9 March 1973, Volume 179, Number 4077 SCIENCE

Contacts with Earth Scientists in the People's Republic of China

Geological tasks are popular; collective participation and relevance to current problems are emphasized.

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In late August and September 1972, I visited, as a private American citizen, my parents, who live in Peking. During the latter part of this visit, with assistance from the travel office of the Peking branch of the Travel Bureau of the Foreign Ministry, I met and spent most of my time with geologists from various institutes in Peking. I also met several paleontologists in Nanking. This article is a summary of my brief renewed contact with geologists in the People's Republic of China (PRC), many of whom I either worked with or knew before 1945. My purpose is to pass on to the scientific community some of the information I gained during this short visit.

I talked with many geologists during my visits to several geological institutes and their laboratories and museums. Contacts with a larger number of geologists, presumably representatives from more than 20 geological units in Peking, were brief and took place at large meetings. The bulk of the information presented here was obtained during visits to institutes and during a briefing session by eight members of the geological institute of the Academy of Sciences.

In 1961, I summarized the status of geology in China (*1*). In order to satisfy the demand for a drastic increase in geological manpower, rapid training programs were established between 1953 and 1958. During this time, individual geological technicians and geologists received 2 to 5 years of training. Candidates were selected from students in junior and senior high school. Three geological colleges were established for training—in Peking, Changchun, and Chengtu. Between 1000 and 2000 geology students were graduated each year. Hence, by 1958, the PRC had a work force in geology of more than 20,000 people, as compared to less than 200 in 1945. Who did the training and teaching? As one of my geologist acquaintances, now stationed in Nanking, casually commented: During those early days, we (the less than 200 active geologists, many of whom had studied in Europe and the United States) did what was needed; we taught, we looked for ores, or we worked in engineering geology or hydrology, whether we were prepared for that or not. Some of the geologists visited and studied in the Soviet Union in the late 1950's, but essentially this ceased in 1960. The geological work force of more than 20,000 in 1958 has perhaps increased tenfold. Many have obviously gained a number of years of practical experience, in spite of possible interruptions during the Cultural Revolution of 1966 to 1969.

Geological Brigades and Geological Bureaus

1958 was a notable year. It was the year when the people's communes, the Great Leap Forward, and the expeditious construction of a socialist society as enunciated by Chairman Mao were initiated. At this time, the major objectives for geologists were to look for mineral resources, study water resources (including prevention of flooding), and find sources of construction materials and fertilizers. These tasks were to satisfy local needs and were to be accomplished on-site by the local work force —that is, the local people. During this period, knowledge of geology became popularized through the people's communes. (Some of the people's communes have laboratories for ore analysis.) Civic units larger than people's communes have geological brigades, which are work forces smaller than those of geological bureaus. The geological bureau is probably equivalent to geological survey, a term no longer used in the PRC. Geological bureaus exist for regions, such as a district (Hsien), or at a regional or provincial level.

There are two general types of organizations carrying out geological tasks: regional (Kuai Kuai, meaning "blocks") and central (Tiao Tiao, meaning "channeled from above"). The regional office, such as that of the geological bureau of a province, is run and financed by the region and is largely autonomous. The central office, such as the Bureau of Geology in Peking, receives direction and funds from the central government. There is, however, interplay between the regional and central offices. For example, each province is responsible for its own geological mapping, but when the data are compiled into the geological map of the country, discrepancies along provincial boundaries must be resolved

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and must be consistent as far as the entire country is concerned. According to members of the geological institute of the Academy of Sciences, during the early days (in the middle and late 1950's) central direction was important; later, because of the large territories covered, local efforts were emphasized in order to get the job done.

Geological Institutes and Geological Research

What about research and theoretical geological work? Most provincial geological bureaus spend approximately 95 percent of their effort on searching for ores and tasks related to production and only 5 percent on research, even though each provincial bureau has a geological research institute. Geological brigades have to deal with such problems as stratigraphy and structure, yet when such problems become too complicated or controversial they are referred to the provincial geological institutes or to institutes such as those of the Academy of Sciences or to geological divisions of various ministries. For example, the Institute of Geology and Paleontology of the Academy of Sciences in Nanking receives fossil specimens from field geology brigades all over the country seeking verification or identification in order to solve stratigraphic and structural problems.

