

INSTITUTE OF CURRENT WORLD AFFAIRS

ADB--40
Yunnan Tin

Laoch'ang (Kochiu)
Yunnan, China
October 15, 1949

Mr. Walter S. Rogers
Institute of Current World Affairs
522 Fifth Avenue
New York 18, N. Y.

Dear Mr. Rogers:

China is one of the few large-scale producers of tin in the world, and the largest tin mines in China bore into the rocky, fog-bound mountains (from which I am now writing) in Southeast Yunnan Province, not far from the border of French Indo-China.

China's tin production does not compare in volume with that of the major world producers, but deposits of this scarce metal are so few and so concentrated that any important source plays a significant role in the international raw materials scene. Published statistics for a "normal" pre-war period (average production from 1922 to 1937) list China as the sixth largest world producer with an annual production over a fifteen-year period of 4,284 metric tons. During the same period Chinese production was overshadowed by the averages of Malaya (46,949 tons), Bolivia (30,783 tons) and the Netherlands East Indies (28,334 tons), and was exceeded by those of Siam (8,665 tons) and Nigeria (6,678 tons). These average yearly production figures do not necessarily indicate the importance of the Chinese deposits, however, because the Chinese tin industry is relatively undeveloped by modern standards, and in spite of the prevalence of primitive methods of exploitation Chinese tin production in the peak pre-war years reached 10,000 to 12,000 tons annually, which suggests that China's potential, if properly developed, is considerable. China might be able to provide a much larger share of the world's demand for tin, which is roughly 150,000 metric tons a year (it has varied from under 100,000 to about 175,000), than it has in the past.

World tin production was disrupted during the war. Malayan and NEI production was disorganized, and Bolivia's share of the world's output soared (1945 exports: 44,137 tons). During that period China produced approximately 8,000 tons a year, which made a valuable contribution to the Allied war effort and provided the Chinese with badly needed foreign exchange.

I do not have the data available here to discuss post-war trends and developments in the world tin market, but it is safe to say that China's tin deposits are still of considerable interest and importance - to China, because tin sales are a source of needed foreign exchange, and to industrialized countries, because tin remains a relatively scarce raw material. Tin is not generally classified among the most essential strategic raw materials, because substitutes are fairly easy to find, but it is still much in demand for use in tin plate, terneplate, solder, Babbitt metal (for bearings), bronze, tin foil, and chemical compounds.

In China, outside of Yunnan, there are half a dozen areas which produce tin. These include Patpo in Kwangsi, Tayü in Kiangsi and Hsianghualing in Hunan, but none of these centers produce more than a few hundred tons a year at the present time. The undisputed tin capital of China is the hsien town of Kochiu in Southeast Yunnan. At its peak, before the war, the mining area around Kochiu produced over 10,000 tons of refined tin. This year it will produce between 3,500 and 4,000 tons, almost all of which will be exported to markets outside of China.

Native tin production at Kochiu has a four hundred year tradition, but continuous mining has probably been going on for only 100 to 150 years. Until recent years the tin produced was used mainly in coinage and in foil used for ceremonial "money" burned at funerals all over China. Between 50 and 100 native mines at Kochiu still account for between two-thirds and three-fourths of the volume of local production, despite their decline in recent years, but the two modern mines belonging to the Yunnan Consolidated Tin Corp. (YCTC) have gradually increased their share of the production. This year they will produce about 1,200 tons - which is below their capacity but which is still a large amount for two mines. The contrast between methods and conditions in the native and modern mines, which are located within walking distance of each other, is striking. It might well be used as a dramatic case study of industrialization in the process in a technologically "backward" economy.

The methods used in the native mines are primitive, slow and, because of the excessive use of manual labor, costly as well. Working conditions are deplorable, and there is almost no concern for the workers' welfare. And the product is inferior.

