JPRS: 3672

10 August 1960

TWO YEARS' SURVEYING AND DEVELOPMENT OF PETROLEUM RESERVES IN COMMUNIST CHINA

by G. Ye. Ryabukhin

Photocopies of this report may be purchased from:

PHOTODUPLICATION SERVICE
LIBRARY OF CONGRESS
WASHINGTON 25, D. C.

U. S. JOINT PUBLICATIONS RESEARCH SERVICE
205 EAST 42nd STREET, SUITE 300
NEW YORK 17, N. Y.

F O R E W A R D

This publication was prepared under contract by the UNITED STATES JOINT PUBLICATIONS RESEARCH SERVICE, a federal government organization established to service the translation and research needs of the various government departments.

JPRS: 3672

CSO: 4077-D

TWO YEARS' SURVEYING AND DEVELOPMENT OF PETROLEUM RESERVES IN COMMUNIST CHINA

/Following is a translation of a Russian-language monograph by G. Ye. Ryabukhin entitled Geologiya v Kitaya (Geology of China), Moscow, 1960, 31 pages./

Table of Contents

The Author's Preface

The present brochure was written at the end of 1958, soon after my return from China. Additions and corrections were inserted at the end of 1959. I read lectures and trained post-graduate students at the Peking Geological Surveying Institute. During the two years of my stay I toured various parts of the Chinese People's Republic. I visited all oil-producing areas to get acquainted with various geological and surveying institutes.

The brochure consists of two parts. The first part tells of trips to certain oil fields, and the second part tells of the training of geologists, to which there is added information on the higher educational institutions of the KNR [Kitayskaya Narodnaya Respublika -- The Chinese People's Republic].

I had always wanted to go to China, wishing to familiarize myself with the geology of its mountains and plains, which have much in common with the geology of our own eastern parts. Eventually, in the years between 1956 and 1958, the opportunity came to visit that enormous and interesting country and to get acquainted not only with its natural beauty, but also with its remarkable people who are constructing a new life.

After a warm and touching welcome at the Pobeda [Victory] railroad station, we were driven along the Peking streets. It was a hot day. The temperature reached 38° in the shade. I perspired freely in my thick clothing appropriate only to Moscow's cool weather.

We drove to the famed Tien-an-men -- the Square of Heavenly Peace -- familiar from newspaper pictures. The car sped along the main Hsin-an-chieh Street and soon entered a maze of alleys with bright and colorful shop signs.

In the northwestern part of Peking, beyond the old city wall, rose the imposing buildings of the new Hsi-tiao Hotel, which is often referred to as the Friendship Hotel. Our car arrived there.

The hotel is situated conveniently beyond the city's noisy streets. The windows overlooked the Western Hills of Peking. The roar of airplanes could be heard as they arrived at the nearby airport.

Every Soviet citizen, who has visited China, is invariably touched by the warm attitude of the Chinese toward everything Soviet. Wherever one appears, be it at an institute, enterprise, or a theater, the kindly eyes are always watching him. He can hear the admiring exclamation "Su Lien, Su Lien" which means Soviet.

I. At the Oil Fields of China

The victory of the Chinese revolution and the creation of the Chinese People's Republic have brought freedom, independence, and national sovereignty to that great country. China has become a truly great state. Jointly with the Soviet Union, and other socialist countries, the Chinese People's Republic is strengthening the might of the socialist camp and is carrying out a struggle for peace and international security.

The Soviet-Chinese friendship is eternal and indestructible.

Observing the 10th anniversary of the Soviet-Chinese Agreement on Friendship, Alliance, and Mutual Aid -- signed on 14 February 1950 -- the Soviet people are wishing that their Chinese brethren achieve new successes in their construction of socialism, under the leadership of the glorious Communist Party of China.

With this feeling the Soviet specialists, assigned at one time or other to work in the CPR, share their knowledge and experience with their Chinese comrades. They help to train numerous young Chinese specialists.

I had to work, mainly, at a university in the CPR.

During the winter months I read lectures and taught post-graduate students. They were eight in number, among them a young girl. These were talented and inquisitive young people, who yearned for great deeds and interesting work.

According to plan, they were to write short scientific themes following a visit and research at one of the oil fields. Therefore, during the summer the post-graduates were sent to various oil-bearing areas of China.

In supervising their work I visited places most interesting from the geological angle. The tour included the oil deposit areas, from the westernmost Sinkiang to the central and eastern parts of the Red Basin, and further down to the great plains of North China and Sungliao. I was accompanied by Yuan Pao-hua, young assistant lecturer at the Geology and Petroleum faculty, and translators Liu Hsueh-chung and Cheng Ming-ying, who were my devoted friends and assistants during my entire stay in the CPR.

The geological structure of China has interested me for a long time. It is a mountainous country. The plains are all at the eastern fringes and hardly constitute one tenth of its 9.9 million sq km. The mountain systems are latitudinal as well as meridional. According to the apt description of the leading Chinese geologist, Li Ssu-kuang, "the geological structure of China is very complex and its territory is bound by the huge Tibetan massif, or 'the roof of the world.' It forms a 'staircase,' the steps of which descend toward the seas, with shelf-like strata, surrounding the Pacific Ocean. The 'staircase,' however, does not follow the semicircular structure. It is rather curved, dented, and broken-up." /See Note/ (Note: See Li Ssu-kuang, Geologiya Kitaya /Geology of China/, page 9. Foreign Literature Publishing House, Moscow, 1952.)

East to west, across these sunken or elevated areas, pass the mountain ranges influencing the flow of China's rivers. The Ying Shan divides North China and Mongolia; the Chin Ling is a watershed between China's two greatest rivers, the Yangtze and the Yellow. The Nan Ling range divides the Yangtze valley from the rivers of South China.

In the west, the Tibetan plateau, with a mean altitude of 5,000 m, consists of geologically young arcs of the Himalayas and the Trans Himalayas and the latitudinal system of the Tang-la and Kunlun ranges.

The mountain ranges north of the Himalayas were formed in the Archeozoic, Cenozoic, and Paleozoic periods in ancient oceans hundreds of millions of years ago.

Between the mountain ranges are the great depressions, sometimes lying below sea level, e.g., the Turfan depression, but more often they rise 2-3 km, as in the case of the Tsaidam depression. These depressions consist of thick stratification of sand, clay, and argillaceous schists dating from the comparatively recent Mesozoic and Tertiary periods, counted in tens of millions of years. Some time in the past large fresh-water lakes existed there; some of these lakes were briny. Flora and fauna deposits in these prehistoric lakes are now oil and coal formations. The existence of vast depressed basins is characteristic of Central Asian geology. Such depressions, lying between mountain ranges, are also found in great numbers in Middle Asia, particularly in the Trans-Baikal area, but they are considerably smaller in size. The Baikal lake depression differs from others only by the greatness of its size.

From the geological point of view, China is a realtively calm and stable area of the earth's core. However, in comparison with other stable areas -- the Russian and North American platforms -- it becomes evident that even as early as the Paleozoic period the Chinese platform began to break into separate blocks and boulders.

The resulting process created depressions in some places. These depressions are bound by very deep breaks, the roots of which, perhaps, sink into the nether areas of the earth's core. We were to look over the oil fields situated in the depressions.

II. The Dzungarian Depression

We started our work in the western frontiers of China.

We reached Urumchi from Peking by plane, via Sian, Lanchow, and the Kansu Corridor, in 15 flight-hours, almost as much time as a flight to Moscow. Sinkiang Province occupies an area of 1.7 million sq km, i.e., 17% of China's entire territory.

New mining towns appeared in Sinkiang with the development of its oil industry.

