic and applied aspects of frozen ground throughout their country. A surprising number of individual organizations are involved. Major practical problems of design, construction and maintenance are obvious from the titles of the papers and the available publications. The Chinese tradition of architecture and construction brings considerable technical experience to frozen ground research. The Ministry of Railway and its Academy of Railway Sciences with over 6000 technical people are obvious leaders in construction of road embankments, tunnels, bridges, and housing on frozen soils. The Institute of Glaciology and Cryopedology is providing the national leadership for permafrost research. The U.S. has no centralized counterparts, except that individuals and subelements within CRREL and USGS provide some focus nationally.
There are some very capable scientists and engineers actively pursuing frozen ground research in China. Many of these representatives will be among the delegates to the Fourth International Conference on Permafrost to be held in Fairbanks in July 1983.

Both the directors of the Ministry of Railway and Institute of Glaciology and Cryopedology indicated their desire to see permafrost research included in the U.S.-Chinese Science and Technology Agreement. We indicated that we would pursue this, if not for 1982, then certainly for the 1983 exchanges. The following is a partial list of topics and activities which can serve as a basis for continuing exchange.

POTENTIAL TOPICS OF US-CHINA COOPERATIVE FROZEN GROUND RESEARCH

Comparison of Laboratory Methods and Results for Frozen Materials
(1) Thermal properties
(2) Unfrozen water contents
(3) Frost heave testing and criteria

Field oriented investigations
(1) Case histories
   (a) drainage and icings along roads and railways
   (b) subsidence of roadbeds and embankments
   (c) failures of structures due to deep frost penetration
   (d) stabilization of ground (tunnels, slopes, shafts)

(2) Properties and distribution of frozen ground
   (a) massive ground ice occurrence and origin
   (b) geophysical techniques for detection
   (c) chemical and physical properties

(3) Field evaluation of frost heaving

(4) Remote sensing
   (a) snow distribution and water yield over frozen terrain
   (b) indicators of frozen ground
   (c) glacier sedimentation

Information Exchange
(1) Update literature - CRREL, USGS, Library of Congress, IGY Data Center A
(2) Establish routine literature exchanges
(3) Prepare joint publications and conduct conferences
(4) Exchange personnel
APPENDIX A. Titles of abstracts in published abstract volume.

PROCEEDINGS OF 2ND NATIONAL CONFERENCE ON PERMAFROST (Abstracts)

CONTENTS

Preface ........................................................... (1)

Session I. Distribution, Characteristics and Formation of Frozen Ground

Basic Characteristics of Permafrost in China
............................................... Zhou Youwu & Guo Dongjin (1)

Preliminary Discussion on the Distribution of Frozen Ground in China and its Zonality
............................................... Xu Xiaoqiu & Wang Jicheng (2)

Compilation of the map of Distribution of Frozen Ground in China at 1:4,000,000
............................................... Xu Xiaoqiu & Guo Dongjin (4)

On the Dividing of High-Altitude permafrost in China into Zones
............................................... Cheng Guodong & Wang Shangling (6)

Permafrost in the Northeast China
............................................... Lu Guowei et al (8)

Zonality and Regional Patterns of Frozen Ground in Northeast China
............................................... Guo Congxin et al (8)

Inspection of Southern Limit of Permafrost in Da-Xiao Xinganling
............................................... Lu Guowei (10)

Law of Temperature Variation of permafrost in the Northern Part of Da-Xinganling, China
............................................... Dai Jingbo & Li Enying (11)

Permafrost in the River valleys, and its Linear Coefficient
............................................... Han Xuchang (13)

Basic Characteristics of Permafrost Distribution in Tian Shan, China
............................................... Qiu Guoqing & Huang Yizhi (14)

Outline of Permafrost in Qilian Shan Area
............................................... Guo Pengfei (15)

Discussion on the Law of Distribution of Frozen Ground in Qilian Shan and its Map at 1:500,000
............................................... Wu Ziwang et al (16)

Climatic Condition for the Development of Permafrost on Qinghai-Xizang Plateau
............................................... Xie Yingjin & Zeng Qunzhu (17)

Some Characteristics of Permafrost Distribution on Qinghai-Xizang Plateau and Comparison with that in High Latitudes
............................................... 1st Hydrogeological and Engineering Geological Team of Qinghai Bureau of Geology (18)

Some Characteristics of Permafrost on Qinghai-Xizang Plateau and a Few Factors Affecting Them
............................................... Tong Bolang & Li Shude (18)

Distribution and Characteristics of Frozen Ground in Qinghai Province
............................................... Xu Wen (18)

Condition of Formation of Thick Permafrost on Qinghai Plateau
............................................... Xu Wen (18)

Geographical Regularity of Permafrost on the Earth Surface--The Distribution, Origin and Developing History of Permafrost
............................................... Zhong Weizhin (19)

Brief Report on Study of the Alpine Permafrost
............................................... Wang Jiacheng (20)

Evolution of Permafrost in Northeast China Since Late Pleistocene and its Age of Formation
............................................... Guo Dongjin & Li Zuofu (21)

Formation and Evolution of Permafrost in Northeast China
............................................... Xie Youyu & Chui Zhijun (22)

Paleoenvironment of the Last Glacial Stage in Northeast China
............................................... Sun Jianzhong et al (23)

Characteristics of Groundwater and Analysis of its Supply Mechanism in Permafrost Area, China
............................................... Lin Penglong (24)
Evolution of Groundwater Resource in Permafrost Area ........................................... Lin Fengtong (25)
Classification of Groundwater in Permafrost Regions on Qinghai-Xizang Plateau ........................................... Zhang Yong & Cal Shiquan (26)
Division of Groundwater Types of Permafrost Area in Northeast Qinghai-Xizang Plateau ........................................... Guo Pengfei (26)
Hydrogeological Characteristics of Permafrost Area in Da-Xinling ........................................... Zheng Qipu (27)
Characteristics of Valley Groundwater and its Prospecting Permafrost Area of Da-Xianling ........................................... Lin Feng (28)
Affect of Geological Structure on Permafrost ........................................... Guo Donglin (28)
Correlation between the Permafrost Thickness and Geologic Structure in Fenghuo Shan on Qinghai-Xizang Plateau ........................................... Huang Yizhi & Mi Farong (29)
Influence of Snow Cover on the Lower Limit of Permafrost in Allay Shan ........................................... Zhang Tingjun et al. (31)
Classification of Frost-heaving Terrain on Qinghai-Xizang Plateau ........................................... ChengGuodong & Qiu Guoping (32)
On Pingo and Patterned Ground in Qinghai-Xizang Plateau ........................................... Chui Zhijun (33)
Types and Characteristics of Periglacial Action along Qinghai-Xizang Highway ........................................... Wang Shaoling (34)
Thermokari along Qinghai-Xizang Highway ........................................... Wang Shaoling (35)
The Characteristics of Sand-wedge Cast Structures along Qinghai-Xizang Highway and Their Age Significance ........................................... Zhang Wexin (36)
Distribution Regularity and Recognition Marks of Permafrost with Richice Content along Qinghai-Xizang Highway ........................................... Qinghai-Xizang Xinhevan Research Group of Science (36)
Patterned Ground along Qinghai-Xizang Xinhevan ........................................... Liang Fengxian Cheng Guodong (37)
On the Thick Layer Ground Ice ........................................... Wang Chunhe. Changchun (38)

