INSTITUTE OF CURRENT WORLD AFFAIRS

CHGO-48*
Visits to Chinese Institutes of Earth Science

2 Avenue des Tilleuls,
Croissy-sur-Seine,
(S. et O.),
France.

August 19, 1965.

Mr. R.H. Nolte,
Institute of Current World Affairs,
366 Madison Avenue,
New York 17, N.Y.

Dear Mr. Nolte,

Last May I visited two of China's top institutes of earth science. One was the Academy-Sinica's Geophysical Research Institute, and the other the Institute of Geology. Both are in Peking. The visits represented the culmination of several years of effort to open up channels of communication with Chinese geologists and geophysicists.

In some respects the visits were unsatisfactory. The time I was able to spend at each was too short, there were language difficulties, and there was no invitation to come back for an extended visit. Nevertheless, initial contacts have now been made which may eventually prove to be useful.

First, a word of warning. The statistical and technical information which I was given will not be of interest to the non-specialist, but for the benefit of those geologists and geophysicists who are interested in Chinese activities in the earth sciences I will reproduce the gist of what I was told and shown. Other readers please accept my apologies and skip this letter.

The first of these visits, to the Geophysical Research Institute, took place on our penultimate afternoon in Peking. I was accompanied by two representatives of the China International Travel Service who both seemed pleased to be visiting somewhere different from the usual routine tourist sights. The girl who acted as interpreter said her father had been a geologist in Shanghai, and she now intended to study geology in her spare time. (It is a measure of her interest and diligence that she must have spent several hours during the night between the two visits learning a large number of geological terms and their English equivalents, so that she might do a better job of interpreting the following day.)

The Institute is in the quarter of Peking where many universities, colleges, and research institutes have been built, and we had some difficulty in finding the correct building. When we finally arrived we were received by the secretary of the Institute and four of the senior research workers. I was told the director was away, and I met none of the other geophysicists with international reputations who I knew worked at the Institute. It was a few days before the second atomic bomb explosion, and it is quite possible that many of the seismologists were on an expedition in connection with this explosion.

---

* The last letter was erroneously numbered 49. It should have been #48. To avoid a gap in sequence this letter is assigned that number.

After a brief introduction by the secretary, each of the four research workers gave a 15 to 20 minute exposition of the work done in his division. They spoke from notes and this part had obviously been prepared with some care before my visit. After the introduction I was taken around the Institute and finally returned to the office for another glass of tea, after which I was asked to write in the visitors book.

The following account is based on the set speeches, and on the answers to my questions. I have made no attempt to check the authenticity of what I was told, and there are some points which I did not understand, mainly due to language difficulties.

The Institute of Geophysics was established in 1950 by combining three existing institutes, one of which was the Meteorological Institute founded in 1928. There are 500 staff members working in the Institute and it is divided into four departments: Meteorology and atmospheric physics (with approximately 100 research workers): earthquake seismology (with 100 research workers); physics of the earth's interior (with 50 research workers); and geomagnetism (with 30 research workers). There is also a factory associated with the Institute for instrument repair and construction. It has 50 staff members.

(a) Seismology Division

The chief, Li Shen-p'ang was not in Peking, and the work of the division was explained by the secretary. He said that before "Liberation" there were only two seismic stations in China and even these did not work regularly. After "Liberation", when large scale construction work was planned, it was realized that it was necessary to have data on seismology. The Government then supported seismological research and a number of new seismic stations were built.

Between 1953 and 1954 a large number of preliminary seismic stations were constructed, but these were fairly crude and were built in a hurry. Since then, 12 fundamental seismic stations have been constructed, and some of the preliminary stations converted to fundamental stations. The Institute manufactures its own seismometers. When I was shown around the laboratory I noted that although some of the equipment was transistorised, the recording mechanism of the seismometers still made use of smoked paper. This is a technique which has been discarded in Western countries for many years. I asked about magnetic tape recording and learned that although the Chinese had tried they have not yet mastered this technique.

One of the projects tackled by this division has been an historical study of past earthquakes in China. Approximately 8000 historical documents have been studied and references discovered to about 15,000 earthquakes. A catalogue has been drawn up showing annual occurrences of earthquakes, and a map prepared to show the frequency of earthquake distribution in China. Preliminary results have been published, but the work is still in progress.

The seismological division has also made a number of theoretical studies, especially on problems related to earthquake energy. It also acts as the central compilation office for the records from Chinese seismic stations. Arrival times of all major earthquakes are cabled in to the division and photographic copies of the records are sent by mail.