Our first visit was to the small mining town of Tu-shan-tze where the existence of oil had been known for a long time. Surveying was first carried out in 1938. However, large-scale surveying work started only in 1956. Here the oil deposits are found in an anticlinal fold /See Note/, which measures 8 km in length and 4 km in width. It stretches north to south, in a foothill cavity at the northern slopes of Tien Shan. It is a narrow and complex fold, with a muc volcano at its nucleus. The fold is formed of sands, sandstone, and clay of red and green colors. The age of the rock is Tertiary. Oil is found in the lower and upper parts of the cutaway. /Note -- A form of stratification in the earth's core, with an upward prominence. This form, created by a mountain-shaping process, is favorable for accumulation of oil and gas./

This oil field resembles, in its aspects and operation, a small oil field in the Fergana depression in Uzbekistan. The wells group within a small area. When we were at the oil field, a new well began to produce oil at a rate of 20 tons per day. There is a small oil refinery in Tushantze.

I was mostly interested in the manifestation of the mud volcano form. It lacked the marked characteristics of mud volcanoes in our Baku area.

However, it had, in the center of the oil field, a prominence consisting of mud made up of rock fragments in the clay. This product of a past volcanic eruption occupies an area of approximately one sq km.

Later we drove in cars to the main oil field of the Dzungarian depression, the Karamai-Urkho. To reach it, we had to cross the depression south to north. After a 20-kilometer ride we lost sight of the last scrawny trees and found ourselves in a desert covered with small, dark pebbles.

The Dzungarian inter-mountain depression is up to 1,000 km long and 300 km wide, forming a rough triangle. In the north it is hemmed by the ridges of the Mongolian Altai system /Sailishan, Tarbagatai, and the Dzungarian Ala Tau ranges/. East to west the depression is open. In the south lies the majestic Tien Shan range, with snow-capped peaks, such as Bogdo-Ula, which towers 6,512 m.

These mountains are formed of metamorphosed rock, lower Paleozoic in the north and upper Paleozoic in the south. The depression was formed by a thick deposit of Mesozoic and Cenozoic sandstone-clay rocks. At the southern tip the thickness of deposit reaches 5-10 km. Here is a complete cutaway from the Triassic deposit, formed some 200 millions of years ago, to the Tertiary deposit. The age of the latter is placed within the first 20 million years. On the northwestern fringe of the depression, in the vicinity of the Karamai oil field, the sedimentary rock thickness is not great -- 500-1,000 m; closer to the center it is 2,000-3,000 m. The Mesozoic and Cenozoic deposits are continental. They were formed on the beds of former lakes.

The end of the Triassic and Cretaceous periods was the era of coal formation here, but oil, apparently, was forming during the entire Mesozoic and Cenozoic periods.

The foundation of the depression in the southern foothill bend, underneath the Mesozoic and Cenozoic rock deposits, was formed of upper Paleozoic rocks. Nevertheless, some geologists assume the presence of a massif in the center of the depression.

Soon we arrived at the large settlement of the Karamai oil field.

In one part of the settlement workers were making bricks from loess loam. Nearby, single and two-story buildings were going up. Colored clay, mined in the vicinity, was used for painting the exteriors of the buildings. Oil wells are scattered throughout a large area, with gaps of 2-3 km.

The Karamai oil field has expanded in one year. Karamai in the Uighur and Kazakh languages means "black oil." The presence of oil and asphalt hills were long known here. They were even described by academician V. A. Obruchev, who traveled in China from 1906 to 1909. However, no surveying was done here earlier on the assumption that the oil deposits were weathered out. Surveying began in 1956.

In October 1955 one of the wells yielded oil and in the same year the number of wells increased several score.

Surveying covered a vast area from Karamai to Urkho, an area of 80-100 km, where wells were drilled 2-3 km apart. Why are the wells so scattered? This is motivated by the geological structure of the area. Oil-yielding rocks of the Mesozoic age cover a vast area, forming a structure called a monocline where the rocks slant slightly.

The Karamai-Urkho area is situated at the northwestern slope of the Dzungarian depression. On the northwest it is bound by the Dzayir range. The range is composed of several mountains: the Khara-Arat in the northeast, the Chenghiz in the central part, and the Kyr in the northwest. The flattened peaks, rising 150-200 m above depression level /600-700 m above sea level/, are near the oil-bearing areas.

Two types of relief are very evident here: the settled, widely dispersed, and flattened forms of the ancient relief, and the clear-cut features of the young relief. The latter resulted from the recent upheaval of the earth.

At a distance of 2 km from the Karamai settlement there is a dark, gently sloping elevation of 50-70 m. At closer range we found it to be an asphalt hill consisting of sand cemented by asphalt and thick oil. Along the slopes ran narrow ditches, about 2 m deep.

Here the local population extracted oil for their daily needs. The oil accumulated by seepage into the ditch, which was periodically collected by the people. The ground underfoot was sticky. Oil was seeping and running down the slope in thin streams. There were many such hills and they all stretched from north to south. Each one of them was at least one sq km in size. There were also asphalt mounds, 2-3 m high, consisting of pure asphalt.

This great manifestation of oil -- the most pronounced in the world -- had also played a negative role in surveying. Some geologists were assuming that millions of tons of oil had seeped through to the surface and that there was no industrial oil left in the Karamai depths. But geological survey has determined that Karamai still contains large deposits of oil. In 1958 new oil horizons opened here.

The best prospects are in the sagging zone, where surveys had not been giving good results for a long time. Aside from the large fault, there are smaller faults closer to the mountains. Due to the slight thickness of sedimentary rock, the Chinese geologists call the entire zone from Karamai to Urkho a young platform. Undoubtedly, it is a more composed tectonic zone, as compared to the pre-Tien Shan flexure in the area of the Tu-shan-tze oil field.

After a day in Karamai we left for the Urkho settlement. It is situated near the Diam River. Even from afar we could see the fairy tale outlines of the bright Aeolian city /See Note/, so beautifully described by academician V. A. Obruchev 50 years ago. /Note -- Aeol is the Greek God of Wind./

These wonderful forms of weathering, apparently, appeared recently when the terrain form was rejuvenated. The ground had risen and underwent great erosion at the same time.

Perhaps there is no other place in the world with such fairy tale figures resembling old castles, towers, palaces, and pagodas. This spot was visited by V. A. Obruchev and he called it the Aeolian City. However, this is a much larger area than he described. The center of it lies 10 km from the Urkho settlement. The oil-bearing sandstone here is cut by vertical fissures, which are filled with black and brittle asphaltite. Seen from afar, the asphaltite looks like coal, but it looks more like a volcanic glass when crumbled. The veins are 1-2 m thick. The asphaltite, called "obruchevite," is used for highway construction. The roots of the vein disappear into the recently discovered oil deposits. Karamai and Urkho actually form one vast oil field. Production plans are outlined for three million tons of oil by 1962. This will be one of China's largest oil fields.

Having familiarized myself with the Karamai-Urkho oil fields, and leaving the post-graduates to write their assignments, I flew eastward to Laotsunmiao.

III. Laotsunmiao

At present a railway line is being built here from Peking, via the cities of Sian and Lanchow. This great route continues further west over the Turfan depression, to the westernmost province of Sinkiang, and on to the Soviet Union border.

It is most vital to develop oil resources in the desert, where the deposits stretch from the western parts of Sinkiang Province to the eastern part of Kansu Province, a distance of more than 2,000 km.

