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JAPAN

by

Van Hoose Smith

A

T H E S I S

submitted to the faculty of the

SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF MISSOURI

in partial fulfillment of the work required for the

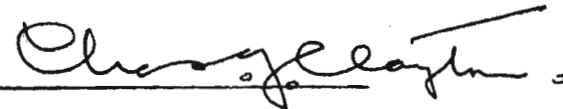
D E G R E E O F

METALLURGICAL ENGINEER

Rolla, Missouri.

1931

Approved by



Professor of Metallurgy.

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Body of Thesis

Introduction

Since graduation from the Missouri School of Mines my work has been along very interesting lines and with the exception of three years spent as a member of a trial crew on Submarines, has been in connection with ore dressing and that particular phase of ore dressing known as flotation. My early training in this line of work was in the Butte, Montana, district, where it was my good fortune to be associated with many old Rolla men including B.H. Dosenbach, A. Hackwood., T.E. Wilson, Hollister and many others. I might say that the old Butte and Superior where we worked had one of the first flotation plants on this continent and I truly think that we made some "Flotation" history.

Leaving Butte in 1916, I came to Canada and have been at work in British Columbia ever since and still along the same line of work, and it has been my privilege to have had connection with the Granby, Howe Sound and Premier operations in this province.

Since 1928, my work has really been in the nature of a consultant, on the various ore problems of

the district, and such work includes the simpler flow sheet treatments of the one economic mineral ore, and also the treatment of the more complex ores such as the Sullivan or similar ores.

In 1929, I received a letter asking if I would make a trip out to Korea or Chosen, as it is now called, for the purpose of applying knowledge gained from small ore tests to large scale plant operation. Korea is that small country, of nineteen million people, which served as a buffer state during the Russian Japanese war, and has been for centuries the battle ground for the armies of the Chinese and the Japanese in their various battles for supremacy in the far east. Korea is the peninsula which projects out from Asia proper and is the closest land to the islands of the Japanese Empire.

A Trip to Japan

Upon investigation, I decided that I would make the trip, and accordingly booked a passage out to Japan on the Empress of Canada, a large steamer of the C.P.R. line. At the time of booking, I found that there would be a record passenger list, due to the fact that there were a large number of the delegates to the World Engineering Congress sailing by the same ship. This congress was held in Tokio with the backing of the Imperial Japanese Government and having such support it was deemed good policy for practically every industrial country to send delegates, such delegates being the men who were leaders in engineering work in their particular countries. On learning all this I decided to cable and wire my principals, that I intended to stop off and listen to the meetings of this congress and made my preparations accordingly.

All plans went forward smoothly and most of the delegates who were to have sailed, had arrived and were duly entertained here in Vancouver by the various civic organizations. Then came the news that our ship, the Empress of Canada, had gone on the rocks on the

passage in to Vancouver Harbor, and that it would be necessary that we sail on a smaller boat. Due to the fact that practically all the passengers were going to the Congress no one could be left behind, so due to the necessary crowding and changes in accommodation we were not long in becoming acquainted with our fellow passengers and so our misfortune, really was a benefit, in that it allowed us all to become acquainted in a manner that would have been impossible under other circumstances.

Our boat finally sailed from Vancouver, British Columbia on October 18, 1929, calling in at Victoria for the last supplies, mail and passengers. Soon we left Victoria and the steady swell of the Pacific ocean made us realize that we were heading further and further from land and that the next few days would prove whether we were to be called good sailors or just plain land lubbers. Fortunately for me, my early training on the submarines made me immune to the movement of the ship so that the passage was a delightful one in every respect.

On the trip over, the programme was usually as follows. Lots of walking of the deck out in the air, followed by deck quoits, or bridge, or a work out in the Gymnasium, or a nap, meals, repeat the walking pro-

cess, minature horse racing in the smoking room, then the breaking up into groups for cocktails before dinner. Then the usual formal evening dinner after which one could go to the ball room for dancing or return to the dining room where some one of the Engineering Congress delegates would usually have some rolls of film which showed some particular phase of the engineering profession, or the habits of the people in some far off country, and who while showing the pictures, would usually keep up a running talk, really it could not be called a lecture, and so we gained a great deal of useful and interesting information.