Some Characteristics of Nonstructural Deformation in Quaternary Deposits ........................................... Wang Fubao (39)
On Rock Glacier of Kunlun Shan Type ........................................... Chui Zhijun (40)
Periglacial Phnomena in Altay Shan ........................................... Li Shude & Zhang Tingjun (41)
Basic Characteristics of the Periglacial Landforms in Northeast China ........................................... Qiu Shanxun et al. (42)
Distribution and Formation of Icing and Icing Mound along Railway in Permafrost Area of Da-Xianling ........................................... Tian Qingfeng (43)
A Study on Crevasses of Frozen Ground ........................................... Xia Zhaojun (43)
Environmental Factors Controlling the Distribution of Noncontinuous Permafrost in the Northern Part of Da-Xinling ........................................... Liu Xinwu (46)
Correlation of Freezing-Thawing Action to Swamp Lands and Agriculture in Sanliao Plain ........................................... Wang Chunjue. Changchun (47)
Analysis of Ecological Destruction and Attenuation of River in High and Cold Mountainous Region ........................................... Du Weiyin (48)
Natural Frozen-Rate of Seasonal Frozen Ground in Middle Temperate Zone of China ........................................... Zhong Xing (49)
Numerical Calculation of Permafrost Table ........................................... Ye Bayou (51)
Method for Determining the Depth of Permafrost Table and its Application to the Cutting Engineering ........................................... Liu Tiehui (51)
Numerical Study on Evolutional History of Permafrost in Northeast China ........................................... Fu Liandi et al. (52)
Characteristics of Seasonal Freezing and Seasonal Thawing in Da-Xinling ........................................... Yangshi Forestry Survey and Design Institute (51)
Calculation of Maximum Monthly Mean Ground Temperature of Permafrost in Da-Xinling ........................................... Xiao Youming (55)
Nomograph for Determining the Maximum Depths of Seasonal frost and Thaw

Xu Xiaozu & Fu Lian (58)

Session II. Basic Physical Mechanical Properties and Processes in Frozen Soils

Simple Calculation on Some Parameters of Frozen Soils

Li Enying (59)

Approach to Method of Calculating Bound Water

Li Guangpan & Cao Min (60)

Effect of Moisture in Frozen Soils on the Ultrasonic Velocity

Pu Rong et al. (61)

Influence of Moisture in Frozen Soil on Velocity of Ultrasonic Wave

Liu Jinten & Zeng Zhongguo (62)

Preliminary Study on Effect of Pressure Variation on Content of Unfrozen Water in Frozen Soils

Zhang Jinheng et al. (63)

Thermal Conductivity of Both the Thawed and Frozen Soils with High Moisture

Tao Xiaoliang & Zhang Jingxin (63)

Experimental Research on the Thermological Properties of Road Engineering in Cold Regions

Wang Yao & Liu Shuangshi (66)

Preliminary Study on Dielectric Property of Frozen Soils

Gu Zhongwei & Li Jinten (67)

Heat-Mass Basis on the Study of Main Features of Frozen Ground on Qinghai-Xizang Plateau

Ding Dewen et al. (68)

Approach to the Heat-Mass Transfer on Surface Layer in Permafrost Regions on the Plateau

Zhu Linnan & Wang Guirong (69)

AModel Study on Heat-Mass Transfer on the Surface of Frozen Ground

Zhu Linnan et al. (70)

Calculation of Frost Depth and Moisture State in an Opening System

Ding Dewen (71)

Prediction of Moisture in the Seasonally Thawed Layer in Permafrost Regions on Plateau

Zhu Linnan & Zhang Jingxin (72)

Solution Ion Migration in Process of Ice Formation

Qiu Guoqing & Huang Cuiyan (74)

Conversion Problem of Parameters in Air-Ground System

Xu Xiaozu (75)

Advance of Studies on the Frost-Thaw Properties of Moist Soils by Mathematical—Physical Method in China

Ding Dewen et al. (75)

Approach to the Basic Laws of Frost Heave of Seasonally Frozen Ground

Xu Shaoxun et al. (77)

Effect of Frost Penetration Rate and Overload on Frost Heaving

Chen Xiaobai et al. (77)

Preliminary Discussion on the Frost-Heaving Behaviours of Fine-Grained Sand and Their Classifications

Wang Zhengyu (78)

Relationship between Moisture Migration and Frost-Heaving Stress

Tong Changjiang & Yu Chongyun (79)

Approach to Calculation of Frost Heaving

Zhang Shizhang & Zhu Qiang (80)

Thermodynamic Method in Frost Heave Calculation under Load

Gao Min & Guo Xinmin (80)

Research on Data of Tangential Frost-Heating Forces of Cohesive Soils for Engineering Design

Heilongjiang Institute of Construction in Low Temperature Fourth Construction and Installation Company, Heilongjiang Province (82)

Research on Tangential Frost-Heating Forces of Pile Foundation at Jintiao Station

Xiao Yaoning & He Changgui (83)

Study on Various Laws of Tangential Frost-Heating Forces

Cui Chengbun & Zhou Kaijiou (84)

Research on Normal Frost-Heating Forces

Tong Changjiang & Yu Chongyun (84)

Relationship between Allowable Frost-Heating Deformation and Frost Heaving Forces

Xu Shaoxun & Xu Zhenghai (85)
Calculation of Normal Frost-Heaving Forces

Xu Zhenhai et al. (87)

Normal Frost-Heaving Forces under Different Restraint States

Tong Changliang & Yu Chongyun (88)

Effect of Frost Penetrating Rate on Frost-Heaving Stress

Tong Changliang & Yu Chongyun (89)

On Experiment of Normal Frost-Heaving Forces in Seasonally Frozen Ground and Their Formulas

Cai Jingcheng (90)

Research on Relationship between Normal Frost-Heaving Forces of Yan Jilin Loam and Area of Foundation

