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CHAPTER IX

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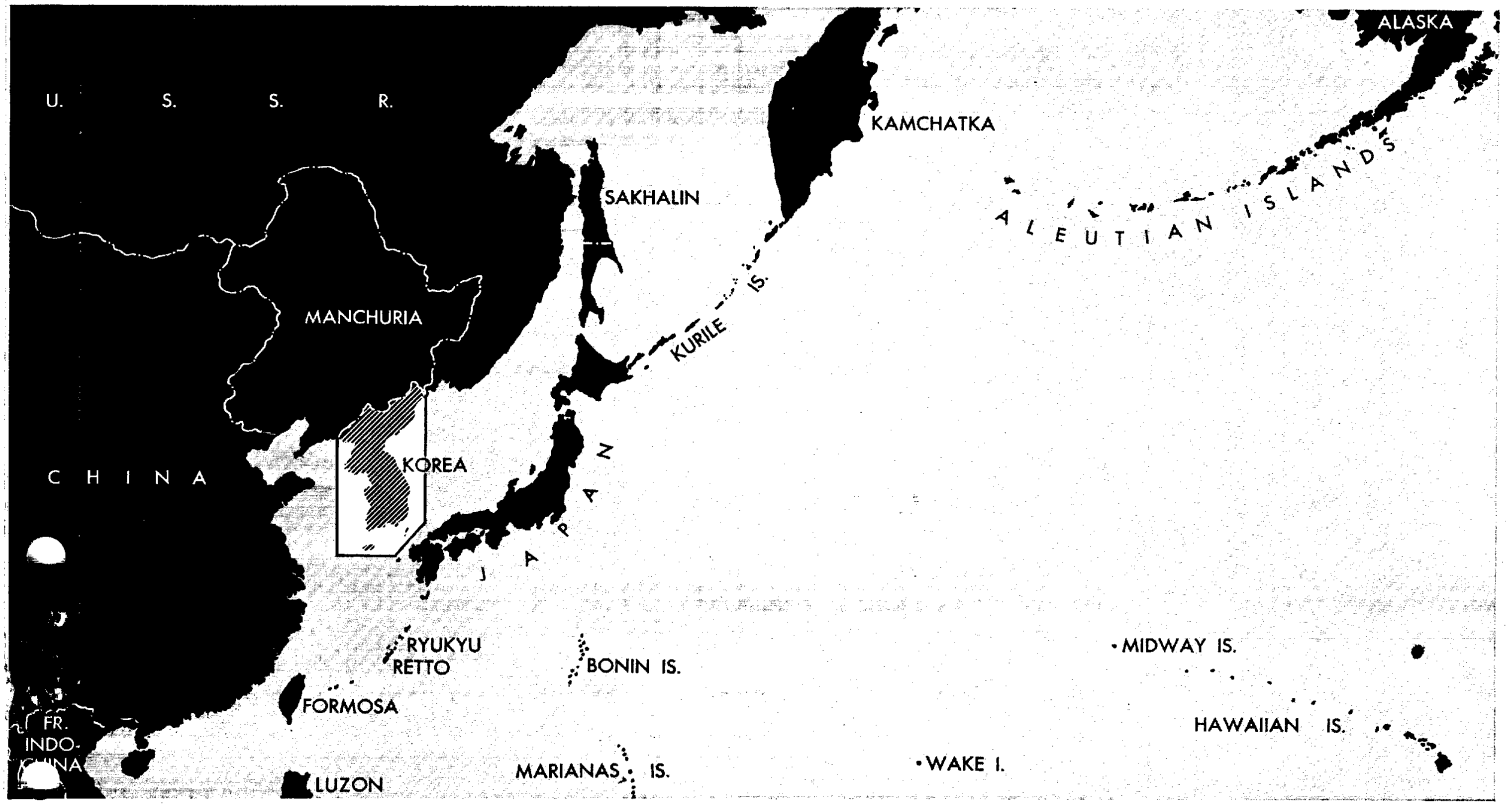

JOINT ARMY-NAVY INTELLIGENCE STUDY

OF

KOREA

(INCLUDING TSUSHIMA AND QUELPART)

RESOURCES AND TRADE

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List of Effective Pages, Chapter IX

Subject Matter	Change in Effect	Page Numbers
Cover Page	Original	unnumbered
List of Effective Pages and Table of Contents, Chapter IX (inside front cover)	Original	unnumbered
Text and Figures	Original	pp. IX-1 to IX-46
Text (reverse blank)	Original	p. IX-47
Figures (inserts, reverse sides blank)	Original	Figures IX-45 to IX-55
Table of Contents cont'd and imprint (inside back cover, reverse blank)	Original	unnumbered

Table of Contents

Note: This chapter is based on material available in Washington, D. C. on 1 March 1945.