The Laotsunmiao oil field is situated in one of the foothill depressions, north of the Nan Shan range. The size of the depression is not large, only 230 km long and 20-50 km wide. Within is the southern foothill fold zone, with the Laotsunmiao, Khersia, and Shihkou oil fields, the central flexure zone where the great thickness of sedimentary rock reaches 4,000-5,000 m, and the northern zone with the Payangho oil field.

This mountainous country has no less than 30 similar basins, not counting the Chiuchuan basin.

Geological survey in this area began as early as 1939, but it reached a large scale only after the liberation.

All of the surrounding mountains command a majestic view of the city and the oil field.

The geological structure in Laotsunmiao makes an assymetrical anticline, 25 km long and 8 km wide, stretching in a northwesterly direction. There are numerous 30-meter derricks.

The axial part of the fold, with both wings consisting of reddish Tertiary suite rock, can be seen clearly from the rock yield.

The nucleus of the structure is broken by faults. The oil lies on three levels -- "K," "L," and "M" -- in the lower portions of the Tertiary deposits. "L" is the richest level. It yields over 80% of the oil and is 40-70 m thick. Six oil-yielding strata are evident here. Gushes yield 100 and more tons per day.

In the spring of 1957, one of the 400-meter deep wells started a gush of oil which was impossible to subdue. Within a week it discharged more than 10,000 tons of oil, traces of which can still be seen on the ground surface.

Several hundred deep, operational wells are being drilled here. Oil in these wells is of a comparatively light type, with a large paraffin content. In 1946 the oil field was producing 97% of China's total output. In 1953 production exceeded 800,000 tons. In 1962 it is planned to double the figure, particularly since the new structures were discovered.

Close to the oil field, and at the site of the former Laotsun monastery, is Yumen city. It is perched 2,400 m above sea level. This is the center of Western China's oil industry. The city has a population of 60,000. The oil workers love it and are proud of their new, desert city, which is literally growing day by day.

The honor for the oil discovery here belongs to the Chinese geologist Sung Kiang-chu. He died at the oil field. A modest monument stands in the middle of the city park. A stone obelisk describes, in Chinese characters, the life of this remarkable man; his portrait is framed with flowers.

On the second day of our arrival in Yumen we inspected the small Scientific and Research Institute, organized a year ago. It occupies a two-story building and is equipped with modern apparatus and instruments. The institute has a geological laboratory to study rock, to analyze oil, and to determine the physical properties of mineral rocks. There are also laboratories for technical and physical analyses. Laboratories on drilling are now in the organizational stage.

IV. The Mountainous Depression of Tsaidam

From Yumen we traveled three days in a car to the Tsaidam depression, over the pass on the Chilinshan range, a distance of 1,000 km.

The Tsinghai-Sikang-Tibet plateau, with the Tsaidam depression at its northern part, occupies an area equal to one quarter of the entire Chinese territory /2.3 million sq km/. It is about 2,000 km long and 1,100 km wide. This is the largest plateau in the world. In the south it is skirted by the Himalayas and Trans-Himalayas, with peaks reaching 8,000 m. The mean altitude of the plateau is 4,000 m. The sources of the great rivers of Asia -- the Yangtze, the Yellow, and the Mekong flowing into the Pacific Ocean, and the Hindus, Bramaputra, and the /Siluen?/ flowing into the Indian Ocean -- are here.

The Tsaidam depression occupies the northern part of the plateau. It lies between the Nanchan range in the north and the Kuenlun in the south. Covering the area of 120,000 sq km, the Tsaidam depression is the lowest part of the plateau. The bed of the depression has an altitude of 2,700-3,200 m above sea level.

We inspected the Leng-hu oil field in the northern part of the depression. First we had to pass through the settlement of a hundred or so warm tents. Immediately beyond the settlement an exploratory well was being drilled in the oil-soaked sand. These sands stretch in a ribbon 20-30 m wide and over 2 km long. Thousands of tons of oil have seeped to the surface, through the fault fissure.

A number of wells, drilled in Leng-hu, yielded a great flow of industrial oil. Oil surveying in 1959 was rewarded with the discovery of large oil deposits and gas reserves in this group. In 1957 there were only a few scattered derricks.

We inspected an uncovered cutaway, gathered rock samples, and talked with geologists. We left Leng-hu and toward evening arrived at the center of the new Manieh oil industry. It was a city of tents where no less than 5,000 persons were living. Among the thousand or so tents there were a few wooden structures -- a hotel, club, electric plant, repair shops, and the central laboratory.

The surrounding hills were remarkable forms of pillars and towers, results of weathering.

Working under extremely harsh climatic conditions, bitterly cold winters, and alpine terrain, Chinese geologists are not only surveying, they have organized year-round work at the central scientific and research laboratory, where in the past three years thousands of analyses were performed.

This place has everything necessary for an advanced oil field. A great deal of research work is being done, too. For instance, spores and pollen of ancient plants are studied, the porosity and permeability of rock is determined, and study of luminescence is organized together with chemical analysis of oil, gas, and water.

I made a circuitous tour of the basin's northern parts, in order to look over the geological sections. The next day we left for the western part of the Tsaidam depression.

At an altitude of 3,100 m stands the Yu-sha-sha tent settlement, scattered over a mountain slope and without a single wooden building. The mountain is formed entirely of oil-bearing sandstone. A precipice here consisted of no less than ten layers of sandstone soaked with oil. Each layer was 2-3 m thick. The sandstone layers were divided by layers of grey, green, and red clay. The upper and lower parts of the cutaway showed thin, but tight, layers of limestone, full of various shells. Some time in the past there existed a lake here which formed the limestone sediment. As the lake was becoming shallow it accumulated a sediment of red clay and sandstone streaked with fine pebbles. All sandstone was of rough grain and oblique formation. These were formed under very shallow water conditions. The oil, most probably, penetrated from the depths.

At the time of my visit, workers were getting the first Tsaidam oil by pumping shallow wells. The oil-bearing fold was approximately 40 km long and 20 km wide. Within the fold three separate cupolas were discovered. The surveying results were good and there was no doubt about the existence of considerable oil deposits.

After a first-hand look at the oil field and after a talk with Chinese geologists on their surveying work, we left for Lanchow. The 1,200-kilometer route lay over mountains, through deserts, and past China's largest lake, Tsinghai, or Kokonor, as it was known in the days of Przheval'sky's travels. In the beginning we moved along the familiar road in the north, but after the first 50 km we turned toward the northeast. The boundless, marshy desert stretched as far as the eye could see. One could walk on the salt-encrusted ground as on hard packed snow. In places the desert glistened with crystals of gypsum.

The periodic deposition of salt had stopped life completely in the Tsaidam depression. The formerly rich fauna of fish and protozoa, and plants in the enormous lake formed ready material for the formation of oil. The actual formation of the depression's bed remains unknown.

Tsaidam has magnificent highways connecting directly with Kansu, Sinkiang, and Tibet. This will inevitably help the more rapid development of mineral riches in Tsaidam, the most elevated of the oil-bearing depressions in the world. The survey work at present is complete on both sides of the two railway lines: the Lanchow-Tsinghai line, which will pass close to Tsaidam, and the line which will stretch to Tibet. Traffic is scheduled to open in 1962 on both lines.

Oil is the most important mineral of the Tsaidam depression. The Chinese press often refers to Tsaidam as the "sea of oil." There is no doubt that it is very rich in "black gold," and in coming years even richer deposits of it will be found in spite of the surveying hardships.