It is my impression that searching for ore and other materials needed for production and construction emphasized by the PRC is the major responsibility of geological brigades and bureaus. For research in support of these brigades and bureaus, and in specific tasks involving other aspects of research, the responsibility seems to rest with the research section of the provincial bureaus of geology, the geological institutes of the Academy of Sciences, and the geological divisions of other ministries under the State Council (Kuo Wu Yuan). Some of the ministries with geological sections or divisions are metallurgy (Yeh Ching Pu); fuels and chemicals (Jan Hua Pu); communications (Chiao Tung Pu); water and electricity (Shui Tien Pu); health [environmental geology and medicine (Wei Sheng Pu)]; construction materials (Chien Tsai Pu); bureau of oceanography (Hai Yang Chu); and agriculture [water utilization aspects (Nung Yeh Pu)]. In general, those geologists whom I knew before 1945 appear to be associated with geological institutes of the Academy of Sciences or with geology departments or colleges, and they appear to be connected either with research or teaching.

Glimpse of Current Activities

Because my visit to the PRC was so short, I got only glimpses of current activities in geological research. I visited the Institute of Geology, the Institute of Geophysics, the Institute of Vertebrate Paleontology and Paleoanthropology of the Academy of Sciences in Peking, the Department of Geology and Geography of Peking University, and the Institute of Geology and Paleontology of the Academy of Sciences in Nanking.

The Institute of Geology of the Academy of Sciences in Peking is located in a large building in the northern suburbs of Peking. The building has several floors and was constructed about 1953. It houses laboratories for chemical analysis of rocks and minerals; spectrographs; rubidium-strontium, potassium-argon, and ^{13}C-^{12}C mass spectrometers and counting equipment; x-ray equipment; an electron microscope; a laboratory for photoelastic study, as related to geological structure and earthquake studies; and facilities for map-making, including a machine for printing Chinese characters on maps. A museum, displaying samples and descriptions of ten new minerals, as well as rock and ore samples from various localities, is located on one of the upper floors. The rock deformation and testing laboratory and equipment for measuring physical properties such as elastic constants of rocks are housed in a separate building that is newer and smaller than the others. My impression was that the x-ray equipment and the mass spectrometers were old and mostly foreign made, but had probably been repaired or modified. The laboratory of geochemistry is located in Kueichou province. The library is in the same building; up-to-date journals are available, a fact made evident in conversations about recently published items.

The principal activities of the Institute of Geology are directly in support of production. Geological research is generally subordinate. Emphasis is placed on coordinating theoretical studies with their applications and on a shift to quality rather than quantity of work. Among the current leaders of the Institute of Geology are several geologists with whom I had worked or whom I had known prior to 1945: Hou Te-feng, Chang Wen-yu, Ying Tsan-hsün, Yeh Lien-tsün, Ku Te-cheng, Hsü Yü-chien, and others.

After the earthquakes of March 1966 at Hsingtai (about 320 kilometers south-southwest of Peking), earthquake prediction became a national project. The Institute of Geology spent more than 60 percent of their effort last year on studies related to earthquake prediction. Earthquake prediction is a program involving some 10,000 trained personnel (including those monitoring water levels in wells and reading earthquake instruments). The earthquake prediction program is run by the Bureau of Earthquakes, which consists of three principal units led by the Institute of Geology and the Institute of Geophysics of the Academy of Sciences in Peking and the Institute of Engineering and Mechanics in Harbin in northeast China.

In developing methods for both long-range and short-range prediction of earthquakes, the program makes detailed geological maps of areas of earthquakes, supplemented by monitoring and surveying of earth movement. The geophysical instruments used in monitoring and surveying are seismometers (made in China), magnetometers, clinometers, extenometers, gravimeters, and strain gauges. Some of the instruments are automated. Water level and radon content of wells are also monitored. The Institute of Geophysics provides not only the geophysical instruments for seismological stations, but also the scientific manpower for interpreting the records. Earthquake brigades, with troops of geologists, geophysicists, and engineers, are organized for provinces and cities in danger of earthquakes. Earthquake stations are established in such regions, and earthquake offices are established for smaller areas. Some of the activities are on the level of people's communes.

For long-range prediction, records on earthquakes have been compiled since 1950. Data on areas of major earthquakes and areas in danger of earthquakes are being compiled, and areas are divided into categories based on such criteria as prediction of danger for 5, 8, 10, and up to 100 years. The short-range tasks of earthquake brigades include the study of engineering geology problems relating to construction, the handling of short-range forecasts by personnel of the Institute of Geophysics, and the formulation of

building construction and structural design criteria to enable buildings to withstand earthquakes (under the jurisdiction of the Institute of Engineering and Mechanics).

As was true of other institutes, most activities of the Institute of Geology, except those directly supporting production, were suspended during the Cultural Revolution. Publication of geological information of the institute will resume by the end of 1972. A new geological map of the entire country, with a scale of 1 : 4,000,000, will probably be published early this year by the Bureau of Geology. I have been told there will be no gaps in the geological coverage at this scale.