(b) Physics of the Earth's Interior

Although much of the scientific work that is done in China is connected

with the construction of the country, work of a more basic nature has not been neglected. Low frequency refraction studies have been made using artificial earthquakes in the Tsaidam Basin. Here the thickness of the sediments was found to be 10 kilometers. In this work the distance between the source and the receivers was 100 kilometers, and a 13 circle array of geophones was used at the pick-up stations.

Refraction work however, is expensive, and the trend has been to greater use of reflection techniques for crustal studies.

One result of all the measurements has been the discovery of a high velocity layer at a depth of from 20 to 30 kilometers, which is only a few kilometers thick, and which has a velocity of from 7.5 to 8.5 kilometers per second.

Use has also been made of surface waves from natural earthquakes. Dispersion studies were made of the New Britain and New Guinea earthquakes, and the results compared with those obtained by Frank Press in America.

In general the group has found its determinations of crustal thicknesses have agreed quite well with those predicted by the geologists. For example, in the Tibetan Plateau the crust is 74 kilometers thick, underneath the north eastern platform it is 40 kilometers thick, and under the Yangtse Valley it is 30 kilometers thick.

Upper mantle studies have been made using P. and S. earthquake waves, and with epicentral distances of from 5° to 30°. Data have been analysed from 12 stations and 37 earthquakes. It has been found that in the eastern part of China there is a regional variation in upper mantle velocities for both P. and S. waves. Two velocity discontinuities have been found in the mantle. The first lies at a depth of about 220 kilometers under continental areas, and varies from 140 to 260 kilometers under oceanic areas. The second discontinuity is at about 400 kilometers.

Another activity of the physics of the earth's interior group has been in the use of gravity techniques. (I was told the man in charge was away, and no one else could, or would, discuss the work of this section).

Finally the division is installing equipment to carry out high temperature and pressure experiments to study the physical properties of rocks under such conditions. Equipment is being built for studies at room temperature and up to 30,000 atmospheres pressure on samples with a diameter of 32 mm., and a length of 170 mm.; and for studies at temperatures up to $2,000^{\circ}$C and pressures up to 100,000 atmospheres.

(c) Meteorological Division

Meteorology is closely related to the national economy, and so there has been a big development in the subject since 1949. Before liberation there were only 10 research workers, now there are more than 100 at this Institute. There are two subdivisions, one is synoptic and dynamic meteorology, and the other is atmospheric physics.

Prior to 1958 emphasis was placed on the following three problems:

1. The study of changes in climate in East Asia. This is a study which should have value for long period weather forecasting. The big changes in East Asia take place between May and June, and between September and October. It has been found that the change of season takes place in several sudden changes, rather than continuously changing.

2. Study of sudden onset of cold currents. This is an important factor in weather forecasting in winter in China. Cold spells in East Asia are sometimes determined by local conditions, but sometimes they are connected with atmospheric conditions in the whole of the northern hemisphere. Therefore for long range forecasting the whole of the northern hemisphere must be considered.

3. Study of the influence of the Tibetan Plateau. The Tibetan Plateau has a great influence on the Chinese climate. The Jet Stream in East Asia divides into two parts in the western part of Tibet, and joins again in the eastern part.

During 1958 the Great Leap Forward occurred and a separate section of atmospheric physics was established. Since then the following problems have been studied:

1. A study of the blocking situation. The atmosphere is constantly moving like a belt, on which are superimposed waves. When the waves are small in amplitude the circulation is smooth. This circulation is from west to east but sometimes the amplitude of the waves is great and the south to north current increases. This "blocking situation" is important for weather forecasting in East Asia, and theoretical studies have been made with a view to aiding numerical forecasting.

2. Research has been carried out on the problems of numerical prediction. This is a consequence of the big development in electronic computors which has taken place in China since the Great Leap Forward.

3. Research on seasonal changes in the stratosphere and troposphere.

4. A study of the influence of solar activity on the atmosphere.

5. Artificial rain-making. Theoretical work on formation of rain in warm clouds and thin clouds has been done.

6. Atmospheric electricity. A study has been made of the effect of lightening on rainfall. Also high voltage laboratory work has been done; and another project has been to study radar meteorology.

(d) Magnetics Division

The magnetics division is in another part of Peking, and comparatively few research workers are in this division. There are seven magnetic stations in China. Most of the research work has been devoted to a study of magnetic variations, magnetic storms and the influence of solar activities. In addition there has been a study of long period changes.