I remember one such evening in particular when a Mr. Murphy, who is the chief Electrical Engineer for the Canadian National Railways, gave a lecture and pictures on his experiments with frazile ice. Up here in the North Country we are bothered considerably with anchor ice, skush, etc., in that such ice builds up in our reservoirs and pipe lines in and around power plants and often times this causes such trouble, that a power plant must be shut down until this frazile ice is eliminated. Mr. Murphy's experiments went to prove that a ten horse power boiler would raise the temperature of the pipe line and valves sufficient to prevent the building up of anchor ice. The point which he

particularly brought out was that ice forms only at say 32 degrees, and if you can apply artificial heat to your valves and raise the temperature to 32.0002 degrees, then you can prevent such trouble and the necessary shut down. On a plant of 35000 HP where such precautions have been taken there has not been any lost time in the winter months for the past three years whereas before making use of this scheme they used to average ten days lost time each winter.

Other talks were given by such men as Mr. C.W. Stone of the General Electric Company, Dr. Hugo Arendt, Director of Railways, Germany, Professor Percy A. Hillhouse, Busby Scotland, C.A. Latimer, New York, all of which were greatly enjoyed.

We arrived at Yokaham, Japan on October 28th, 1929, and after clearing of baggage, went on up by special trains to Tokio, the capital of Japan. Every one spent the first day in sort of stretching his legs, getting settled in the hotels in Tokio, and getting away the mail which we had so carefully written on the way over.

Engineering Congress

Then came the opening of the Engineering Congress, and the parade of the top hats and stripped trousers. It seems that the custom in Japan is to wear a frock coat and top hat at anything like a formal day meeting and owing to the numbers attending the congress I doubt if it was possible to secure a silk hat or a pair of stripped trousers within a hundred miles of Tokio. There were to be some 700 papers read during this congress of which 435 were to be in English and the balance in Japanese. Due to very excellent arrangements all papers had been printed in advance so that it was possible to secure copies beforehand and to read them at leisure.

Mr. J.V.N. Dorr very kindly sponsored me at the congress and thru him I was able to secure copies of all the papers in which I was interested. It became evident at a very early date that it would be impossible to read the papers at the meetings of the congress; so that after the first two days, the papers were read by title only and then some social function would cause an adjournment.

Professor Richards of Boston Tech, was present at the congress and during his visit to Japan ranked

second only to the Royal Family. The reason for this was, the fact that the greatest man in Japan today outside the Imperial family was formerly a student of Professor Richards and since the whole idea of religion in Japan lies in the worship of ancestors, great teachers, etc., then one can realize the homage paid to Professor Richards as having guided the great man of Japan on his way to knowledge.

Owing to the limited accommodation at many of the resort places of Japan, it was necessary that we go on our side trips to the various shrines, parks, lakes, etc., in squads. One does not require an interpreter in passing thru those portions of Japan which are ordinarily travelled by foreigners in sight-seeing. One finds that English is the universal language and all Germans, French and other Europeans converse with Japanese by means of the English language.

After spending two weeks in Tokio and in sightseeing in various nearby places, I took train on to the west end of Japan to Shimonosaki, where one takes the steamer for Fusan, the southern port of Korea. The trains are very much like the continental trains, being small coaches, narrow gauge tracks and making very good speed. The trains carry diners and

one finds "European" food, and the menus are printed in both English and in Japanese. I may state here, that outside of the hotels which are patronized by foreigners, one does not drink water unless it has been boiled. On the trains one either stays with tea, or beer. In certain parts of the Japanese empire it is possible to secure "Tan San" or a bottled spring water which is very palatable and which is free from contamination.

As you pass along thru Japan on the train, you first notice that all the railway cuts are lined with stone. Owing to the heavy rainfall and the nature of some of the material thru which these cuts are made, there would be a great deal of interruption of train service due to slides. However due to excellent maintainence of track and right of way one can usually set ones watch by the arrival and departure of the trains. The Imperial railways are the property of the Government of Japan and are run in a first class manner.

All thru Japan one finds an effort being made by the Japanese to accommodate their people to foreign ways. The children wear clothes to school not unlike our own boys and girls wear here at home. The men and women engaged in business of better class wear

foreign clothes. It is only in the rural districts that one finds the old picturesque dress, old types and styles of hairdressing, and the children of the Japanese doll type. A reason for the foreign dress, is, that it is both warmer and cheaper, than the Japanese dress, so that it is probable, that within the next two or three generations we will see the Japanese adopt the foreign clothes entirely, and thereby lose much of their grace and charm.

Korea

Arriving at the western end of Japan, one embarks on a steamer for Korea. These are modern boats capable of 22 knots per hour, and are very sea worthy since the passage across the straits is usually one of the roughest passages of any where in the world.