The tertiary deposits in Tsaidam show more than 100 structures favorable for oil and gas surveying. To date over 200 derricks have yielded oil or gas. Individual derricks yielded gushes of over 100 tons per day from the productive levels, located at the lower part of tertiary deposits. Surveying work is in full swing at 35 structures. Deposits of gas were found in a number of places, at the northeastern part of the depression. Along the sides of the depression gas and oil deposits were discovered at only 300-600 m depths. The most promising are in the western and northwestern parts of the depression. /See Note/ /Note -- P. Ya. Antropov. On Certain Achievements of the Geological Surveying Service of the Chinese People's Republic, Sovetskaya Geologiya (Soviet Geology), No. 12, 1958, p 7./

Aside from oil, the basin has other minerals. The sedimentary rock contains coal. The large and small lakes of Tsaidam contain large reserves of borax, potassium, and common salt. In the surrounding mountains, especially in Kunlun and Tang-la, there is iron ore, lead, copper, nickel, chrome, gold, and phosphorus.

Although industry is generally being developed in the Tsaidam depression, the basic industry is mining.

V. The Red Basin

This basin derives its name from the great quantities of ferruginous sandstone, shale, and clay which, with the help of the humid climate, form a red-colored soil.

The main part of the Red basin lies in Szechuan Province.

Szechuan Province is the bread basket of China. Over 80 million people live here. In rice crops Szechuan, like Kwangtung Province, holds one of the most important positions in the country. The total arable acreage in the province constitutes 21% of the entire territory, and in Chengtu -- where rice and wheat grow in winter -- the arable acreage is more than one half of the entire land.

Chengtu is the main city and the trade center of Szechuan Province. In the past few years Chungking underwent great development, but Chengtu retains its importance with its higher educational institutions and plants. Goods are shipped from there to Shansi in the northeast, to the mountainous areas of Tsinghai Province in the northwest, and up to Kangt'ing in the southwest, where the alpine highways to Tibet originate.

After arriving in Szechuan I started out to inspect the gas fields of Lungch'ang, in the company of post-graduate students and geologists.

Wells in Lungch'ang are drilled to a depth of 2,500 m. Some of them yield up to 500,000 cu m of gas fuel per day from the dense, fissured limestone of the Triassic period. Limestone is formed in folds 12 km long and 4 km wide, with angular inclines up to 50° in the northern wing and 20-30° in the southern wing. This creates a favorable condition for subterranean gas storage.

We visited a small plant where chemically pure carbon black is produced by burning gas. The gas passes through an installation which removes sulphur. The desulphurized gas then passes into furnaces -- low brick buildings -- through perforated pipes. It burns and forms soot. The upper part of the furnace, in the form of a metal shed, collects the soot. The shed is constantly moving in order to drop the soot through funnels into a wide pipe. The soot is then sucked into the distribution room, where it is purified and packaged. Almost all work is mechanized. Carbon black, or pure soot, is mainly used in the rubber industry to manufacture automobile tires and inner tubes.

Szechuan has a number of similar plants. They can also be found in Northeast China, particularly at the Fushun shale and coal mines.

One forms an unforgettable impression of the Lungch'ang oil field. Nature here is striking. Bamboo groves are interspersed with slender palm trees. Among the palms grow the southern pines with spreading limbs, often portrayed in Chinese paintings. Magnificent two-story houses stand among the greenery. Banana trees reach the height of two-story buildings. Oil derricks are visible on the mountains and sometimes in the lowlands, in the middle of rice fields.

We looked over the Huang-kuo Shan area /meaning "cucumber mountain" in Chinese/, where there is a small, new settlement, hardly one year old.

Ten deep wells have already been drilled here. Several of them yield gas. The derrick armature is iced due to the rapid expansion of gas discharge. The gas is used for the daily needs of the settlement. Unlike Lungch'ang, gas in Huang-kuo Shan gushes from depths of 500-700 m only, from the upper parts of Triassic limestone. One well yielded light oil from a depth of 1,000 m.

Oil produced in 1957 was essentially the first oil yield in the Szechuan basin. In 1959 great deposits of oil were discovered in the gently sloping structures of the Red basin's central parts. But during our visit only gas deposits, with signs of some oil, were found in the southern and southeastern parts of the basin.

The Huang-kuo Shan fold is about 25 km long and 3-4 km wide; the wings are steep, the vault even, and the shape box-like. A well was being drilled to a depth of 2,500 m in its central part, aimed at the deeper Permian formation which is assumed to contain gas and great quantities of oil, similar to that of Lungch'ang.

It took us several hours to reach Chungking from Huang-kuo Shan. This large European style city lies in the mountains. It is one of the warmest spots in China. The mean temperature in July is 29.5°. On windless days temperatures may reach 35-37°. Such heat stays for days and is accompanied with very high humidity.

The Szechuan basin is shielded from the cool northern winds. From the south monsoons descend on the basin and warm it even more. Palms and mulberry trees grow alongside pines in its mountains.

We left Chungking for the Shihwukuo oil field, 30 km from the city, where for the past four months a gas gusher had been active. The Shihwukuo oil field is on a narrow fold stretching scores of kilometers. Such folds are numerous in the eastern parts of Szechuan Province.

The Szechuan basin, in the Shihwukuo area, consists of a broken-up mountain range with relative elevations of 500-600 m. The derricks are in deep valleys, among trees and rice fields, and only occasionally on higher ground. We visited the southern part of the basin where over 60 favorable structures are known; industrial gas is found in ten of them. Gas deposits are estimated in billions of cubic meters.

In the Szechuan basin, or Red basin as it is better known, Cretaceous and Jurassic rock are commonplace, with red and pink sandstone-clay, formed in ancient times in the great lake. Their thickness is about 3,000 m. Beneath these lie carbonized sea rocks of the Triassic age, limestone, dolomite, marl, and shale of about 2,000-meter thickness. Below these are Paleozoic and Jurassic rocks, alternating with coal-bearing suite and limestone. So far there are no data on the composition of the more ancient deposits. The total thickness of sedimentary rocks in the basin, above the crystallic formation, reaches 8,000 m.

Facts of gasogenic riches of Szechuan were known about 2,000 years ago, when men dug wells in temples, using bamboo contraptions, to a depth of 200 meters. Thus the first wells in the world were drilled in ancient China. Gas was used to illuminate and heat homes. Gas production through primitive methods began only about 100 years ago.

Until 1949 the volume of drilling work was very small. Gas was known to be only in two places -- Lungch'ang and Shihwukuo. Large-scale surveying was recently carried out in Szechuan. Oil and gas sandstone of the Jurassic age was found in 1958 in the central and most placid area of the basin. There Chinese specialists, in cooperation with Soviet scientists, discovered large structures with more than 25 natural subterranean deposits of oil, reaching 50 km in length and 20 in width, i.e., Lungyussu, Kuanan, Nanchung, and others. These structures, somewhat similar in form and size to our platform folds in the area of Second Baku, yielded oil gushes. Today it is one of the largest oil fields in China, the exploitation of which is barely beginning.

The characteristic feature of the CPR's oil deposits is their location in vast inland basins. The edges of these depressions and basins are formed of Paleozoic, Cenozoic, and Archeozoic structures, while the central parts Mesozoic, Cenozoic, and, as a rule, continental deposits. The basins, sharp in relief, are surrounded by mountain ranges with peaks two, three, and more kilometers high. Our Fergana and Baikal basins appear to be similar in their morphological structure to the basins of China -- we can also call them Central Asian basins -- although ours are considerably smaller in size.

The main inter-mountain basins of China occupy vast areas, in thousands of square kilometers: Tarim basin -- 850; Red basin -- 190; Dzungarian basin -- 150; Tsaidam basin -- 120; and Turfan basin, with the bed lower than sea level, has a maximum length of 245 km and width of 120 km.