Comment

My visit was limited to about three hours, the first two of which were taken up with set speeches, and the remaining time spent touring some of the laboratories. There was insufficient time to ask all the questions I would have liked to do, and at times there were problems in communication. Despite this, certain general impressions can be stated, although it must be admitted that some of them are more intuitive than based on a really objective appraisal.

The first thing of note was the youth of the research workers. There were few that I saw who could have been over 30 years of age.

Secondly, the library was excellent. It had one of the most complete

collections of current journals related to geophysics that I have seen in any country. The librarian said there were 640 foreign and 140 Chinese journals.

Thirdly, I was struck by the relative crudity of the instrumentation, especially in seismology. Chinese seismologists are working with instruments of a type which were discarded in Western countries more than 20 years ago. Yet despite the relatively poor instrumentation the Chinese geophysicists seemed to be getting a maximum of information out of their data.

On the other hand much of their work was on the application of known techniques and there was little that I was shown which was really new and exciting. If this is representative of the present level of Chinese geophysics then I believe it will be many years before major contributions from Chinese geophysicists can be expected.

Time and again when I was shown examples of Chinese scientific endeavour the adjective which came to mind was "sensible". (I was not shown the nuclear research!). I would apply the same adjective to the level of work on these aspects of geophysics. It would not, in my opinion, be sensible for a country as poor as China to invest more of her resources in such a relatively academic subject.

The Institute of Geology

I had asked for permission to visit Peking University, but it turned out to be closed for vacations and I was invited to visit the Institute of Geology in its stead. This I readily accepted since it is one of the principal training institutes for China's geologists and geophysicists. I was recieved by Professor Gau Yuan-kuei, the Director of the Institute, Professor Tang Chen-tse, the head of the geophysics division, and Wang Shao-shu, the secretary to Professor Gau.

Professor Gau gave the "brief introduction". He explained that the Institute had been founded in 1952, as a result of a Government policy to set up special technical training institutes in order to meet the manpower requirements of the Five Year Plan.

At the beginning it was small in size with 110 teachers for 310 students. It began by combining the geology departments of Tang Shan Engineering Institute (in Herbei Province), Peking University, Chung Hua University, and Tientsin University. At first there was no special campus, but in late 1952 work was begun on the present site. Now, there are 140,000 square meters of buildings and dormitories. The student body has grown to more than 4,000 (600 of whom are women) and there are 800 on the teaching staff (with more than 10% women). The latter include 37 professors and associate professors and 140 lecturers.*

---

* Presumably the other 600 teaching staff are quite junior demonstrators and assistant lecturers. It was the only time at any university or college that I got a breakdown of the academic staff. It suggests that only about ¼ of the figure which the Chinese include as teaching staff would rank as members of the academic staff in Western universities.

A mineralogy laboratory at the Institute of Geology

The Institute is divided into five faculties with ten specialities in all.

A. Geology Faculty
   1) General geology
   2) Stratigraphy and paleontology
   3) Geochemistry

B. Metal and Non-metal Mineral Deposit Geology and Prospecting Faculty

   4) Speciality same name as Faculty
   5) Coalfield geology and prospecting
   6) Oil and natural gas geology and prospecting

C. Geophysics Faculty
   7) Mineral exploration geophysics
   8) Oil and natural gas geophysics

D. Hydrogeology and Engineering Faculty

E. Engineering Prospecting Technique Faculty

Students are required to study for five years. In addition to the 4,000 regular students there are 1,000 corresponding students from all parts of China who take their course by mail. There are more than 100 research workers who study for a further three years after graduation. Since the Institute began 13 years ago, 7,500 students have graduated, together with 150 research students.

Professor Gau continued to bombard me with statistics. There are 320,000 volumes in the library, and the Institute has 80 laboratories, with more than 600 microscopes of all types. There are no tuition fees and all students live on the campus. There are no boarding fees, although in principle the students should pay for their own food. In fact 70% of all students receive grants from the State to help buy food and books. Medical treatment is free.

Ten percent of teaching hours are devoted to lessons on political ideology, and a further two hours a week are spent on studies of current affairs. All students are expected to spend a month a year doing industrial work. Usually this work is related to the student's speciality, "But," said Professor Gau, "the purpose is to put the students with members of the labouring class so that they will not feel superior to the labouring class, and will get the labourers' point of view."