Here at Fusan in Korea, one runs up against the customs and immigration authorities for the first time, where the examination may be said to be severe. The Japanese Government maintains a mandate over Korea and properly so because it is necessary that she protect herself from military aggression from that direction. The customs man is particularly interested in whether you have any fire arms, opium or cigarettes or cigars. The law states that Koreans are not to hold fire arms in their possession under any circumstances

for fear of an uprising. Tobacco and opium are practically government monopolies so that you are allowed only 10 packages of cigarettes or one box of cigars. Not being an Oriental I was not interested in the opium end of the regulations. The customs laws are not severe otherwise because one can import any sort of machinery or materials for mining, milling or smelting operations, duty free.

The district to which I was travelling is that which lies in the far north and just 15 miles from the Yalu River or the border of Manchuria. The northern part of Korea is that portion which is hilly and in which the economic ore bodies have been found. The southern part of the country is an agricultural country, devoted mainly to the growing of rice and Soy beans. In passing thru Korea one notices many differences from Japan - first of all in costume, the Koreans wearing white clothes of a distinct pattern. The Koreans also wear a full shoe, not sandals and have never spread their toes. Since they walk a great deal, they have a great stride and swing along with a freedom of movement unknown amongst the Japanese.

The railways in Korea have the standard gauge with pullmans, dining car, observation cars, etc., just as we have in America. They have one improvement over

our trains in that a freshly laundered kimona, all sealed in a paper package and also a pair of bedroom slippers are at your disposal, in your berth. The railway stations are marked with sign posts with the name of the station in both English, and Japanese and Chinese so that one cannot mistake the town. Also the time tables may be had in English so that by watching the time and the time table one can get along very nicely altho only a few of the people can speak in English when you reach Korea.

I stopped off at Seoul, the old capital of Korea and there met the foreign residents at the Seoul Club. The custom in the Orient is for foreigners to have their clubs, and meet each day at the close of the day's work, and have a social time for a few hours before dinner. They all gather at the club with the usual card game, sweepstake tickets, and discussion of both local and foreign affairs, as learned from the newspapers. Dinner is usually held at about half-past eight in the evening so that there is usually three hours for such social intercourse. It was at the Seoul Club that I heard the origin of the various mining concessions, how they were granted by the old Korean Emperor at a time when his cash resources were dwindling and were granted for a cash consideration. The

extent of such concession is usually land twelve miles by twelve miles. Such concessions were granted to German capitalists, to French and to American interests. The concession to which I was going was the one granted to a group of Frenchmen and which the Frenchmen worked for a period of some fifteen years and then sold to an English Syndicate.

It was in Seoul that I first ran into what is known as the Eurasian problem. Men who went to Korea years ago, from various countries, have often followed the custom of the country and taken a wife from among the native population. Among the natives this is considered all right and proper since women are looked upon as mere chattels any way and the marriage to a foreigner would insure presents and money to the woman's parents. In many instances such marriages have been terminated by the return of the man to his own native land in which case he usually has made provision for the native woman left in the foreign land. But there are exceptions, as oftentimes, the man has had a spell of typhoid or of small pox or there have been children born to the couple, and due to the devotion shown by the woman, her careful nursing and her ability to secure food for her family under conditions of hardship and sickness the man feels that he cannot abandon

the woman who has shared his hardships and proven herself to be a helpmate. Such men are those who are self-exiled from their own people and home land because he realizes that he cannot return home to his own people with a dark skinned wife and some half caste children. His children are fated to associate only with the natives or other half castes and the doors of the better homes are closed to them even out there in the Orient. Out of some 400 foreigners in Seoul, about ten percent have native wives. Those having native wives and children and who have acquired wealth, try to educate their children in France where there is less distinction between pure bred and the half caste races.

From Seoul I travelled to Mochori, the point on the railway nearest the mining property. Here I was met by the accountant of the property and was told that we yet had a seventy mile journey by auto before reaching camp. So we stopped for a breakfast and then loaded everything into a trusty "Chev" and away we went.

I was struck by the excellence of the roads and learned that the Japanese have instituted a system of working the roads by which it is compulsory for all the natives to work a certain number of days in lieu of taxes. These roads have been surfaced with crushed stone and are able to stand the heaviest sort of traffic.

However the Japanese count these roads as military highways and are interested only in those which run North and South so that once you leave one of the main military highways you are liable to get into some pretty tough going.