Aside from their orographically sharp outlines, all small and large basins have these characteristics:

(1) The great thickness of Mesozoic and Cenozoic rocks, reaching 5,000-8,000 m /established through drilling and geological observation/.

(2) Presence of great break-ups along the basin sides.

(3) Presence of folds on the periphery and central part of the basin. The folds occasionally slant 25-40° and more. More than 100 are counted in each of the larger basins.

Aside from the described basins, there are three vast and little-explored plains on the territory of the CPR: the Northern Chinese, containing three well-defined basins, occupies an area of 400,000 sq km; Manchurian /Sungliao/ with an area of 200,000 sq km; and Ordoss, which forms a depression of 200,000 sq km.

The three above-mentioned plains within the Sino-Korean platform differ materially from the inter-mountain basins described earlier.

They are characterized by a lack of sharply defined folds, by elevations of 1-3° angle slant in the strata, and, as a rule, by lesser thickness of sedimentary rocks. They resemble vast and even flexures rather than gaps. At present surveying work is carried out in all of the mentioned basins where presence of oil and gas was established.

Concluding the description of our tour through the better known oil-bearing basins and surveying areas, I shall attempt to give a general evaluation of China's oil fields. The foreign press had obviously underestimated China's oil potential, due to the absence of ancient sea basin sediment to which one usually connects the formation of oil. Clearly, the oil monopolies did not want to lose China as a vast market for their liquid fuel.

It is now known that the CPR has sea deposits with rich oil formations, such as the Triassic and Permian deposits in the Red basin.

In the Triassic and Permian rock, with alternate oil and gas deposits, and also in the continental coal deposits, there is industrial oil and gas. The presence of considerable oil is evident in Paleozoic marine deposits in Kweichow, Yunnan, and Kwangsi provinces of South China. There are paleogenic marine deposits in the vast Tarim basin.

But the main evaluation of China's oil reserves is not based on these facts. The main fact is that China has numerous industrial deposits formed in the continental, and primarily, ancient lake deposits. Here is the new theory and practice that Central Asia is contributing to the oil-prospecting business.

The theory of the continental origin of oil is being successfully studied by Chinese geologists. Chinese scientists have made it their current task to carry out geochemical research on this question.

The territory of China has vast oil and gas-bearing basins in which Chinese geologists found hundreds of structures favorable for the accumulation of industrial oil. The main difficulty lies in the fact that the rocks have poor permeability and low porosity. The Chinese scientists' task consists of finding rocks with good permeability and porosity, and where this is impossible to study fissured rocks wherever oil and gas form deposits.

There are many good fissured zones in world-wide oil exploitation. Even the world famous oil fields of Iran and Iraq are closely related to fissured limestone. Recent special literature on oil attributes great significance to fissures in oil and gas accumulation. Proof that China has conditions for the formation of porous collectors is in the Laotsunmiao oil field, partly in Karamai, and also on Taiwan Island. To find more of similar, or even larger, deposits in the basins is a challenge to the geologists of China.

In the past few years Chinese surveying brought to light 662 oil-bearing structures /See Note/. The number is steadily increasing. Great hopes are inspired by the Sungliao /Manchurian/ plains in the northern part of China, visited by the author in 1958. /Note -- See Ho Chang-kung's "To Coordinate the Existing Experience and to Achieve Further Leap Forward in Geological Work," Soviet Geology, No. 12, 1958./

In 1958-1959 more than ten structures were discovered there and wells showed oil-bearing sandstone of the Cretaceous period, approximately the same as those in the oil fields of the eastern part of the Mongolian People's Republic.

In the vicinity of the great city of Shanghai, gas from small wells is successfully used by small enterprises. We visited the Yangtze estuary where oil surveying is in full swing. Sinks of oil and gas were found in wells drilled in southern parts of China, from the Paleozoic and Triassic deposits of Kweichow Province.

At present the total area of prospective oil and gas resources in the CPR, with sedimentary rock favorable for the formation of oil, has increased and is estimated 25 2,670,000 sq km -- almost one third of the republic's total territory. Oil resources already surveyed exceed 2 billion tons; in 1949 they amounted only to 206 million tons.

Most of the oil fields, with sand stratum, have oil of very good quality, light specific gravity, low content of sulphur, and high content of gasoline.

In 1949 China was producing only 320,000 tons of oil. Production has increased more than tenfold. In 1958 it reached 2,260,000 tons and in 1959, 3,700,000 tons. However, this amount meets only one third of the country's needs. Therefore, great attention is being paid in China to synthetic liquid fuels derived from combustible shale.

The largest deposits of shale are in Fushun, in the north, and Mayaoming, in the south of China. Both places have developed a liquid fuel industry. In the past few years many deposits of combustible shale and bituminous coal were found in almost all provinces of the CPR. In the years of the First Five-Year Plan /1953-1957/ the capacity of liquid fuel enterprises tripled and in 1958 construction of over 500 small and medium-size plants began with the aim of producing a total of 1,200,000 tons of synthetic oil annually.

China plans in 1962 to bring the production of oil, including synthetic fuel, to 6 million tons.

Not wishing to belittle the importance of liquid fuel, derived from shale and coal, as a geologist and oilman I wish to conclude with confidence that the time is not far off when the entire vast socialist economy of the CPR will be getting all its oil and gas primarily from natural sources, the discovery of which still continues.

Many famous scientists are working in Peking. I met China's leading geologist, Li Ssu-kuang, in 1958. In the spring of that year he was living in one of the smaller palace building at the Summer Palace, situated at the foothill and dominated by the majestic Buddhist Temple of Phorsanga. Li Ssu-kuang is the author of the "Geology of China," translated into many languages. He is also the author of the original tectonic theory of the earth's formation. I visited him in the company of two deputy directors of the Peking Geological Surveying Institute, Professors Chang Hsi-t'i and Ma Hsiu-yuan, and interpreter Cheng Ming-ying.

Our host turned out to be a tall and poised man in a modest blue cotton suit common in China. He reached the age of 69 and his hair was gray.

"The geological map of our two territories, as is the friendship of our two great peoples, has no boundaries," said Li Ssu-kuang. "Your geological successes are important also for our own territory."

Then the scientist spoke on his original views on tectonics /structure of the earth/. In 1958 Li Ssu-kuang's book, Vikhrevaya Tektonika /Vortical Tectonics/, was published in the Soviet Union. On the basis of his analysis of China's geological formation, and also in other parts of the world, Li Ssu-kuang considers that aside from oscillatory movements -- due to condensation and expansion of the earth -- a major part is attributed to the horizontal shift, or "vortical tectonics," which formed astonishing folds resembling the letters Xi, Eta, and Epsilon in the Greek alphabet.

Reasons for these movements are far from being clear yet, although centrifugal efforts, undoubtedly, play the most important part. The structures, made by these movements, can be seen in the system of granite fissures on the shores of the Pohai Bay and Japan Sea, and even on a larger scale in the Chilinshan and Nanshan ranges. The scientist was able to duplicate these forms in a laboratory experiment, on plates covered with plasticine. This process was described in the "Vortical Tectonics."

The Chinese scientist was actively interested in oil surveying. He said that earlier China's oil potential was underestimated. As the Minister of Geology, Li Ssu-kuang considers oil surveying one of the most important tasks of China's geological service. He talked at length on the yet unexplored resources of the North China plains, stretching for 1,000 km from Peking to Shanghai; on the Manchurian plain -- called Sungliao after the Sungari and the Liaoho rivers. These plains contain oil and gas deposits of undetermined conditions.

The conversation also touched upon the recent discoveries of Chinese geologists in the Red basin, on the vast areas of gently sloping folds of Jurassic rock containing large sources of oil.