Zhou Youcai (91)

Analysis on Relationship between Normal Frost-Heaving Forces and Amount of Frost Heave for Yan Jilin Loam

Heilongjiang Institute of Construction in Low Temperature (92)

Research on Horizontal Frost-Heaving Forces

Ding Chingkang (93)

Experimental Research of Horizontal Frost-Heaving Forces on Hydraulic Retaining Wall

Guan Pengqian et al. (94)

Research on Reaction of Frost-Heaving Forces to Pile Foundation and its Self-Anchor Action in Seasonally Frozen Ground

Sui Xianzhai & Zuo Li (95)

Experimental Research on Reaction of Frost-Heaving Forces to Foundations

Cui Chengshen & Zhou Kaijiong (96)

Study on Reduction of Tangential Frost-Heaving Forces on Pile Foundations by Residual Oil and Active Ion Cation

Ding Chingkang (97)

Experimental Research on Frost Susceptibility of Cohesive Soils

Fourth Construction and Installation Company, Heilongjiang Province and Heilongjiang Institute of Construction in Low Temperature (98)

Outlook Experimental Research on Tangential Frost Heaving Forces

Ding Chingkang (99)

Freezing Properties of Soils under Different Consolidated State

Xu Shaoxin (99)

Research on Frost-Thaw Properties of Cohesive Soils under Unsaturated and Consolidated State (No.1)

Xie Yingqi (100)

Research on Frost-Thaw Properties of Cohesive Soils under Unsaturated and Consolidated State (No.2)

Xie Yingqi et al. (101)

Research of Mechanical Problems of Frozen Soils by the Theory of Calculation of Layered Half Space

Heilongjiang Institute of Construction in Low Temperature (102)

Strength of Frozen Soils and Their Failure Behaviours

Zhang Jiayi et al. (102)

Behaviours of Triaxial Shear Strength of Frozen Soils

Zhang Changming & Feng Cunyao (104)

Residual Strength of Frozen Soils

Wu Zhiang & Zhang Jiayi (105)

Failure Behaviors of Frozen Soils under Uniaxial Stress Condition

Ma Shumin & Peng Lianhui (107)

Research on Ultimate Long-Term Resistant Forces of Anchor Arm in Permafrost

Ding Jiaojia & Zhang Juxin (108)

Some Developments on Research of Strength and Rheological Properties of Frozen Soils

Zhang Changqing (109)

Experimental Research on Large-Scale Direct Shear Test for the Frozen Thaw Boundary and Thawed Soils in Field

Tong Zhiquan (109)

Relationship between Stress and Strain of Frozen Soils under Complex Stress Conditions

Zhang Changqing (110)

Elastic and Compressive Deformation of Frozen Soils

Zhu Yuxin et al. (112)

Experience Formula of Thawing Settlement and Consolidation Coefficients for Frozen Da-Xinanling Loam

Zhou Kaijiong & Cui Chengshan (113)

Creep Behaviours of Ice-Layer With Soil

Wu Zhiang et al. (114)

Influence of Moisture in Frozen Soils on Their Rheological Behaviours

Zhang Jiayi et al. (116)
Session III. Engineering Designs and Constructions in Permafrost Area

Design Theory and Calculation in Frost-Resistant Layer on Concrete Road Surface .............................................. Bing Wenhuan (119)

Engineering in Alpine Permafrost Regions ......................................................... 1st Survey and Design Institute of Highway, Ministry of Communications Application of Lime Stabilized Soils on the Highway (119)

On the Height of Embankment with Asphaltic Pavement in Permafrost Regions on Qinghai-Xizang Highway .................................................. Qinghai-Xizang Highway Research Group (120)

Utilization of Heat Insulation in Thermal Insulating Layers of Subgrade ................................................................. Huang Xiaoming & Yang Hairong (122)

A Few Problems in the Calculation of Thermal Engineering in Embankment Construction on Frozen Ground ................................................ D ing Dewen & Cheng Guodong (123)

Design and Construction of Cutting in Massive Ground-Ice Area ................................................ Huang Xiaoming & Shu Daode (123)

Damages to Highway Engineering in Permafrost Regions in Da-Xinganling and Their Prevention and Remedies ........................................... Shi Huaqiang (124)

On the Prevention and Remedy to Ice-Wedge and Pinggo along the Railway Line in Permafrost Regions of the Great Xinan Mountain .................................................. Jian Q ingfen (125)

Determination of Critical Height of Railway Embankment in Permafrost Region on Qinghai-Xizang Plateau ................................................ Huang Xiaoming (126)

The Minimum Height of Filling for Reservation of Frozen Subbase under Qinghai-Xizang Highway in Permafrost Area .................................. Zhu Xuewen (127)

Mathematical Analysis of Frozen Process in Construction of Road

Embankment in Summer ............................................................... Cheng Guodong & Ding Dewen (129)

Tunnel Engineering in Cold Regions ......................................................... Nie Fengming (131)

Air Temperature in Tunnels in Cold Regions .................................................. Nie Fengming (131)

Design and Practice for Preventing Frost-Heave in Sleeper Beam Bridges with Shallow Foundation .................................. Ling Chunwei (132)

Discussion of Calculation Methods on Thawing Ground Depth of Culvert Foundation in Permafrost Regions .................................... Ye Bayou (132)

Investigation of Artificial Upper Limit of Permafrost under Culverts in Permafrost Regions of Nen-Lin Railway ................................ Zhou Kaizhong & Cui Chenghan (133)

Determination of the Empirical Formula for Artificial Upper Limit of Permafrost under Culverts in Permafrost Regions on Qinghai-Xizang Plateau ........................................... Yang Hairong (134)

Experimental Research on the Method of Laying Water Supply and Drainagepipes in Permafrost Regions .................................................. He Jie, (135)

Design of Water-Supply and Drainage Engineering in Permafrost Region on Qinghai-Xizang Plateau .............................................. 1st Survey and Design Institute, Ministry of Railway (136)

Cone Shape Heat Preservation Water outlet and Analysis of its Thermal Regime .................................................. He Jie & Li Huiying (136)

Antiheaving Test and its Application in Electrothermal Water-Supply Piping .................................................. He Jie & Zhen Qiu (137)

Experimental Research of the Long Distance Water-Supply Construction in Chaqiao Adit at Reshui Coal Mine in Permafrost Region .................................................. Li Youmei (138)

Simulation Test of Frost-Thawing in the Deep Mine Shaft by “Skin Depth Penetration Current Method” in Permafrost Regions ................................................................. Zhang Rongwu (139)

Design and Construction of Building in Permafrost Region ................................................................. Zhao Wenhua (139)