A typical small mine at Laoch'ang (Old Mine) an area ten kilometers from Kochiu where most of the native mines are located, looks to the untutored eye like nothing more than a small hole in the side of the mountain below which, on the surface of a small valley, are spread what appear to be mud flats. The hole is the opening of the mine and measures roughly $3\frac{1}{2}$ by $2\frac{1}{2}$ feet. From the opening a shaft of like size descends several hundred feet, on a slippery slope of thirty degrees, and horizontal shafts branch off from it. The shafts are so small that only children up to the age of about fifteen can descent into the damp underground. Each child miner can make only a few trips in and out of the mine each day, and he drags up forty to sixty pounds of soft red ore on each trip.

The red clay ore brought out of the mine in this manner contains two to three per cent of tin scattered in particles throughout the clay. The ore is crushed in a crude stone grinder, and then the tin is extracted by a slow process of sedimentation on the "mud flats." Mixed with water, the ore flows down a series of levels, the heavier particles sinking to the bottom from where they are removed in the form of brown "sand." This process is repeated many times, the percentage of tin in the ore concentrate gradually increasing. Finally the ore concentrate is transferred to sloping stone sluices. The ore is fed to the top of these sluices, and workers use bamboo ladles to splash water over it as it descends, repeating the process of concentration. This is done many times until the ore concentrate contains seventy per cent tin. The ore is then transported by mule down the mountain, a four- or five-hour trip on a rock-paved path, to the tin merchants' establishments in the town of Kochiu. There, if necessary, the sluice process of concentration is repeated on some of the ore. Thereafter, part of the product is exported as ore concentrate for further processing elsewhere (the large American tin refinery in Texas is one destination; smelters in Haiphong and other places also buy the concentrate). Part of the ore, however, is smelted and refined by crude native methods in Kochiu. The resulting tin is only 95 to 96 per cent pure, however, so it too is usually sent elsewhere for final processing or is mixed with Malayan tin to achieve the 99.8 per cent purity usually demanded in the international market.

The native mines' share of total Kochiu production is as large as it is simply because there are so many mines, and because it has not been possible to-date to organize and finance modernization to the extent necessary to work the whole area.

The legal concession for the whole area is held by the YCTC, but native mines are allowed to continue operation on the basis of traditional rights.

The YCTC is a modern company organized in 1940 when three older companies were combined. The first modern equipment was introduced to Kochiu in 1908, and mechanization was gradually increased thereafter. Of the three companies consolidated in 1940, one was run by the Central Government's National Resources Commission (NRC) and two by the Yunnan Provincial Government, or more specifically by Y. T. Miao, the Minnesota-educated "tin king" of China who is one of the most powerful men in Yunnan Province.

At present YCTC shares are divided between the Yunnan People's Development Corporation (YPDC), a semi-governmental provincial organization under Miao (40 per cent of the shares), and two Central Government bodies, the NRC and the Bank of China (30 per cent of the shares each). The management consists of Miao (representing YPDC) as Manager, and Li (representing NRC) and Tai (representing the Bank of China) as Assistant Managers. Actual operations at the mines are supervised by Assistant Manager H. S. Li and Chief Engineer T. T. Ni, both of whom are NRC men. YCTC is, therefore, primarily a governmental organization in which both the Central Government and the provincial authorities have a share.

Including staff, miners, other workers, and guards, 4,500 men are now employed by YCTC to produce about 1200 tons of tin a year. This appears to be a large ratio between employees and output, but tin mining at best is a difficult and slow process, and the YCTC's output per employee is much higher than that of the native mines. It could be increased even more if modern methods were introduced further according to plans which unfortunately cannot be implemented until YCTC obtains additional machinery. The present capitalization of the company is Yunnan Silver \$20.5 millions (about U.S. \$4 millions at present), and the Chief Engineer estimates that an additional investment of U.S. \$1 million for new equipment could increase the productive capacity of YCTC by two to three times. The Chief Engineer also asserts that YCTC is one of the most efficient mining enterprises in China and has a lower ratio of staff (now 230 men) to workers than any comparable organization in the country.