We passed a few auto trucks as we went along towards the mine, but the trucks were owned by the mining companies. The bulk of freight on the country roads is carried by the old two wheel bull cart. The draft animals are not particularly large yet they seem to have that patience and reliability which will probably allow them to compete in freighting for years to come. The driver in his white clothes walks along the road beside the bull guiding the animal by the line attached to the ring in the nose. Occasionally one meets a pack train where the ponies are loaded as in the western part of the United States. Then as we neared the villages we saw many coolies carrying their burdens on their backs on what was called a jiggy.

The Chosen Corporation

We finally arrived at the camp of the Chosen Corporation around lunch time and I was taken to the manager's home for lunch and to learn a little of the preparations made for my accommodation.

There were only seven foreigners at this

concession, and they were, the Manager, the Mines Superintendent, Mill Superintendent, Assistant Mine Superintendent, Accountant and myself. All were English speaking people. The manager was married and his wife was a French woman, who could understand a little English, but who spoke, but brokenly. All the remainder of the staff were either Koreans or Japanese. All the actual mining and milling was carried on by Korean labor.

Each of the foreigners carried on his own establishment so I was given a six room brick house, with all modern conveniences including a cook who spoke English and a house boy who was Chinese and could not even speak Korean, but the cook spoke Korean and Chinese as well so that we managed to get along all right. After having been introduced to my home sweet home, I was asked to make out a list of the food that I would want, the same to be sufficient to carry me for six months. So with the help of the Manager's wife and the several foreigners I made up my list, which consisted mainly of canned goods, flour, sugar, etc. Meanwhile the cook drew on the manager's home for such supplies as I needed, and so I started out housekeeping in that far land.

Milling Problem at the Plant of Chosen Corporation
Taiyudo Chosen (Korea)

I will now tell something of the problem which came up in the milling of the ore from this concession.

This ore is mined from a quartz vein which is ramified by small seams of a graphitic clay material, and the walls of the vein consist of a sort of a graphitic shaley material. The above graphitic materials break down under treatment into a rather peculiar clay which was called primary colloidal slime.

The milling process in use consists of stamp milling followed by the separation into sand and primary slime in Dorr Duplex Classifiers. The primary slime overflow from these classifiers, which is all practically thru 200 mesh, is thickened and treated by flotation. Normally and with a good supply of fresh water, flotation is satisfactory, but, in winter, when they were short of water and had to reclaim water from the mill pulp, using lime to settle it, the bad effect of this foul water on flotation was very marked. So long as they could keep the primary clay unflocculated, flotation was satisfactory but the pulp was sensitive and the least impurity in the water flocculated the slime immediately. With unflocculated pulp it was

possible for them to flow off the tops of the thickeners a small quantity of colloidal clay. There was insufficient thickener capacity any way, and with flocculated pulp the overflowing colloidal clay then entangled and carried over with it rich sulfide minerals.

It was thought that the valuable mineral in the primary slime consisted of extremely fine grained galena with which was associated high gold values. The problem was to save the whole of the galena in a flotation froth. There was also a small amount of sphalerite pyrite and pyrrhotite in the slime, which minerals did not seem to carry high gold values, at least the local staff did not think so.

The problem was to improve the flotation extraction when using neutral water and if possible to find out some means of obtaining satisfactory results when using reclaimed foul water which contained of course lime which had been added for settlement purposes.

The problem was complicated by the fact that the ore contained widely different amounts of some soluble alkaline material and when the pulp became alkaline even when using fresh neutral water, flocculation occurred and flotation difficulties arose.

Chemical analyses soon proved that the soluble salts in question were the sulfates of calcium and magnesium. The corrective was Soda Ash. Owing to the fact that soda ash did not permit of a clear overflow from the thickeners it was necessary to use lime for clarification giving a crystal clear overflow from the thickener tanks. Then it was necessary to eliminate the soluble salts from the thickener underflow prior to flotation. This was done by adding soda ash and then passing the thickened slime into a conditioning tank. Copper sulfate was then added as a conditioner to counteract the effects of the lime on the pyrite and a long time period of conditioning given the pulp prior to flotation. Recovery immediately picked up to well above 90% and the ratio of concentration which had averaged only 3:1 now became 6:1. The flotation tailings were eliminated to waste, and the flotation concentrate sent on over to the concentrate regrinding section and then to the Dorr Counter Current Decantation plant for the recovery of the gold values by cyanidation.

The original test work which had been done in England on this ore called for all sliming and cyanidation. This was found to be impracticable at

at the plant owing to the fact that the slimes became flocculated and entrained gold values, and recovery suffered as much as 25%. Hence the adoption of the combined flow sheet, of gravity concentration and cyanidation on the sands, and thickening and flotation and cyanidation on the slimes. The ore treatment scheme has been studied and I have recommended the adoption of a fine grinding and flotation flow followed by cyanidation of the gold values from the flotation concentrate. This flow is being adopted, as being more fool proof, lends itself to better sampling and more accurate work.