Chow Min-chen (a mammalogist) and Woo Ju-kang (a paleoanthropologist) accompanied me on a quick tour of the Institute of Vertebrate Paleontology and Paleoanthropology, which is located near the Institute of Geology of the Academy of Sciences in Peking. I also met Yang Chung-chien, a vertebrate paleontologist. Chow, an old friend, also accompanied me to Choukoutien, where a new skull of *Sinanthropus pekinensis* was discovered in 1966. This is an important find, since the five skulls found earlier disappeared during World War II.

An account of the advances in paleoanthropology up to 1965 was published by Woo Ju-kang (*2*); much of the later work has not been published. Woo let me photograph several important finds (some of which were published in his review article): teeth of *Dryopithecus* from Yuanmo, Yunnan province; a hominid skull from Lantian, Shensi province; the new skull of *Sinanthropus pekinensis* from Choukoutien; and teeth and mandibles of *Gigantopithecus* from Kwangsi province.

Rich mammalian fauna are associated with some of these paleoanthropologic finds; these fauna were studied and the findings published by Chow Min-chen (*3*). However, the important finds of recent years have not been published yet; these include Middle Paleocene lemuroids from Chienshan, Anhuei province; a Middle Paleocene mammalian fauna from Nanhsiung, Kwangtung province, and Chaling, Hunan province; and a Late Paleocene mammalian fauna from Tulufan of Singchiang–Uigur Autonomous Administrative Region. According to Chow, the Paleocene fauna are the only ones that have been found outside the United States. One of these new finds is a new genus and species of Pantodonta. Publication of descriptions of these materials was planned to begin in late 1972.

There have also been many finds of lower vertebrates. Several of these were described in the July 1972 issue of *China Pictorial* by Yang Chung-chien and his students: the flying reptile *Dzungaripterus*; the skull of a giant rhinoceros *Dzungariotherium; Turfania*, a kind of paleoniscid fish of the Late Permian. Another find is *Lystrosaurus*, of the Early Triassic, in Sinchiang; *Lystrosaurus* has also been found in Antarctica. Just how findings of *Lystrosaurus* relate to each other is an interesting question.

Department of Geology and Geography, Peking University

I also visited Peking University. Among those on the faculty of the department of geology and geography were Lo Sun-hsün and Wang Chia-yin, whom I knew before 1945. Enrollment of students in the department of geology and geography was resumed in May 1972. This is the first enrollment since the Cultural Revolution began in 1966. About 160 students were enrolled in two areas of earth sciences: geomechanics and geochemistry. Courses to be offered in geomechanics, in addition to mathematics, physics, and chemistry, are general geology, combined mineralogy and petrology, geomechanics, paleogeography and lithologic facies, paleontology, historical geology of China, geophysics, geophysical methods, political science, physical education, actual physical labor, and foreign languages. Other courses in geology may be added later. Courses offered in geochemistry, besides mathematics, physics, and chemistry, are general geology, mineralogy, petrology, mineral deposits, geochemistry, experimental methods, and geomechanics.

The emphasis of university education is on making study parallel to practice—that is, to practice what the student has learned. Just how this is to be done in the geology courses mentioned above was not explained. The university has more than ten factories. For instance, a biology student spends part of his time going to classes and studying biology and part of his time working in a pharmaceutical factory run by the university. Arrangements can also be made for students to work in a factory (related to his field of study) outside the jurisdiction of the university. It was pointed out to me that, after the student has completed the 3 to 4 years of training curriculum now planned, he can continue study, join a research institute, become a teacher, or go back to his old job (a student who has worked for five or more years before enrollment generally continues to draw the same salary from his old job). He is guaranteed a job.

I also visited the geological display of the department. Most of the samples are from various parts of China.

Institute of Geology and Paleontology

The activities of the Institute of Geology and Paleontology of the Academy of Sciences in Nanking are those of fossil identification and settling problems of stratigraphy. Six scientists I knew prior to 1945 have been in this institute since 1950 or thereabouts. They are Lu Yen-hou (trilobite specialist), Chao Ching-ko (ammonite specialist), Yang Ching-chih (bryozoa specialist), Hou You-tang (ostracod specialist), Ku Chih-wei (pelecypod and gastropod specialist), and Li Hsin-hsueh (paleobotanist). They and their colleagues are responsible for the complete revision of the lower Paleozoic section of north and northeast China. They have developed great interests in spore and pollen studies, Charophyta, other areas of paleobotany, and ostracods; they are particularly interested in deposits of continental facies, for I was told that the oil fields of importance in China are from rocks of continental facies.

I believe that being able to speak Mandarin fluently, and to read and write Chinese, as well as the fact that I knew a few of the geologists already, helped me to regain contact with geologists in the PRC. These are the first steps toward further exchange of data and ideas of mutual interest and benefit.

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