The YCTC installation at Kochiu is divided into three areas: the main area on the outskirts of Kochiu, which consists of the administration, a modern ore dressing (concentrating) plant, some semi-modern concentrating facilities, a modern smelter, a modern refinery, laboratories, machine shops and so on; Hsinch'ang mine, which consists of underground shafts which send their ore to Kochiu by a $4\frac{1}{2}$ Kilometer aerial tramway, and secondary alluvial deposits which are concentrated by a semi-modern sluice system and are then sent to Kochiu by mule in the form of seventy per cent concentrates; and Laoch'ang mine, which consists of a modern underground mine with over six kilometers of well-constructed tunnels, and a semi-modern ore concentrating facilities from which the seventy per cent concentrate is sent by mule to Kochiu. The actual mining takes place, therefore, at Hsinch'ang and Laoch'ang, the concentrating at Laoch'ang and Kochiu, and the final smelting and refining at Kochiu alone, and all three of these sites combine modern and semi-modern processes. At present the two mines produce 250 tons of ore a day, and the smelter and refinery turn out 100 tons of 99.8 per cent pure tin a month, but with the addition of equipment as planned, the product of refined tin from the YCTC installation could be increased to 5,000 tons a year, instead of the present 1,200.

The technical contrasts between the modernized processes and equipment of the YCTC and the primitive native mines is highlighted by the fact that one can compare the

old and new directly. At Laoch'ang, for example, within a few minutes walk from the native mines I have already described one can descend into the YCTC mine by electric elevators, which zoom down over 600 feet (at a speed disconcerting to a surface dweller), walk through miles of large, well-constructed shafts and tunnels, and see miners equipped with modern devices working in an upright position under electric lights. The YCTC's aerial tramway, mechanized ore concentrating tables, electric ore crushing drums, power plants, and other paraphernalia of modern mining are a startling contrast to the holes and "mud flats" nearby. The differences between the old and the new also appear in the contrasting statistics on production and costs. To cite one example, 160 men at the Kochiu ore dressing plant can produce as much concentrate as 700 men at Laoch'ang, even though Laoch'ang uses semi-modern and partially mechanized concentrating methods which are considerably more efficient than the methods used in small native mines.

The contrast in working conditions is, if possible, even greater. The management at YCTC is enlightened and believes that it has social responsibilities as well as a technical job to do. As a result, YCTC's workers, all adults, work an eight-hour day (there are three shifts) and a six day week. Their pay, roughly Yunnan Silver \$1.00 per eight-hour shift, is low by non-Chinese standards, but it is higher than prevailing wages in the region. They are provided with sanitary housing in company dormitories or houses free of charge. The company sells them food at relatively low prices; food costs them about a third of their wages. They receive free medical care from modern doctors. They are given nine holidays with pay each year. A pension plan has been introduced - a fact which is remarkable even though the only workers eligible are those over sixty who have been with YCTC over ten years. Perhaps most remarkable of all is the monthly meeting which is held by the staff together with elected workers' representatives to discuss grievances and possible improvements in working conditions. All of this is based on a paternalistic approach by the management, and there is no labor union, but YCTC's workers live a very different sort of life from that of other workers in the region. The men most responsible for this enlightened paternalism seem to be Y. T. Miao, H. S. Lu, and T. T. Ni. The latter two especially are examples of the best kind of non-political, competent, socially-conscious technicians in China. (Ni as Chief Engineer receives less pay than a common manual laborer in the U.S.)