The Korean seems to be a good mill man, and a good miner. They are very liable to petty thievery but when you realize that his pay is often only 60 cents a day American money and that his fuel will cost him about 15 cents a day in the winter, then you can overlook a few things like that. In passing thru the mill the mill operators would look to me to indicate whether or not I was satisfied with the way the machines were running. The sign of approval is one which undoubtedly was borrowed from the Chinese and which sign spread over into Italy and Europe in the early days. The sign of approval is "Thumbs up" whereas the sign of disapproval is the opposite, or "Thumbs

down". While on different customs and signs, I might state that the sign of mourning is the wearing of sackcloth. I did not notice any ashes, but there is still enough dirt about the average coolie that a few daubs more or less of ashes would not adhere to his person.

The accounting end of a gold property in Korea is an interesting thing to study. There was an embargo on the shipping of gold from the Japanese Empire, so that all the gold must be sold in Japan. The company itself was an English Company with a capitalization in Pounds Sterling. Assays followed the English system of pennyweights of Gold to the ton. Sales of bullion were made in terms of the "momme" which is the Japanese unit by which precious metals are bought and sold. The unit of cost for the plant operation was the Yen (or fifty-cents our money). All foreign staff were paid usually by draft on London or San Francisco either in dollars or pounds shilling and pence. So around the accounting office one begins to become familiar with the various rates of exchange and the various mediums for buying and selling and estimating the worth of bullion.

The gross values in the ore at this particular property ran around 8.00 dwt per ton which is to

say about \$8.00 per ton. Costs were Yen, 0.50-11.00, per dry ton of ore milled and mined or \$5.25 our money. Recovery was 90% overall, including both cyanidation and flotation. Tonnage treated per day amounted to 350 tho sometimes 11000 tons per month would be mined and milled. The ore reserves were limited and thought to be sufficient only for about two or three years.

Salaries in that part of the world vary, the manager receiving about \$1200 to \$1500 per month with every thing found including house, servants, fuel, food wines and liquers, cigars, etc. In fact the manager is given everything free, since he is supposed to do the entertaining of officials, guests, staff, etc. Mine and Mill Superintendent will receive from \$400 to \$600 per month with house, servants, and free board but without the other perquisites. The assistants will receive from one-third to one-half this amount. The highest priced native will usually be below that of one of the junior foreign engineers.

Power for these operations came over a transmission line from the coal fields at PenYang. The cost of power was 1.75 cents per K.W.Hr. in our money. Prior to the building of this transmission line the company developed their own power and used a series of gas producer engines. This installation was still

intact and came in very handy on a number of occasions when power service was interrupted.

My work being completed at Taiyudo, I made ready to go home. I enjoyed my stay there, some five months and found every one most hospitable. We too had our club, to which we all went at the close of the days work and where we had an excellent library, billiard table, magazines, papers, a bar and commissary and a moving picture machine. We would knock off work about 4:00 P.M. each day, go to our homes and change clothes, go to the club and start a bridge game. At about 7:00 P.M. the mail would arrive and I quickly learned to ask in the Korean language as to whether I had any mail or not. Then about 8:00 we would have the final hand and all be home around 8:30 when we had our dinner. No one went out of his own home after dinner was over but spent the remainder of the evening in reading, studying or writing. This was a very good custom as it insured everyone being out to work at proper time after having had plenty of rest. Of course there were exceptions to this programme, such as at Christmas and New Year and at Korean New Year. Each time that there was a foreign holiday there would be a gathering of all the foreigners and usually we would invite the various native Korean or Japanese

heads of departments. Such occasions were always formal and usually consisted of a dinner and some entertainment afterwards. Then the better class natives, such as the Postmaster, Schoolmaster, Doctor, etc., and all the other Japanese and Korean heads, had their own club to which we were invited on occasions of their own celebrations, they usually returning courtesy for courtesy. Such affairs were always of great interest to me, since we were served native food in the native manner and by the native Geisha or KeeSang as the Koreans call their dancing girls. All of the native entertainments included both Japanese and Korean dancing, lots of speeches which always had to be interpreted two ways, into English and Japanese or English and Korean or as needed. Then too we were showered with the old custom of the sake cup ceremonial since at these entertainments we drank only rice wine or sake. It seems that it is the custom there if you wish to honor a person while at dinner, you fill your cup with hot sake and send it by bearer to the person whom you wish to honor. He drains the cup, washes it out and fills it and returns it to you. Now imagine only seven foreigners and some 35 to 50 natives all wanting to honor the foreigner. It looks like an endless

procession of Sake Cups coming your way and it has a kick. Of course their object is to get you three sheets under, but there are ways of declining gracefully when one has enough.