Experimental Research of Building Foundation in Permafrost Region .................................................. He Changyu & Xiao Youming (140)
Studies on Adaptable and Principles of Building Foundations in Permafrost Region on Qinghai-Xizang Plateau
............................1st Survey and Design Institute, Ministry of Railway (141)

Thawing Plate of Heated Building
.............................................He Changgeng & Xiao Yuming (142)

Computation on the Thawing Depth for Foundation of Heating Building in Permafrost Region
.............................................Zhao Yunlong & Wang Luanfu (142)

Discussion of Computation on the Thawing Depth for Foundation of Heating Building in Permafrost Region
..................................................................................................................Zhao yunlong (143)

Method of Draft Mapping for Determining the Thawing Plate of Heating Building in Permafrost Region on Qinghai-Xizang Plateau
.................................................................................................................. Ma Zonglong (144)

Types of Railway Construction Foundations in Permafrost Region and Their Evaluation
..................................................................................................................Chen Zhuhui & Ma Zonglong (145)

Determination of Depth of Building Foundation According to Classification of Frost Heaving Types
..................................................................................................................Li Chenlong (147)

Research on Blast Hole Pile Foundations in Permafrost Region on Qinghai-Xizang Plateau
.................................................................................................................. Ma Zonglong (148)

Frost-Resistance Foundation-Sand-well Anchorage Method
.................................................................................................................. Zhang Zhenhua (149)

Indoor Model Testing of Pile Foundation in Permafrost Region
.................................................................................................................. Liu Hongbiao (149)

Experimental Research on Anchorage Plate in Frozen Ground
.................................................................................................................. Zhang Luxin (151)

Experimental Research on Filling Concrete at Negative Temperature in Permafrost Region
..................................................................................................................Nie Fengming (151)

Discussion and Design of Blasting Pile Foundations in Seasonal Frozen Ground
..................................................................................................................Zhang Yiyuan (152)

Engineering Properties of Artificial Freezing Ground in Frozen-Thawed State
..................................................................................................................Xiang Binghan (152)

Permafrost of Mangui Regions and Investigation on Failure of Building
..................................................................................................................Jiang Mingfu (153)

On the Cause of Damage of Deer Puer Repair Factory in Da-Xinganling Caused by Freezing and Thawing
..................................................................................................................Shi Huajiang (153)

Investigations of the Thaw Bowl under a Heated Building of Deer Puer Repair Factory in Da-Xinganling Permafrost Region
..................................................................................................................Wang Hongbin (154)

Prevention and Remedy for Damage of Hydraulic Structures in Seasonal Frozen Soils
..................................................................................................................Xu Shaixin et al. (157)

Deformation and Stability of Irrigation Ditch under the Action of Frost-Thawing
..................................................................................................................Sun Yuliang (157)

Property of Frost Heaving in Irrigation Ditch Lined with Concrete and the Measure of Replacing Subsoils with Sand Gravel in Qiansu
..................................................................................................................Zhu Qiang (158)

Classification of Frost Susceptible Soils under Irrigation Canal Lined with Plain Concrete and Anti-Heaving Measures
.................................................................................................................. Liaoning Hydraulic Research Institute (159)

Discussion on the Destruction of Frost-Heaving in Trapezoid Irrigation Canal
..................................................................................................................Liaoning Hydraulic Research Institute (159)

Preventive Measure of Frost Damages in Drainage Systems in Seasonal Frozen Ground Regions
..................................................................................................................Wang Wenka; & Ling Chuanwei (160)

Fluidic Caisson Plate Gate Measure for Frost-Resistance Floodgate Plate
.................................................................................................................. Xu Shaixin & Zhao Zhishun (160)

Some New Types of Hydraulic Structure Adaptable in Cold Regions
..................................................................................................................Qian Fenglian (161)

Investigation on Destruction of Flood Discharge Sluice at Nan Guang County, Heilongjiang Province
..................................................................................................................Pang Guoliang (161)

Thawing and Freezing Property of Soil and Construction of Earth Dam in Winter
..................................................................................................................Wu Wenjin & Wang Liang (161)
Discussion of Earth Dam Construction Going Beyond the Year without Thermal Insulating Measure in Seasonally Frozen Zone ........................................ Xie Xingyi & Zhang Wujian (162)

Some Studies on Important Engineering Construction in Permafrost Region in our Country ................................................................. Wu Zilong, Ding Chongkang (163)

General Researches on Frozen Ground for Construction Engineering in China .............................................................................. Liu Hongwu (163)

Classification of Frozen Ground for Engineering Construction ........................................................................................................... Wu Zilong (165)

Some Engineering-Geological Problems of Railroad Construction in Permafrost Regions on Qinghai-Xizang Plateau ........................................ Ding Jinhong & Zhang Lixin (165)

Thermal Engineering Problems and Their Basic Principles in Permafrost Constructions Taking the Study on the Thermal State in Building Subgrade as an Example ........................................... Ding Dewen & Zhu Linya (167)

A Research on the Mean Temperature in the Frozen Wall of a Deep Shaft at Panji Mining District .................................................. Chen Wenbao (168)

Results on the Finite Element Analysis of the Formation of Frozen Wall in a Deep Shaft at Panji Mining District ................................ Zhang Yan (169)

Discussion of Some Questions on the Earth Stress in the Frozen Wall of a Deep Shaft ................................................................. Chou Wanzhi (169)

Session IV Exploration and Measuring Techniques

Application of Geophysical Method to Permafrost Survey in China ......................................................................................... Huang Youzi et al. (171)

Exploration of Permafrost Table by Shallow Formations Seismic Method ............................................................................. Zhou Puchun & Chen Dawei (172)

Applications of Landsat Images to the Interpretation of Permafrost in Tian Shan Area .......................................................... Luo Xiangguo & Liang Feixian (173)

Preliminary Application of Landsat Images to Investigating the Permafrost in Qilian Mountain Area ............................................... Remote Sensing Group, 0026 Corps, PLA (174)

Analysis of Several Methods for Determining the Unfrozen Water Content in Frozen Soil ............................................................. Zhang Jinhong & Fu Rong (175)

Determination of Unfrozen Water Content in Frozen Soil by Contact Method ........................................................................... Fu Rong et al. (176)

Discussion on Stress of Frozen Soil and its Test Methods ........................................................................................................... Cao Fuchao (177)

Some Problems in the Test on Frozen Soil by Using Home-Made Triaxial Shear Apparatus .......................................................... Zhang Changning & Feng Cunshao (178)

Pocket Precision Thermistor Thermometer ............................................................................................................................... Li Guangxin et al. (179)