The men who run YCTC at Kochiu work under tremendous difficulties, some general and chronic in China and some peculiar to Yunnan or to the tin industry in particular. The major installations at Kochiu were damaged by Japanese bombing during the war, and some of the damage has not yet been repaired. Badly needed equipment has not been forthcoming, and the staff has been forced to improvise on a day-to-day, shoestring basis. Some of the equipment needed reached Shanghai (1,000 tons of machinery) just before the Communists, but the Civil War caught up with it, and no one knows when it will be possible to bring it South. Last year ECA authorized a loan of U.S. \$1 million which would have enabled YCTC to carry out their planned expansion by building their own power plant (power now bought from the YPDC plant at K'aiyuan makes up ten per cent of production costs; power from a plant of their own would be one-fourth as expensive), constructing an aerial tramway from Laoch'ang to Kochiu, and making other important improvements, but soon after the authorization Nanking fell to the Communists, and the loan was canceled. If the Civil War had not blocked YCTC's expansion and improvement program, the company's staff estimates that production costs could have been reduced by twenty to thirty per cent (from the present cost of U.S. \$0.60 to U.S. \$0.70 per pound).

Banditry does not simplify YCTC's problems. Kochiu is an isolated mountain district fifty kilometers by road to K'aiyuan and about the same distance by a "toy railway"

(two foot gauge) to Pishihtsai (near Mengtse), both of which are on the Yunnan-French Indo-China railway. Although banditry in this area has been considerably reduced in the past few months, it still exists. Some of the bandits are "T'ufei" (local bandits) and some are "T'ukung" (local Communists), but regardless of which they are, the threat of attacks forces the use of armed guards at all YCTC areas and the use of body guards for company personnel. At the present time there are almost 300 troops guarding the three main YCTC sites.

Transportation, or rather the lack of it, creates another major problem. Before the war, refined tin and ore were shipped by rail the 578 kilometers to Haiphong, the important port in North Indo-China, but the rails South of Mengtse were removed during the war. At present, therefore, all the tin and ore exported is shipped by air from Mengtse to Haiphong. The cost of this short haul is U.S. \$0.06 per pound. Until an informal French-Chinese agreement was reached on September 13, furthermore, the French placed many difficulties in the way of this air lift because French planes were not allowed to land at Mengtse. Now that their planes can participate the French are more cooperative, but the airfield at Haiphong is undependable and is often out of operation in bad weather.

The U.S., which has been stockpiling tin, is the largest buyer in the market, which in practice has meant that the price has been set rather arbitrarily in New York. Tin producers such as YCTC must accept what they can get. Until recently the price C.O.D. was U.S. \$1.03, but it has now been reduced to U.S. \$0.96. The margin of profit of YCTC, like that of other tin producers, has been reduced accordingly.

Perhaps the strangest, and at present the most critical, problem facing YCTC is strictly local. Until recently YCTC sold its tin to NRC which paid them in local currency. Now YCTC sells through YPDC or private firms and finds itself unable to convert foreign currencies received into Yunnan Silver Dollars, the only currency acceptable to the workers at Kochiu. As a result YCTC is in the peculiar position of accumulating credits but having almost no local currency to finance current operations. Because of this fact the YCTC workers have not received any of their wages for September or October. This state of affairs obviously cannot continue indefinitely, and the enlightened labor policy of YCTC will not be very impressive if no way is discovered to pay the workers.

Despite all problems, however, tin mining continues at Kochiu without serious interruption. Production and employment at both the native mines and YCTC is declining rather than increasing, but tin mining continues to be the most important industry in Yunnan. The technical staff of YCTC, furthermore, expect the work to go on regardless of political and military developments. News received yesterday of the Nationalist evacuation of Canton caused no stir; it was expected and accepted fatalistically. Production at Kochiu will undoubtedly go on much as before even if the Communists take over, and most of the staff believes the Communists will eventually reach them.

The men at Kochiu expect to produce tin whatever happens, and it is estimated that even at the rate of 12,000 tons a year the Kochiu mines could continue operating for 100 years. If and when the Communists do take over, however, the export market may change. The Soviet Union is short of tin and lacks control of or easy access to any of the world's major sources of tin supply.

Sincerely yours,

A. Doak Barnett

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