And so I finished up a very pleasant stay in Korea so called the land of the Morning Calm. The return to the railway was made via the concession belonging to the American company where I found them having their troubles starting up a new filter. It happened to be of a type with which I was acquainted so they said that I was a very welcome visitor. After ironing out the kinks, we managed to get away from their hospitality. Once at the railway we had a wait of several hours at the company rest house and then on to Seaoul. The Mine Superintendent came with me to Seaoul since he wished to see the dentist and there happened to be a good one at the mission hospital there. So a few days at Seaoul, a trip to the west coast to Chemulpo and then on back to Japan. I had decided that I would visit the principle mining centers of Japan before returning home, so wired to Tokio for an interpreter to come down and meet me and then I started off.

Various Mining Activities in Japan.

I first visited the operations of the Nippon Mining Company which are located at Oita, Kyushu, Japan, the southern most and westerly island of Japan. The Sagonoseki Smelter was the particular point of interest to me because it was at this place that they were practising electrolytic treatment or smelting of their slag and increasing their copper recovery. This smelter was the first to introduce fuel thru the tuyeres of the blast furnaces and such is still their practice.

Smelters are handicapped in the Japanese Empire in that there must be no damage done, by smelter gases, to the farm lands. The stack at this smelter is one of the highest in the world and is located out on a point of land extending into the sea so that no matter which way the wind blows, the smelter fumes are carried out over the water for 85% of the time. Most smelters have installed sulfuric acid plants and also are equipped with nitrogen fixation apparatus so that they are able to turn out sulfate of ammonia as a by-product. Modern smelting equipment is used thru-out excepting at this particular plant they use the old style Japanese type of converter for removing the sulfur from the matte. These are very interesting to

a foreigner yet are now obsolete and preparations were being made to put in a new converter installation.

After leaving the Nippon Mining Company I was invited up to Beppu, a famous Japanese health resort, by the Manager of the Sagnoseti Smelter. This gentleman was an old acquaintance of mine from both Butte and British Columbia days. Beppu is a place off the beaten tourist track and it was there that I stayed for the first time at a Japanese Inn. It was there that I saw for the first time the custom of mixed bathing in the central bath and learned the reasons for the daily baths of the Japanese people. Sometimes they take two or four baths in a day. The reason is this. Their houses are not heated so that when they become cold they get into the hot bath as a means of raising their bodily temperature. There is no soaping of the body in the bath proper as we do in this country. If you wish to use soap then you do so from a small hand tub carefully rinsing all signs of soap from your body before getting into the bath proper. Once in the bath, you stay there for twenty or thirty minutes. The water is so hot in a Japanese bath that about ten seconds was enough for me. The bath or pool is usually of metal and heated by a charcoal fire which is kept

burning continuously, the fire being in contact with the tub or pool. So if you become cold while at a hotel or an inn you just run on down to the bath and absorb a few B.T.U.'s, put on your clothes again and when you feel the need again then repeat the dose. The baths in the public houses will hold from as few as one or two, on up to the large baths like swimming pools in this country. As regards mixed bathing, I may state that no thought is given the matter in those country places, as nakedness is prevalent everywhere but not noticed.

Beppu is famous for its many hot springs and Japanese visit the place during the winter months on account of these springs and also because of the mildness of the climate.

Due to the consideration of my host, I was treated to the best Japanese music and dancing available in that part of Japan. Japan has no written music such as we have and all singing or playing of the various instruments is taught by one performer to another. Of course there are Japanese orchestras playing foreign instruments and playing foreign music but they never attempt their own native music on the foreign instrument.

From Beppu I went on further south on the Island of Kyushu to visit a tin mine. This is known as the Mitate Tin Mine and is owned by the Anglo Oriental Mining Company of London. They paid some millions for the property, it having been brought to the production stage by a Japanese prince who owned the mine and most of the neighboring country. The ore contains about 2% tin and a mill is available for concentrating the ore.

While the machinery in the mill is the latest type of American ore dressing machinery, the mill building itself is an example of what a Japanese mill wright can do when he is really turned loose on a job. Built as it is of timber, huge beams, posts, trusses, one is surprised to find every timber has been hand planed to a finished surface and the walls in between have been plastered. All retaining walls are of masonry of massive proportions and I believe that unless the ants get into the wood that the place would last for centuries.