Designing and Making of Transducers for Determining the Mechanical Properties of Frozen Soil by Ultrasonic Method ........ Zhang Jinhong et al. (179)
### APPENDIX B. PAPERS PRESENTED AT CONCURRENT SESSIONS

#### SESSION I. DISTRIBUTION, CHARACTERISTICS AND FORMATION OF FROZEN GROUND

**14 OCTOBER 1981, MORNING**

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zhou Youwu and Guo Dongxin, Basic characteristics of permafrost</td>
<td>in China</td>
<td>1</td>
</tr>
<tr>
<td>Lu Guowei et al., Zonality and regional patterns of frozen ground</td>
<td>in northeast China</td>
<td>6</td>
</tr>
<tr>
<td>Dai Jinbo and Li Enying, Law of ground temperature variations in</td>
<td>permafrost in the northern part</td>
<td>11</td>
</tr>
<tr>
<td>Xu Xiaozu and Wang Giachenu, Distribution of frozen ground,</td>
<td>of Da-Xinganling, China</td>
<td></td>
</tr>
<tr>
<td>Xie Yinggin and Zen Qunzhu, Climatic and radiation conditions for</td>
<td>permafrost development in the</td>
<td>17</td>
</tr>
<tr>
<td>Han Xuchang, Permafrost in river valleys and its linear coefficient</td>
<td>Qinghai Xizang Plateau</td>
<td>13</td>
</tr>
</tbody>
</table>

**AFTERNOON**

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guo Pengfei, Outline of permafrost in the Qilian Shan area</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Cheng Guodong and Wang Shaoling, On dividing high altitude</td>
<td>permafrost of China into zones</td>
<td>6</td>
</tr>
<tr>
<td>Wu Ziwang et al., Discussion on the law of frozen ground distribution in Qilian Shan and its mapping at 1:500,000</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Tong Boliang, Permafrost map at 1:60,000 along the Qinghai-</td>
<td>(no abstract)</td>
<td></td>
</tr>
<tr>
<td>Li Shude and Zhang Tingjun, Basic features of periglacial phenomena,</td>
<td>Altai Shan, China (missed presentation)</td>
<td>41</td>
</tr>
</tbody>
</table>

**15 OCTOBER 1981, MORNING**

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wang Chunhe (Changchun), Correlation of freezing-thawing action to</td>
<td>Swamplands and agriculture in</td>
<td>47</td>
</tr>
<tr>
<td>Cui Zhijiu On rock glaciers of the Kunlun Shan type</td>
<td>Sanjiang Plain</td>
<td>40</td>
</tr>
</tbody>
</table>

* See abstract volume.
Zhang Wenxin, The characteristics of sand-wedge cast structures along the Qinghai-Xizang highway and the significance of their size

Wang Shaoling, Types and characteristics of periglacial action and thermokarst along the Qiughai-Xizang Highway

Cheng Guodong, Distribution regularity and recognition marks of ice-rich permafrost along the Qiughai-Xizang highway

Liu Xinwu, Environmental factors controlling the distribution of discontinuous permafrost in the northern part of great Khingan Ranges

AFTERNOON

Xu Xiaozu, Conversion problem of parameters in air-ground system

Zhong Xing, Natural freezing rates of the seasonally frozen ground in the middle temperate zone of China

Guo Dongxin and Li Zuofu, Evaluation of permafrost in northeast China since late Pleistocene and its age of formation

Sun Jian Zhonz et al., Paleoenvironment of the last glacial stage in northeast China

Xin Jeming, Chemical weathering and leaching in permafrost (no abstract)

Cui Zhijiu, On pingos and patterned ground on the Qinghai-Xizang Plateau

16 OCTOBER 1981, MORNING

Xia Zhaojun, A study of cracking in frozen ground

Qiu Guoqing, Classification of frozen terrain on the Qinghai-Xizang plateau

Luo Xiangrui and Liang Fengxian, Application of Landsat images to interpretation of permafrost in the Tian Shan

Huang Yizhi, et al. Geophysical methods (see paper in Memoirs No. 2)

Liang Fengxian, Use of aerial photographs to interpret ground ice features (no abstract)

Lu Guowei (for author not present) Relationship of forest industry and permafrost in northeast China.
SESSION II. BASIC PHYSICO-MECHANICAL PROPERTIES AND
PROCESSES IN FROZEN SOILS

14 OCTOBER 1981, MORNING

Xu Shaoxin, Approach to the basic laws of frost heave of seasonally frozen ground.

Zhu Qiang, Approach to calculation of frost heaving.

Wang Zhengqiu, Preliminary discussion on the frost-heaving behaviors of fine-grained sand and their classifications.

Gu Zhongwei, Preliminary study on dielectric property of frozen soils.

Ding Dewen, Calculation of frost depth and moisture state in an open system.

Zhu Linnan, Prediction of moisture in the seasonally thawed layer in a permafrost region on the plateau.

Kang Ruiging, A solution of a comprehensive process with heat and moisture transport in frozen ground by the analog computer.

AFTERNOON

Zhu Linnan, Approach to the heat-mass transfer on the surface layer in permafrost regions on the plateau.

Qiu Guoqing, Solution ion migration in the process of ice formation.

Liu Jinren, Influence of moisture in frozen soil on the velocity of ultrasonic waves.

Tao Zhaoxiang, Thermal conductivity of both the thawed and frozen soils with high moisture.

Fu Rong, Effect of moisture in frozen soils on the ultrasonic velocity.

15 OCTOBER 1981, MORNING

Sui Xianzhi, Research on data of tangential frost-heaving forces of cohesive soils for engineering design.

Cui Chenghan, Study on various laws of tangential frost-heaving forces.

Tong Changjiang, Research on normal frost-heaving forces.

Xu Zhenhai, Relationship between allowable frost-heaving deformation and frost-heaving forces, and theoretical calculation of normal frost-heaving forces under different areas of foundations.
Guan Fengnian, Experimental research of horizontal frost-heaving forces on a hydraulic retaining wall.

Chen Xiaobai, Effect of frost penetration rate and overload on frost-heaving.

Yu Chongyun, On the tangential frost-heaving forces.

AFTERNOON

Ding Qingkang, Research on horizontal frost-heaving forces.

Tong Zhiguan, Experimental research on large-scale direct shear test for the frozen-thawed boundary and thawed soils in the field.

Ma Shimin, Experimental research on creep behavior of frozen soils under uniaxial compression tests and failure behavior of frozen soils.

Wu Ziwas, Discussion on problems of rheological behavior in frozen soils.

16 OCTOBER 1981, MORNING

Xie Yinggi, Research on frost-thaw properties of cohesive soils under saturated and consolidated state.