The students also spend a total of 33 weeks during the 5 year course on field studies. Before graduation they are required to write a report in which they must solve a problem which has actually been encountered in the field.

The Institute pays special attention to physical fitness, and has an excellent record for its mountaineering. Some of the students and staff were on the Chinese expedition to Chomo Lungma (Everest), and one of the three who climbed to the peak was from the Institute. Also three of the nine women alpinists who broke the world record by climbing a 7,546 meter peak were from here. They climbed Mount Mustak(?)in Sinkiang.

Following this introductory session we went to look at the Faculty of Geophysics. The first laboratory I was shown was the well-logging laboratory. This was quite elementary and the equipment crude. The second stop was at the gravity laboratory. On the walls were many familiar diagrams showing the mode of operation of different types of gravity meters. There was a Sharpe gravity meter called "Canadian gravity meter #111" in a box labelled #6 of 10. There was also a Chinese-made quartz spring gravity meter which it was claimed had a sensitivity of .3 milligal. Finally there was an Askania gravity meter, and an Askania tortion balance.

We next visited the electrical methods model laboratory. Here were six identical tanks containing water and with copper plates which simulated ore bodies. The potentiometers and recording equipment had been made at the Shanghai Geological Instruments factory. The experiments were performed by third year students.

The fourth stop was at the seismic instrument laboratory. An experiment was in progress, with a woman professor in charge, to study the characteristics of seismometers. (An experiment which might be found in any exploration geophysics laboratory course at a Western university.) The laboratory also had a bank of 24 channel amplifiers from an old seismic recording truck.

Following the visit to the Geophysics Faculty we went on to see some of the mineralogy and petrology laboratories. All of them were well equipped with microscopes. One laboratory, for example, had 15 microscopes with universal stages and were for the use of fifth year students.

The walls of most of the corridors in all the buildings were plastered with posters and slogans, most of which were denouncing American action in Vietnam. There were vivid drawings of American planes in flames, and charts showing Viet Cong successes. I was told they had all been prepared by the students themselves.

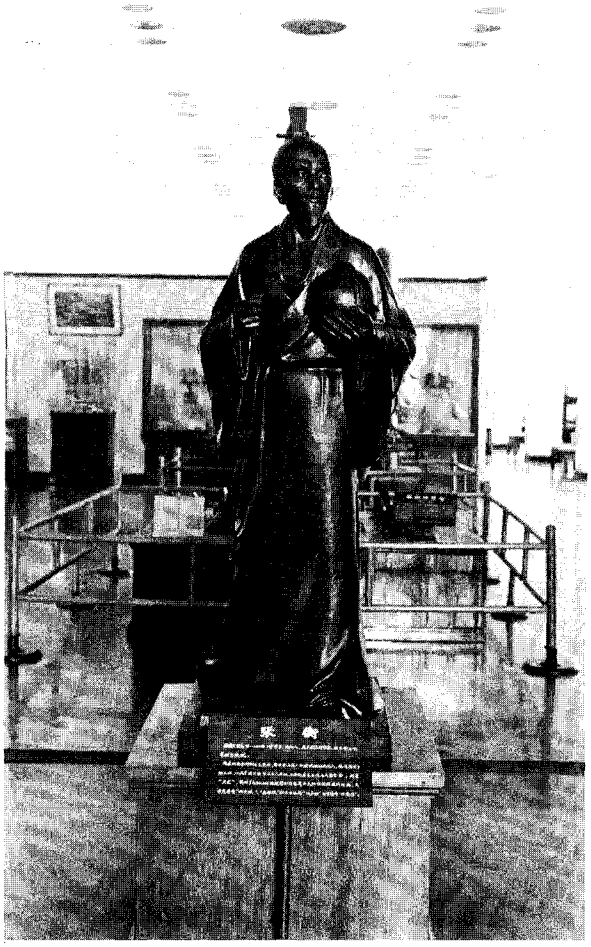
This Institution was one of the most impressive teaching institutes that

I saw in China. It is a self-contained unit with its own shops and cinema. The facilities for training in mineralogy were excellent, and those in geophysics good. The Institute clearly reflects the emphasis that the Chinese Government is putting on the exploration and development of the country's mineral resources.

Yours sincerely,

C.H.G. Oldham.

C.H.G. Oldham.



Jang Herng who invented the seismoscope in the First Century A.D.. The statue was on display in the Peking Museum of Chinese History. The sketch and model were in the Museum of the Institute of Geology.

Received in New York August 26, 1965.