The one feature of their milling practice in which I was particularly interested, was the attempt to overcome the oversliming of the tin in their grinding mill, by operating the mill in closed circuit with

hammer screens with 40 mesh openings. You see the tin being heavier than the rest of the ore, hangs up in the classifier and is overslimed. Once the tin is ground too fine it is almost impossible to recover it by gravity concentration so that it is necessary to employ stage-grinding and stage concentration. They found that the principal gangue material in the tin concentrate was pyrrhotite, so were operating furnaces giving the concentrate a light roast and thus driving off some sulfur and increasing the difference in specific gravity between the tin and the iron sulfide. However, we soon had a small flotation cell rigged up and operating in an acid circuit and floated off the iron sulfide and sent the concentrates as flotation tailings to a settling bin.

Here too I ran up against the Japanese law which provides for the protection of the Japanese farmer and his farm land. This law has to do with the disposal of tailings from a concentrator. A n operator cannot allow tailings or even discolored water of any sort to escape from his plant, into a stream, or the inspector will shut him down. This compels every one to filter their mill tailings and stack them as dry tailings in some gully or valley where there are no

agricultural activities. At this Mitate operation, the tailings were filtered and carried by aerial tram to a neighboring valley where they were stacked.

I received word that my interpreter would meet me over on the coast, so I returned to Beppu, picked up my interpreter, and took steamer thru the Inland Sea to the Island of Shikoku to visit the plant of the Sumitomo-Besshi Mining Company, a copper mining enterprise. The trip thru the Inland Sea was the most beautiful passage of my entire experience in the Orient. There are many islands of pretty coloring, with the deep green foliage, varied colored rocks and a sea of such intense blue that one never tires of looking at the scenery. Then too the native boats and their sails of various shapes made a never-to-be-forgotten sight.

The Sumitomo Besshi Mine has been in the hands of the one family since the 17th century and there has been some mining going on there ever since that time. The profits from this mine form the basis of the Sumitomo family fortune, one of the greatest individual fortunes in the Orient.

It is a copper property averaging about 33% copper together with considerable pyrite. There is also some gold and silver. They have absolutely, the

most modern equipment possible both at the mine and the mill and at the smelter. The smelter is located on an island out at sea some eight miles distant from the shore. I visited thru their mill and found them doing very good work considering the flow sheet employed and was asked by their manager what I thought of their plant. I told him that it was not quite the way that similar ores were being treated in America. Imagine my surprise when I was told that the plant was a duplicate of one built in America. However the plant in question in America had altered their flow sheet whereas they had not yet done so out there.

Here again I found great sulfuric acid plants, nitrogen fixation plants, fertilizer mixing equipment. Ships were being unloaded in the harbor, their cargo being phosphate rock from Florida. They were experimenting on the program of selective flotation and the utilization of the resultant high sulfur pyrite concentrate in the manufacture of sulfuric acid. Their aim and object in all operations seems to be the desire to eliminate the necessity of importing any thing which they can obtain themselves thru by-producting operations. I do not know of any mining company on this continent which has tried so hard to utilize every

item of value which they have in their ore. It should be a lesson to us on this continent to be more careful in husbanding our natural resources.

Power is as cheap in Japan as in any place in the world. You can name your own price if you agree to take the power at non peak load hours. The reason for the cheapness of power is that it is so inexpensive to develop. There is a great abundance of rainfall in the hills of Japan. The hills are high, giving good heads and the distance from the source of the power to the consumer is usually a comparatively short distance. Excess power that is developed can usually be utilized in Nitrogen fixation plants because owing to the heavy demands upon the soil, nitrogen fertilizer is in great demand. On many of the farms it is the custom to double crop the land, the first crop being grain and the second being rice. This necessitates the use of great quantities of fertilizer. Then too Japan found the necessity of making herself self sustaining as to nitrogen products for war purposes since in the advent of a war she would be cut off from the usual South American Nitrates.

From Besshi, I went back to Niihama, on the Island of Shikoku, and there took steamer for Kobe,

Japan. I stayed a few days in Kobe, being interested in talking over the proposed requirements, in machinery for the Chosen Corporation. I found that any sort of mining or milling machinery could be obtained in Kobe even the patented varieties. One thinks that the manufacturers over there have little regard for patent laws because many of the items in question are made without reference to the company owning the patent. But the law is this, you can secure a patent in Japan on any machine or process just as you can in this country, but in order to hold your patent, you must start manufacturing the patented article within twelve months in the Japanese Empire. Many foreigners take out a patent in Japan and fail to start up within the specified time. In the catalogs of the different machinery houses one can see cuts of Hardinge Mills, Dorr Classifiers, American Filters, etc., which those Japanese companies make without any reference to the parent company whatsoever.