Liu Hongxu, Research on mechanical problems of frozen soils by the theory of calculation of layered half space.

Wu Ziwas, Residual strength of frozen soils.

Zhu Yuanlin, Elastic and compressive deformation of frozen soils.

SESSION III. ENGINEERING DESIGN AND CONSTRUCTION IN PERMAFROST

14 OCTOBER 1981, MORNING

Huang Xiaoming, Design and construction of cutting in massive ground-ice area.

Bing Wenshan, Design theory and calculation in frost-resistant layer on concrete surface.

First Survey and Design Institute of Highway, Ministry of Communications: Application of lime-stabilized soil on the highway engineering in alpine permafrost regions.

Liu Yongzhi, On the height of embankments with asphaltic pavement in permafrost regions on Qinghai-Xizang highway.

Ling Chuanwei, Design and practice for preventing frost-heave in sleeper beam bridges with shallow foundations.
Wang Ziyuan, Ministry and Railway: Studies on adaptability and principles of building foundations in permafrost regions on the Qinghai-Xizang Plateau.

AFTERNOON

Ye Bayou, Discussion of calculation methods on the thawing ground depth of culvert foundations in permafrost regions.

He Jie, Experimental research on the method of laying water supply and drainage pipes in permafrost regions.

Zhang Jianqiu, Design of water-supply and drainage engineering in permafrost region on the Qincaizhi-Xizang Plateau.

15 OCTOBER 1981, MORNING

Zhao Yunlong, Discussion of computation on the thawing depth for foundation of heating in permafrost region.

He Changgeng, Thawing plate of a heated building.

Li Chenlong, Determination of depth of building foundations according to classification of frost heaving types.

Chen Zhuohuai, Types of railway construction foundations in permafrost region and their evaluation.

Chou Wanxi, Discussion of some questions on the earth stress in the frozen wall of a deep shaft.

AFTERNOON

Ding Qingkang, Long-term pull resistance of anchorage rod in permafrost.

Zhang Luxin, Experimental research on the anchorage plate in frozen ground.

Ding Dewen, Numerical study of the freezing process of the shaft wall.

Xu Shaoxin, Prevention and remedy for damage of hydraulic structures in seasonally frozen soils.

Sun Yulian, Deformation and stability of irrigation ditch under the action of frost-thawing.

16 OCTOBER 1981, MORNING

Kong Quinuan, Classification of frost susceptible soils under irrigation canals lined with plain concrete and antiheaving measures.
Ling Chuanwei, Preventive measure of frost damages in drainage systems in seasonally frozen ground regions.

Guan Fengnian, Some new types of hydraulic structures adaptable in cold regions.

Wang Liang, Thawing and freezing properties of soil and construction of earth dam in winter.

Li Anguo, Calculation of the normal frost-heaving forces on lined plates of a ditch.
APPENDIX C

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<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (77)</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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<td>The Changchun Institute of Geography, Academia Sinica (42)</td>
</tr>
<tr>
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<td>China Academy of Railway Sciences</td>
</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (60, 179)</td>
</tr>
<tr>
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<td>Northwest Institute, China Academy of Railway Sciences</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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<td>Qinghai Coal Mine Design Institute (138)</td>
</tr>
<tr>
<td>Li Yusen</td>
<td>China Academy of Railway Sciences</td>
</tr>
<tr>
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</tr>
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<td>Institution</td>
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<td>---------------</td>
<td>------------------------------------------------------------------------------</td>
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<tr>
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</tr>
<tr>
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</tr>
<tr>
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<td>Changchun Institute of Geology (23)</td>
</tr>
<tr>
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<td>Heilongjiang Shuihua County Water Conservancy Bureau (132, 160)</td>
</tr>
<tr>
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</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (63)</td>
</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (62, 67)</td>
</tr>
<tr>
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</tr>
<tr>
<td>Liu Tieliang</td>
<td>Northwest Institute of the China Academy of Railway Sciences (51)</td>
</tr>
<tr>
<td>Liu Xinwu</td>
<td>Peking University, Geography Dept. (6, 46)</td>
</tr>
<tr>
<td>Liu Zhecuen</td>
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</tr>
<tr>
<td>Lu Guowei</td>
<td>Yakeshi Forestry Design Institute (6, 10)</td>
</tr>
<tr>
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<td>China Academy of Railway Sciences</td>
</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (173)</td>
</tr>
<tr>
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</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (107, 166)</td>
</tr>
<tr>
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</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (29)</td>
</tr>
<tr>
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</tr>
<tr>
<td>Name</td>
<td>Institution</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica</td>
</tr>
<tr>
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<td>Northwest Institute of the China Academy of Railway Sciences (123)</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
</tbody>
</table>

45
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Wang Yuzhao  Jilin Institute of Geology (23)
Wang Zhengqiu  Harbin Institute of Architecture (78, 165)
Wang Zhugui  Northwest Institute of China Academy of Railway Sciences
Wang Zijun  Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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<td>Bureau of Industrial Electricity, Northwest Institute of Hydroelectric Experiments Survey and Design (162)</td>
</tr>
<tr>
<td>Wu Ziwang</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (102, 105, 112, 114, 116, 163, 165)</td>
</tr>
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<td>Xi Yingqin</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (17)</td>
</tr>
<tr>
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</tr>
<tr>
<td>Xian Cunde</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (70)</td>
</tr>
<tr>
<td>Xiang Bingchan</td>
<td>Anhui Coal Mine Design Institute (152)</td>
</tr>
<tr>
<td>Xiao Youming</td>
<td>Ministry of the Railway Third Institute of Survey and Design (55, 83, 140, 142)</td>
</tr>
<tr>
<td>Xie Yinqi</td>
<td>Institute of Water Conservancy Survey and Design, Heilongjiang Province (17, 77, 100, 101, 163)</td>
</tr>
<tr>
<td>Xie Youyu</td>
<td>Institute of Geography, Academia Sinica (6, 22)</td>
</tr>
<tr>
<td>Xin Wenying</td>
<td>Qi-Qihaer Railway Bureau</td>
</tr>
<tr>
<td>Xu Shaoxin</td>
<td>Heilongjiang Institute of Hydrology (85, 99, 157, 160)</td>
</tr>
<tr>
<td>Xu Shuyin</td>
<td>Department of Geology and Geography, Lanzhou University</td>
</tr>
<tr>
<td>Xu Wen</td>
<td>15th Geological Team of Qinghai Bureau of Geology (18)</td>
</tr>
<tr>
<td>Xu Xiaoxin</td>
<td>Heilongjiang Provincial Scientific Research Institute</td>
</tr>
<tr>
<td>Xu Xiaozu</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (1, 56, 68, 75)</td>
</tr>
<tr>
<td>Xu Zhenghai</td>
<td>Institute of Water Conservance Survey and Design, Heilongjiang Province (87)</td>
</tr>
<tr>
<td>Yang Hairong</td>
<td>Northwest Institute of the China Academy of Railway Sciences (122, 134)</td>
</tr>
</tbody>
</table>