A few days after our visit newspaper reported that Li Ssu-kuang and Kuo Mo-jo -- two outstanding scientists of China -- were elected as foreign members of the USSR Academy of Sciences. In the summer of 1959, A. N. Nesmeyanov, president of the USSR Academy of Sciences, presented the scientists in Peking with membership diplomas.

"I am proud," wrote Li Ssu-kuang later, "that I was chosen as a member of the great family of Soviet scientists."

Li Ssu-kuang was born in 1899, in Huangkang county, Hupeh Province. He spent many years in exile in Japan as an associate of Sun Yat-sen. Within the span of his long life he visited many countries and participated in numerous international geological congresses and conferences.

After the overthrow of the last, Ching dynasty in 1911, Li Ssu-kuang left for England, where he studied geology. Following his return home in 1920, he taught at the Peking University and continued scientific and research work, especially studying the micro-fauna of the perma-carbon rocks of North China. At one time he was the director of the Academic Institute of Geology. In 1935 and 1936 he delivered lectures at the Oxford University in England. Upon his return home, he studied with deep fascination the glacial period of China and worked out his original tectonic theory.

In 1952 Li Ssu-kuang became the Minister of Geology of the CPR, concurrently with his post of vice-president of the Academy of Sciences of China. His famous work, the "Geology of China," became a manual for a whole generation of geologists; it was first published in 1949 in English and in 1953 it was translated into Russian. The scientist is now working on the questions of plastics and dynamics of the earth's core, using experiments, mechanics, and mathematics. He is also preparing a major work on China's geology.

In 1960, Soviet ambassador to the CPR, S. V. Chervonenko, presented Li Ssu-kuang with a gold medal named after the outstanding Russian geologist A. P. Karpinsky, for his contribution to the study of geology, paleontology, petrography, and other geological sciences.

In the field of geological sciences China holds a high position. The nation has thousands of workers in the geological service, consisting mainly of young people. They are doing important work and are publishing the results in scientific periodicals. They are conducting a great number of theoretical and practical assignments, and are actively participating in geological survey and surveying for various minerals. Under the direction of Professor Chang Weng-yu, members of the Geological Institute of the Academy of Sciences of China have compiled a tectonic map of China. This important geological achievement will further aid the prospecting work. Chinese geologists have also taken into consideration the positive experience of Soviet geologists.

Soviet geologists, and particularly the scientific staff of the USSR Academy of Sciences, and specialists from the USSR Ministry of Geology, have helped and continue to help their Chinese comrades.

In the past ten years hundreds of Soviet geologists worked in the CPR. Many delegations visited that country. Professors V. M. Sinitsin and M. N. Sayidov worked in China almost ten years. Their names are known to all Chinese geologists.

At the end of 1958 the first All-China Conference of Geologists was attended by a group of Soviet geologists, headed by the Minister of Geology, P. Ya. Antropov, and including academician K. I. Satpayev and the corresponding members of the USSR Academy of Sciences H. M. Abdulayev, A. A. Amiraslanov, and others.

The following persons have greatly helped in the study of geology and development of China's oil industry: academician A. A. Trofimuk; corresponding members of the Academy, M. I. Varentsov, M. F. Mirchink, L. V. Pustovalov, B. S. Sokolov, V. I. Smirnov; professors I. O. Brod, S. G. Sarkissian, F. A. Alekseyev, V. M. Kreyter, V. N. Kotliar, A. A. Logichev, A. S. Khomentovskiy, A. V. Snarskiy, P. P. Zabarinskiy, V. N. Pavlinov, S. N. Simakov, and geologists I. E. Shiriayev, F. S. Panteleyev, A. V. Kuchapin, and others.

During the 1958-1959 compilation of the CPR tectonic map great help was rendered by a group of scientists, including academicians N. S. Shatskiy and A. L. Yanshin, corresponding member of the USSR Academy of Sciences Yu. A. Kosygin; professors P. K. Kropotkin, N. P. Kheraskov, and others.

The All-China Stratigraphic Conference was attended by a group of Soviet geologists, including academician D. B. Nalivkin, corresponding member of the Academy I. I. Gorskiy, and professor N. A. Beliayevskiy.

During geological expeditions dozens of Soviet geologists worked hand in hand with their Chinese colleagues. While rendering technical assistance the Soviet geologists are also learning from their Chinese friends.

Large-scale geological survey and surveying work is carried out by the Chinese to enrich their country with new discoveries.

Chinese and Soviet geologists are performing their work cooperatively in numerous cases. For instance, the joint, long-term expedition to the Amur River basin, long-term paleontological expedition to North China, and the joint efforts on the elaborate theme entitled "The Study of the Pacific Ocean Ore Belt on the Territories of the USSR and China."

Immediately after graduation Chinese students take part in every field of geological survey -- from field surveying to theoretical work at educational institutions. There is a considerable number of Chinese geologists who were educated in the Soviet Union.

Achievements in the development of geological surveying work in China are truly great.

In the past years geological teams of China acquired good technical equipment. According to available data, a total of 10,320,000 m of exploratory wells were drilled by the end of 1957. This figure is 60 times more than the entire drilling work done in scores of years prior to liberation. In 1958 China had a total of 4,684 drilling equipment, but in 1959 the number was doubled. Productivity of labor in drilling work is growing, too.

In 1949 surveying was being done for 18 types of minerals, while at present the number reached 71, 64 of which proved to have large industrial deposits /See Note/. /Note -- See Ho Chang-kung's "To Coordinate the Existing Experience and to Achieve Further Leap Forward in Geological Work," Soviet Geology, No. 12, 1958./

If prior to the liberation of the country there were 200 persons engaged in the geological service, an army of 40,000, consisting of geologists, engineers, technicians, and others, are engaged in the service now. By studying the country they are making brilliant discoveries every year.

In the past years large deposits of coal, oil, ferrous, nonferrous, and rare metals were discovered in the course of surveys. We have already discussed the promising reserves of oil.

In the reserves of coal China holds the third position in the world, after the USSR and USA. The total reserves of coal in China are estimated at 1,500 /sic/ million tons. The reserves which have already been surveyed constitute 43.6 billion tons. In coal production China has already overtaken Britain and is approaching the USA level /387 million tons/. In 1959 the CPR produced 347.8 million tons of coal. The coal is of good quality and can be found in all provinces of China, particularly in the northern and northeastern parts of the country /Tatung coal basin/. A number of coal mines are in the proximity of rich iron ore deposits.

Prior to liberation it was considered that China had little iron ore. However, recently very rich iron ore deposits were found almost in all parts of the country.

The three largest iron ore bases of China are: Anshan in the northeast, Tayeh in Central China, and Boyan Obo in North China. The surveyed iron ore reserves in China now exceed 8 billion tons, while the geological reserves are estimated at 100 billion tons.

China at present occupies one of the leading places in the world in reserves of coal, iron, tin, tungsten, copper, aluminum, molybdenum, manganese, lead, zinc, mercury, and also phosphorus, borax, asbestos, and potassium. /See Note/ The tungsten reserves constitute 90% of the world's surveyed deposits and 80% of the world's known antimony reserves. /Note -- Figures from an article by Ho Chang-kung, Deputy Minister of Geology of China, in the Druzhba (Friendship), No. 35, 1959./

In the past few years a number of large deposits of chrome and nickel, and over 3,000 large and small deposits of copper were discovered in China.

These are only initial successes of the army of geologists who have quite recently started their deep study of the country fabulously rich in minerals.

The exceptionally high tempo of geological surveying work demands an establishment of new geological institutes in China. Plans, drawn to create technical schools and short-term courses for the lay population, have already been carried out to a great extent.