From Kobe I travelled up to Tokio again and on up into Northern Central Japan to visit the operations of the Ashio Copper Company. On arriving at the station where we left the train, we were met by the police who very politely inquired of my

interpreter as to our length of stay, our purpose in coming there and where we were going from that part. This is the customary treatment of strangers in an out of the way place, and the information given to the police is immediately checked up by phone so that they can keep a very close check upon strangers in their midst. Here too in this district I noticed that the people about the place were curious as to our appearance, clothes, size, etc. One could hear their remarks of "Oke San", meaning "See the big one".

I did not get to see as much of the operations at this property as I would have liked owing to the fact that the staff were too busy obtaining information from me and having me show them how to make small scale tests on flotation test machines. I do not know how they ran their tests before but I do know that they were very much surprised when I kept the volume of the pulp in the test machine up to a constant level by addition of water. The Ashio operators use the native Camphor oils and tars as frothers in their flotation plant. The effect is similar to that produced with the Pine Oils but they require about 25% more of the local oils and the froth is usually high in Insol as the result of this excess. The Ashio Company has the

same problem of tailings disposal as have the other operating companies in that they must filter the tailings and then send them by aerial tram over to a barren gulch. They were treating about 800 tons per day thru the mill, tho probably mining 1500 tons per day. Owing to the cheapness of female labor the companies usually have great hand picking plants where they remove high grade, pyrite, waste and milling ore is that which remains after the balance have been eliminated.

Leaving this district I returned to Tokio where I spent some time in looking over the rebuilt areas, noting the improvement in this new part of Japan because it is new since 1923 when they had the terrible earthquake. After seeing the area that was devastated at that time and the state of the same area now, one can have a great deal of admiration for the men who so daringly set out to rebuild that district. Construction of the permanent buildings is of fire and quake proof type. Streets are wide and of excellent material.

On returning to this country I was interested in hearing on all sides the discussion of the pacific coast trade with the Orient. It seems that

it fell to an alarmingly low figure during the year 1930. They compared how it had built up since the great war to such high totals in 1925 and 26 and then how it has gradually fallen away. The whole reason was that the Japanese people worked hard and fast to rebuild their great empire.

I returned to Canada in the early summer of 1930 after having spent some seven months over in the Japanese Empire. Since that time I have been giving considerable thought to the future of that country and of China and Manchuria. I do not recommend that field to our engineering graduates because of the fact that all countries out there are building up a policy of "The Orient for Orientals". This is nothing but right since the oriental is excluded from competition in most Caucasian countries, so that it is only natural for them to wish to husband their resources for exploitation by their own people.

Then, too, we do not realize in this country the fact that the great masses of population of this globe have turned to Communism. Starting with Russia, spreading to China, now in India, and Japan being affected to a greater degree than we realize. In fact only the English speaking peoples seem to have anything like a stable form of Government, and recent elections have shown that the voter is dissatisfied with conditions as they exist and has registered his voice in the matter by voting for a change.

In Japan, religion and Government are sort of interwoven together. The head of the country, the Emperor, is also supposed to be the direct

representative of the Sun God. So far Japan has been able to keep communism under control, but with a rapidly increasing population, with limited agricultural areas, the fight for existence will become more difficult. The Japanese Government has taken steps to hold the increase in population to a minimum, by opening up some twenty Birth Control Clinics distributed thru the main cities and centers of the Empire, both to furnish information and serve as a dispensary for supplies in carrying out this work. It is agreed that some years will elapse before they achieve the desired result, but all agree that it is a step in the right direction. Japan, too, is making every effort to keep out of their country, all literature, all labor agitators, and apostles of communism so that it may be possible for them to weather the present world conditions.

From the foregoing, I wish to emphasize the fact that within a very short time it will be impossible for foreigners to carry on industries or professional work in the Orient. Of course the exception will always occur and in this instance it will be the man or corporation that has a monopoly on some item or along some particular line of endeavor. The Oriental will never become a leader in any particular

industry save in Agriculture, but he will be able to make use of all the new machines, processes, developed elsewhere and the Japanese will be the first of the Oriental races to make use of them. Our engineers will always be able to "show them how" for the first time, after that they will be able to carry on themselves.

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