47
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution and Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ye Bayou</td>
<td>Northwest Institute of the China Academy of Railway Sciences (51, 132)</td>
</tr>
<tr>
<td>Yu Chongyun</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (79, 84, 88, 89)</td>
</tr>
<tr>
<td>Zeng Qunzhu</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (17)</td>
</tr>
<tr>
<td>Zeng Zhonggong</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (62, 171)</td>
</tr>
<tr>
<td>Zhang Changqing</td>
<td>Northwest Institute of the China Academy of Railway Sciences (104, 109, 110, 178)</td>
</tr>
<tr>
<td>Zhang Jiayi</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (102, 105, 112, 114, 116)</td>
</tr>
<tr>
<td>Zhang Jinsheng</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (61, 63, 72, 175, 176, 180)</td>
</tr>
<tr>
<td>Zhang Luxin</td>
<td>Northwest Institute of the China Academy of Railway Sciences (151, 167)</td>
</tr>
<tr>
<td>Zhang Qingyun</td>
<td>Shenayang Institute of Minerology (23)</td>
</tr>
<tr>
<td>Zhang Rongwu</td>
<td>Ministry of the Railway First Institute of Survey and Design (139)</td>
</tr>
<tr>
<td>Zhang Shixiang</td>
<td>Gansu Water Conservancy Bureau (80)</td>
</tr>
<tr>
<td>Zhang Tingjun</td>
<td>Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (31, 41)</td>
</tr>
<tr>
<td>Zhang Wenxin</td>
<td>Lanzhou University Geology and Geography Departments (19, 36, 63)</td>
</tr>
<tr>
<td>Zhang Xing</td>
<td>Jilin Institute of Hydrology (49)</td>
</tr>
<tr>
<td>Zhang Xiuhua</td>
<td>Xian Highway Institute (66)</td>
</tr>
<tr>
<td>Zhang Yan</td>
<td>Institute of Coal Science (169)</td>
</tr>
<tr>
<td>Zhang Yiyan</td>
<td>Heilongjiang Lindian County Water Conservancy Bureau (152, 163)</td>
</tr>
<tr>
<td>Zhang Yong</td>
<td>Qinghai Ge-er-mu 1st Hydrological and Engineering Geological Team (26)</td>
</tr>
</tbody>
</table>
Zhang Zhenhua  Northeast College of Agricultural, Department of Hydrology (149)
Zhao Wenhua  Heilongjiang Institute of Forestry Design (139)
Zhao Yunlong  Qiqihar Railway Bureau Institute of Technology (142, 143)
Zhao Zuosheen  Heilongjiang Institute of Hydrology (160)
Zheng Qipu  Ministry of the Railway 3rd Design Institute Frozen Ground Team (27, 137)
Zhong Wenxin  Lanzhou University Geology and Geography Departments (19)
Zhou Changqing  Low Temperature Construction Research Institute of Heilongjiang Province (94)
Zhou Kaijiong  Ministry of the Railway Third Institute of Survey and Design Frozen Ground Team (84, 96, 113)
Zhou Kaizhong  Ministry of the Railway, Third Institute of Survey and Design (133)
Zhou Fuchun  Northwest Institute of the China Academy of Railway Science (172)
Zhou Yajie  Jilin Institute of Geology (23)
Zhou Youcai  Low Temperature Construction Research Institute of Heilongjiang Province (91)
Zhou Youwu  Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (1)
Zhou Zhangqin  Heilongjiang Low Temperature Construction Research Institute (165)
Zhu Linnan  Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (72, 168)
Zhu Qiang  Gansu Research Group of Anti-Frost of Ditches (80, 159)
Zhu Xuewen  Ministry of Communications, Institute of Highway Science (127)
Zhu Yuanlin  Lanzhou Institute of Glaciology and Cryopedology, Academia Sinica (102, 112, 114, 116)
Zuo Li  Water Conservancy Sciences Research Institute of Heilongjiang Province (95)
Appendix E

LANZHOU INSTITUTE OF GLACIOLOGY AND CRYOPEDOLOGY, ACADEMIA SINICA*

Director: Shi Yafeng (Professor)
Vice Director: Wang Wenying (Senior Engineer)
Wang Zhuntai (Assistant Researcher)
Zhou Youwu (Associate Professor)

This Institute was developed primarily on the basis of an Alpine Ice and Snow Utilization Team organized by Academia Sinica in 1958. Its first task was the investigation of mountain glaciers of Northwestern China. In 1960 the research work of permafrost was added. In 1962, the organization was changed into the Division of Glaciology and Cryopedology, Institute of Geography, Academia Sinica. It investigated mountain glaciers in West China, the permafrost of the Qinghai-Xizang (Tibet) Plateau, and hydrology of arid regions in Northwestern China. In 1964, the study of debris flow was also started. In 1965, the Division of Glaciology and Cryopedology amalgamated with the Division of Desert Research from Peking, forming the Institute of Glaciology, Cryopedology and Desert Research, Academia Sinica, and carrying on scientific studies on glaciers, frozen ground, desert and debris flow. In June 1978, the Division of Desert Research was changed into an independent institute, with the remainder forming the Institute of Glaciology and Cryopedology. This Institute includes: 1) Division of Glaciology; 2) Division of Cryopedology; 3) Division of Glacial- and Debris-flow Sedimentology; 4) Surveying and Mapping Service; 5) Analysis Laboratories of Material Composition; 6) Research Laboratories of Remote Sensing and Telemetry; 7) Library and Information Service; 8) Editorial Board. At present there are 350 staff and workers.

The important research areas are as follows:

Glaciology: This Division mainly studies the distribution, physical properties, variation and natural resources of ice and snow in China and

* Edited from the original English copy
the action of Quaternary glaciation. Since 1958, the important regions investigated are the glaciers of Qilian Shan, Tian Shan, Mt. Qomolangma and Mt. Xixiabangma of the Himalayas and other alpine regions of Qinghai-Xizang (Tibet) Plateau; control of avalanche and snow drifting in Tian Shan; and the mechanics of ice jamming on the Yellow River. Since 1974, the research has included the variation of glaciers in the Karakoram, repairing the damaged section of China-Pakistan Highway in the Qilian Shan, and the effective utilization of water resources for the promotion of agriculture in the Kansu Corridor. New achievements have been made on the forecasting of advances and recessions of glaciers. In recent years, with the help of aerial photos and large-scale topographic maps, and in accordance with the specified requirements of the World Glacier Inventory Program, nearly 3,000 glaciers in Qilian Shan have been properly inventoried. New progress has been achieved in the fields of glacial hydrology, the relations between glaciers and climate, glacial sedimentation, Quaternary glaciation and climatic variations.