According to Chinese terminology, the following forces were mobilized to assault the depths of the earth: "regular army," consisting of large geological and surveying expeditions equipped with modern technology; the "partisan units," consisting of survey teams organized by local economic organs; and the "people's militia," made up of groups from local populace to carry out surveys in their immediate localities. The latter consists of tens of thousands of peasants who acquired a minimum knowledge to detect signs of simple mineral deposits. Thus many thousands of people are engaged in the search for useful minerals. According to our Chinese friends, a year of concerted campaign resulted in discoveries four times as much as during the entire First Five-Year Plan period. Every province in China has equipment pools. New deposits of coal and combustible shale are being found. According to incomplete data, 150,000 cases of ore findings were recorded in 1958.

In some counties almost 70% of the population is taking part in mineral surveying. In Teh-hsing county, Kiangsi Province, 40,000 local people surveyed 20,000 lots in ten days and found a number of mineral deposit sites /See Note/. /Note -- See Ho Chang-kung's report to the First All-China Geological Conference, Soviet Geology, No. 12, 1958./

In evaluating these successes Ho Chang-kung, one of the oldest hands in the field of geological service, writes: "The day-by-day correct leadership of the CPC, the large and tested army of geological personnel, provided with latest technical equipment, and the nation-wide movement for mineral surveying open unprecedented opportunities to build up the mineral and raw material bases."

The vast territory, promising great mineral resources, and the selfless aid of the socialist countries, are the prerequisites for the unprecedented leap forward in the development of geological work.

The Chinese masses are acquiring geological knowledge in order to help the geological cadres. The movement for "the geological participation of the entire party aided by the entire population" is afoot.

VI. The Training of Geologists in China and Remarks on Higher Educational Institutions

The geologist, as an explorer of China's rich mineral resources, is a popular figure in that country.

The training of geologists of various specialties are carried out basically in the large geological and survey institutes, and only a certain number are taught in other trade institutions /petroleum, mining, etc./.

At the close of 1958, three geological and surveying institutes and seven geological departments at universities were attended by 14,000 future geologists. Additional 18,000 young boys and girls were studying at 15 technical schools. The future plan is to bring the number of students to 30,000 in the geological institutes and to 40,000 in technical schools /See Note/. /Note -- See Soviet Geology, No. 12, 1958, p 19./

The Peking Geological Surveying Institute, where I worked during 1956-1958, is one of the largest in China. Like the majority of Chinese higher educational institutions it is only seven years old.

The institute is situated in the northwestern part of Peking, 20 km from the center of the city, amidst eight other new schools. Across from it is the beautiful building of the Metallurgical Institute, and alongside are the multi-story buildings of the Petroleum Institute. Somewhat in northerly direction is the Mining Institute with its traditional Chinese type roofs.

The modest, pink and bright buildings of the Geological Surveying Institute stand in the center of the university town. In 1958 the institute had nine three- and five-story school buildings with a total floor space of 50,000 sq m, and auxiliary buildings, housing dormitories, apartments for professors and teachers, and dining halls, totaled 73,000 sq m.

Peking now has over 30 higher educational institutions with a total attendance of 140,000, ten times more than ten years ago.

Each school is self-containing and has classrooms, laboratory buildings, dormitories for students, houses for teachers and staff, dining halls, clubs, nurseries, hospitals, and sports arenas.

Is it wise to have the schools thus centralized, beyond the city limits? In my opinion, it has many advantages. For instance, if an interesting lecture is delivered today at the Petroleum Institute the students of the Mining and Geological Surveying Institutes can be there in a few minutes. And if tomorrow an interesting report or lecture is read at the Geological Surveying Institute then the students of the Petroleum, Mining, and Metallurgical institutes have only to cross the road.

The teachers of various schools have close contact among themselves and are constantly exchanging experiences. Frequent meetings are practiced by teachers and students of various institutes. Furthermore, the students are isolated from the city noises and have no distractions in their studies. In the winter, when the Western Hills are covered with snow or in the spring when plums are in blossom, one feels himself much closer to the University Town and the mountains than to the city.

The Geological Surveying Institute in Peking is attended by more than 4,000 students, including some foreigners mainly from Vietnam, Korea, and Indonesia. There are evening course, too.

The institute has trained over 2,500 students in the past years, which is ten times more than the number of geologists trained during 30-40 year period in the old China. In 1959 the institute accepted 1,200 first-year applicants.

The institute trains geologists of various specialties. There are six departments: geological survey and mineral exploration, geology and mineral surveying, geology and oil and gas surveying, geophysical, hydrogeological and geological engineering, and surveying techniques. These departments are further sub-divided into specialized fields, such as: geological survey and exploration of mineral resources, geology and surveying for metallic and non-metallic deposits, geology and coal and shale surveying, geology and surveying for oil and gas deposits, petroleum geophysics, metallic geophysics, hydrogeological and geological engineering, surveying techniques, and a special section where management cadres for geological-surveying work are trained. The latter course somewhat resembles the economic branch at our own geological-surveying schools.

A great attention is devoted to the independent work of the students, together with coordination of theory and practice in the curriculum.

In the past five years about 100 well-equipped laboratories were founded at the institute. They are particularly devoted to hydrogeological, chemical, and geophysical methods of surveying, and are affiliated to 25 departments of the institute. The Chinese comrades are, naturally, very proud of them.

In the spring of 1958 a general geological museum was organized from the combined sources of various departmental museums. Until a special building is built to house it the museum is temporarily scattered in 18 separate halls. Various types of minerals from China's mining sites, such as: iron, chrome, manganese, nickel, copper, and so forth, are very well displayed. Separate halls are dedicated to China's oil fields and coal mines.

The museum has included materials donated by the geological museums of the Moscow University, Sverdlovsk and Leningrad mining institutes, the Moscow Petroleum Institute named after academician I. M. Gubkin, the Irkutsk Mining and Metallurgical Institute, and other higher schools of the Soviet Union. A close contact was established with the latter and collections of samples were exchanged. The museum at the Peking Geological Surveying Institute has a hall containing gifts from the USSR museums, which include Ural jasper, samples of Baikal mica, samples of igneous rocks from the Ukraine and Kola Peninsula, and so forth.

For the time being the museum is of an educational nature, but in the near future the institute will form a Geological Board and the museum will be expanded to include the regional geology of various provinces of China; it will then be entrusted with scientific and productional tasks. The museum will eventually become the central geological museum of the CPR.

The Peking Geological Surveying Institute has 420 teachers, including 17 well-known professors whose works enriched geological science of China. Among the latter are: Yang Fu-ling, Chang Hsi-t'i, Ma Hsi-yung, Yuan Tien-t'ing, P'ang Chou-hsiang, Shih Chi-shan, and others.

The institute is conducting a large-scale scientific and research work. Conferences are held annually and various works are published.

In conclusion, I shall point out certain general characteristics of higher educational institutions of China. Only recently the higher education in China was of scholastic nature, but in the past ten years modern universities have emerged.

The majority of the Chinese higher schools are of technical nature and were founded in the past 6-7 years. In addition to the growth of universities, during the 1958 "leap forward" movement, many counties, and even some lower administrative subdivisions, have founded a large number of special type of higher educational schools where studies are conducted without disrupting the production.

In 1959 a total of 810,000 students were attending 841 higher educational institutions, including some 270,000 newly accepted applicants. Additional institutes with evening classes are attended by 300,000 students. Thus the total of students in the CPR exceed 1,100,000.