Permafrost: We mainly investigate the formation, development and the prevention of damage to permafrost along the Qinghai-Xizang Highway, in several coal mining districts of Qilian Shan and also in some places in Northeast China. In recent years, we conducted research on the distribution and thermal properties and mechanics of permafrost along the Qinghai-Xizang Highway and obtained a group of fundamental parameters on mechanics and other data as required for railway design. The investigation of frozen ground through the Tian Shan for the Southern Xin Jiang Railway has also been taken up. Frozen soil mechanics (including frozen soil rheology, frost heave forces, frozen strength and thaw settlement), frozen soil heat capacity (frozen soil thermal heat conductivity, water migration, changes in temperature field, etc.), ground ice, seasonal frozen soil and other fields have also been studied. Recently, a map of the permafrost distribution along the Qinghai-Xizang Highway at a scale of 1:500,000 has been compiled, based on the characteristics of permafrost on the Qinghai-Xizang Plateau.

Debris Flow: We mainly study glacial debris flow and the characteristics, distribution, formation, development and preventive measures of debris flow. In recent years, we investigated the debris flow along the
Sichuan-Xizang Highway and in Dongchuan district in Northwest provinces. Preventive projects have been engineering works of various plants, mines, factories and so on. Scientific data are useful for socialist construc-

Surveying and mapping: We have finished the 1:500,000 maps of the Beiluo and the 1:60,000 maps of the Baturu glaciers; the 1:200,000 maps of Tomol Peak in "Tan Shan" and several other districts.

Material analysis: Mainly the material analysis of cold regions and trace elements in snow and ice provide quantitative analytical data to the study of glaciology.

Remote sensing and telemetry: In recent years, a thermometer has been fabricated and put into use, which is being used, and satellite images and data have been used in the analysis of changes in glaciers, snow and ice resources, and the amount of snow and ice resources, and the interpretation of data, supplying new means for the study and development of glaciology.

Library and information: In our library, there are more than 1000 books and more than 240 journals, Chinese, English, Russian, and so on. All of the above-mentioned publications are related to the various disciplines with which we are concerned. In addition reports, papers, journals and books are acquired from 20 nations on a exchange basis and from 200 institutes/organizations in China. Most recently we have begun to publish a quarterly with English titles, abstracts, and foreign information entitled "Journal of Glaciology and Cryopedology."

Editorial Board: The final product of scientific investigations by the staff in and out of our institute takes the usual form of publications. Among others, the quarterly "Journal of Glaciology and Cryopedology" (in Chinese and with English abstracts) has been published by the Editorial Board since 1979.
attending the National
Committee on
Permafrost and
Vegetation
Organizing permanent
workshop on
cooperation
among agencies.

Permafrost

Leaving—chaired
work on Buffalo
vegetation, and cooperation

Study has become available. My
permafrost, and vegetation
studies of hydrology, remote
would like to discuss some of
which are contained in several reports, which
involves looking at some maps of Alaska. Please do not

*Presentation was taped and has been translated into Chinese (Chinese copy
available at [URL]).
Appendix G. Comments by J. Brown at the Closing Ceremony - Second National Chinese Conference on Permafrost - Lanzhou
18 October 1981

I would like to, once again, express my appreciation to the Organizing Committee for this opportunity to participate in the Conference. In the last six days I have learned a great deal about Chinese permafrost and frozen ground research, and the related engineering problems. It is my observation that there are more organizations, researchers and engineers in China than in the U.S. and perhaps Canada combined. The quality of the research in China is very good. You also have developed extensive practical experience.

In the U.S. we are interested in many of the same frozen ground problems: 1) distribution of permafrost, 2) frost heave and properties of soil and water, 3) geophysics, 4) remote sensing and mapping, 5) construction.

In the last ten years in the U.S. there have been many studies associated with pipelines and roads. Our experience only goes back to the 1940's. So our research is not very old either.

During 1981, there was another permafrost conference. In March 1981, the Canadians held a conference that was similar to the one held here in Lanzhou this week. The publication of the Canadian proceedings will be of great interest to you. It will contain reports on recent research in North America. The proceedings will be dedicated to Dr. Roger Brown who died last year. I will ask the Canadians to send copies of this book to you when it is published.

Now for some comments about this conference. The Organizing Committee is to be congratulated for the excellent preparation for the conference. The conference was very well organized. I personally appreciated the English abstracts and translations. Many of the presentations were well illustrated with 35-mm slides, lantern slides and photographs. This is the procedure we use in the U.S. These visual aids help the audience to understand the presentations. Many papers were available for distribution at the conference. This is also very good as it gives the participants an opportunity to study the reports. Following the presentations, there were
some good discussions between the authors and the audience. This is also very useful.

The summary papers on the first two days provided excellent reviews of past research. These survey papers will be important contributions to the international permafrost research. I hope the papers will contain literature references to the major published research. I look forward to receiving all of these papers.

I attended Session I. I learned a great deal about permafrost distribution, characteristics, and formation. I now appreciate the full extent of permafrost in China. You have many excellent detailed observations which are being published. The formation of ground ice, the degradation of permafrost, the age of permafrost and periglacial features and thermal conditions of the ground are all of great interest to me and my colleagues. The comparison of these characteristics with those in North America, Europe and Asia is very important.

It is my impression that the papers presented in Sessions II and III were also very significant. The engineering aspects of permafrost and frozen soil are very important in solving practical problems. We have the same problems of designing, building, and maintaining roads and structures on seasonally frozen ground and permafrost. Frost heave and permafrost degradation are our major problems. You have many case histories or practical experiences with frozen soils. The reports from Session III will be of great value to us.

In summary, both the quantity and quality of the work and papers are impressive. I will take back many ideas to report to my colleagues in North America. You have many excellent papers for the 1983 Conference in Alaska. I wish the Conference organizers success in editing and publishing the results of the conference. I will always remember this conference for the scientific exchanges and for your friendship.

I look forward to seeing some of you at CRREL in 1982 and in Alaska in 1983. I also look forward to returning to China to see your frozen ground under actual field conditions. Perhaps an international conference will be possible.

Thank you once again.