The process of organizing new higher educational institutions is not yet complete. The new ones, as a rule, are founded by the efforts of the existing universities, technical schools, or larger industrial enterprises. The new schools will offer courses of 2 to 5-year duration. The class work will be closely related to the development of industrial, agricultural, and cultural potential of the school's home province.

The problem of curriculum has been largely solved. The curriculum of Soviet universities is accepted as basis, but certain reduction of class hours is achieved through abolishing, or partly conserving, the lecture courses. Simultaneously the hours dedicated to practical training are increased.

The concrete forms of coordination between studies and production are being gradually crystallized. During the month of July 1958 Peking higher schools have founded almost 200 plants commensurate with their major subjects. At these plants students are not only to study but also to produce for the country. For instance, the Aviation Institute is planning to make planes and the metallurgical plants of various universities must produce steel. The teachers and students of the Railway Institute are participating in the laying of railway tracks. Large-scale auxiliary economies were also introduced at the schools.

In order to help the industrialization progress of Peking, a Geological Board was inaugurated at the Geological Surveying Institute.

Its tasks include surveys and surveying in the areas close to the capital city. The work is done by teachers, aided by the students.

The Changchun Geological Institute has also founded Geological Board for Kirin Province.

The most complex problem of Chinese higher schools is that of training the teaching cadres. The number of old professors and lectures is small /not more than 10%/. The main teaching body consists of young students who had graduated within the past 3-4 years. The training of the teaching cadres is being accomplished with 2 and 4-year post-graduate studentship. They write interesting, topical papers. Conferring of degrees, as a rule, is not practiced. The total number of teachers in higher educational institutions has increased from 16,000 in 1949-1950 to 68,000 in 1957-1958. Several years will be required for the new, forceful teaching generation to take over. In the past two years various movements were launched in the higher schools and the numbers of students of peasant-worker class have increased /to 36% of the total/. Particularly important is the movement that swept the country -- to readjust the working style and to eliminate waste and conservatism.

The idea of this nation-wide movement is to increase the previous production level while using the same amount of labor, materials, and financial expenditures. The slogan of the movement is: "more, faster, better, and cheaper."

Teachers and students have introduced thousands of suggestions for improvement of work. Comrades who lived extravagantly and lacked in full participation in the public life, were criticized. All teachers and students took part in the movement.

For instance, suggestions were introduced that students physically participate in the construction of institutes, give regular assistance to agricultural cooperatives, and provide services in their everyday life /growing vegetables for the dining halls, operating barber shops, etc./.

The suggestions and critical remarks are written and submitted to a variety of special committees: concerned with the problems of studies, the coordination of study with labor, the economical expenditure of funds, and so on. In addition, the suggestions submitted by students and staff members are written in large characters on pieces of paper or old newspapers, are displayed in the school premises. Right from the start every student pledged to write critical messages of 20-30 words. This form of a wall newspaper could be found pasted on the walls, and even the sidewalks, of the campus.

Eventually the suggestions, some repetitious, were concentrated into a single principal form in the shape of a watermelon. The seeds consisted of individual questions. Many "watermelons" were displayed, with great number of "seeds."

These measures resulted in the improvement of student work. At last the students were getting the high marks they merited. Undoubtedly, this was a fruit of the better consciousness and political maturity of the teacher and student body.

Our Chinese friends attribute the successes in the educational and scientific-research work to the fraternal help of the Soviet Union. When their higher schools were founded and the curriculum set up the experience of the USSR was always taken into consideration. In the past ten years more than 1,000 Soviet specialists in a variety of educational fields have visited China. Over 700 of them conducted lecture courses. Their important task was to train teacher cadres from among the ranks of young honor graduates. The Soviet specialists enjoyed their work and considered it as act of honor bestowed on them by Soviet higher educational institutions. They also helped to set up 337 faculties and over 550 laboratories.

The Chinese higher schools pursue life according to their national traditions and the characteristics of progress in China's socialist revolution.

The Second Session of the VIII Congress of the CPC in May 1958 has outlined the main tasks for the cultural revolution in the country, which includes: eradication of illiteracy; introduction of general primary education; a gradual establishment of local middle schools in all counties; and establishment of higher educational institutions and scientific research organs in all regions and some of the counties.

The Chinese call the Soviet Union their "elder brother" and they continually learn from it. However, there are things that are worth learning from our "younger brother," too.

China's technical achievements in making paper from reeds and manufacture of high-quality ceramics, the harvesting of rich crops of grain and fruits are widely recognized. Each field of knowledge has its complement and, at times, experience of tradition.

Competent scientists in the fields of natural, mathematical, technological, and social sciences are now working in China. The whole world knows the names of Kuo Mo-jo, the president of the CPR Academy of Sciences, and Li Ssu-kuang, vice president of the Academy and the Minister of Geology of the CPR. They were recently elected as foreign members of the USSR Academy of Sciences.

The author of this brochure, as a geologist, had an opportunity to learn many valuable facts while studying the geology of China -- formation of loess, characteristics of oil and coal bedding, and recent ore formations.

The Chinese higher educational system is still young but offers certain traits which are of interest to the older Soviet higher education. One of its remarkable features is its unswerving desire to combine theory with practice. Lectures are read at the production sites and under expeditionary conditions. Diploma theses are prepared at the enterprises.

In this respect there is much in common with our plans for reorganizing our own higher education.

Although the Chinese higher education still has a lot of unstabilized groping, the present Chinese experience in organizing plants at their higher schools and teacher-student participation in large-scale contractual work, it is of interest to us while our own higher educational system is being reorganized.

Aside from this, all Chinese students are constantly helping the agricultural cooperatives and spend an hour every day working at the campus community gardens, laundries, and barbershops. The teachers maintain contact with the nation-wide scientific and research work. In 1956, in cooperation with Soviet specialists, many took part in outlining the 12-year draft plan for the development of science and technology. The plan will bring the CPR a world status in the field of scientific development.

The Chinese higher schools have new, spacious buildings, where students study in shifts and use the laboratories equipped with modern instruments.

Almost every laboratory has equipment, scale models, and original blueprints. The majority of technical schools have machine tooling shops to make laboratory equipment. But of particular interest is the large quantity of efficient, yet cheaply made, wooden scale models of lathes, machines, mining equipment, pipes, and so forth. There are also models for biological, anatomical, and paleontological studies which show the structure of a human body and various other organisms.

Aside from mimeographs and hand-presses, almost every institute owns printing machines to turn out textbooks and other works.

Publishing is carried out swiftly, 2-3 months after the submission of the manuscript, without superfluous formality or protracted reviews. It is true that, from technical point, the quality of publications is not always good, paper is of poor quality, editing and corrections are not thorough enough. However, these shortcomings can be easily avoided in the future and they should not detract from the great advantages designed to strengthen China's higher education.

Almost all the courses, taught by Soviet specialists, are printed in the school by typographical method, 500-2,000 copies each, in Chinese or Russian. Some of the courses are also published by the state publishing houses.

The work of the visiting Soviet teachers and specialists command great attention from the Chinese colleagues. These Soviet specialists not only tour the attractions of China's historical sites, but go on field assignments and visits with geological expeditions and surveying teams. They give direct assistance and enrich their lectures with materials derived from China's daily problems.

Chinese friends extend warm and touching farewells to the departing Soviet specialists. Every Soviet specialist, who had worked in China for a period of time is given a medal of Soviet-Chinese friendship, on behalf of Premier Chou En-lai, in addition to many letters and references.

In conclusion I wish to say that with the victory of the people's revolution in China, the Chinese and Soviet peoples have established friendship and cooperation which are getting stronger year by year. One of the manifestations of this friendship is the exchange of visits between the specialists of the USSR and the CPR.

5878 - END -