(Table of Contents continued, inside back cover)

RESOURCES AND TRADE

90. *Introduction*

A. Korea's economic position.

Japan's prewar policy of integrating the Korean economy with that of the home islands has been accelerated during the war. Today Korea is not only a strategic link in the supply route for military operations on the Asiatic mainland, but it is also an increasingly important source of essential war materials. At the same time, there is some evidence that Japan is attempting to increase Korean self-sufficiency in order to ease the strain on her own production and transport.

In peacetime Korea was principally a source of raw materials and foodstuffs for Japan, and a market for her manufactured goods. As war drew nearer, Japan inaugurated a policy of intensive development of Korean raw materials, while at the same time the tempo of industrialization was stepped up, in preparation for the day when manpower, industrial facilities, and shipping would prove inadequate for the continued expansion of industry in Japan proper.

Japanese capital and management, with the aid of subsidies, tax exemptions, and other inducements, moved into Korea and undertook a large expansion program. As a result, production rose sharply in all fields, especially in manufacturing. In terms of value (without allowing for the effect of substantial price increases), total production in Korea was almost quadrupled between 1933 and 1941. Included in this expansion were increases of 120% in agriculture, 235% in forestry, 700% in mining, 300% in fishing, and 440% in manufacturing. As a result, the Korean economy became relatively less agricultural and more industrial. Thus, agricultural production dropped from 60% of the total value in 1933 to 40% in 1941, while manufactures rose from about 25% to over 40% of the total.

These value figures, however, exaggerate the true position, especially as it was in 1941, because the value of manufactures includes not only the actual contribution of manufacturing but also the cost of the raw materials used. It is noteworthy that in 1938, 74% of the 24,000,000 people in Korea were still engaged in farming, as compared with 7% in commerce, 3% in manufacturing, and 1% in mining.

B. Economic regions.

Primarily for the convenience of the reader, Korea is treated in the present chapter as comprising 3 regions: Northern Korea, Central Korea, and Southern Korea. Northern Korea contains the east-coast provinces of Hamgyong-pukto, Hamgyong-namdo, and Kangwon-do, and the west-coast provinces of P'yongan-pukto, P'yongan-namdo, and Hwanghae-do. Central Korea comprises Kyonggi-do and Ch'ungch'ong-namdo, on the west coast, and Ch'ungch'ong-pukto in the interior. Southern Korea consists of Kyongsang-pukto, on the east coast, Kyongsang-namdo and Cholla-namdo, on the south, and Cholla-pukto, on the west coast. (FIGURE IX-45)

(1) Northern Korea.

Although more rugged and less fertile than the other regions, Northern Korea is rich in mineral resources and water power, and has become increasingly important industrially. Agriculturally, it specializes in crops which do not require irrigation, and produces 80% of the millet and buckwheat grown in the country, 75% of the beans, 70% of the Irish potatoes, and most of the native cotton. Virtually the only remaining commercial forests in Korea are here. Its east coast is responsible for 47% of the fish catch, and it contributes 86% of the yield of marine industrial products.

The region contains the principal iron-ore fields; the bulk of the country's production comes from the mine at Musan (Mozan). Most of the important coal mines are in the north. Northern Korea has the only manganese mine, most of the tungsten, nickel, mica, copper, lead and zinc deposits and processing facilities, and is an important producer of magnesite and other minerals. Almost all the Empire's fluorspar is obtained here. Korea's magnesium-reduction and alumina and aluminum capacity is concentrated in Songjin (Jōshin), Hungnam (Kōnan), Wonsan (Genzan), Yongamp'o (Ryūgampo), Chinnamp'o, and possibly P'yongyang and Sinuiju (Shingishū). The country's 7 major cement plants are all in the region. It has the only known by-product coke-oven plants and synthetic-petroleum installations, and the most important petroleum refinery and commercial storage.

Nearly ⅘ of Korea's power-generating capacity is in the hydroelectric developments of Northern Korea: the Changjin-gang or Chōshin-kō, the Pujon-gang or Fusen-kō, the Hoch'on-gang or Kyosen-kō, and the Kanggye or Kōkai. By far the largest plant is on the Amnok-kang (Yalu River) near Sinuiju, and 24 of the 28 plants with a capacity of at least 10,000 kilowatts are in this economic region. There is known to be an integrated grid system linking the power developments to the principal cities, and power generated within the area is furnished also to Central and Southern Korea.

The iron and steel industry at Ch'ongjin (Seishin) and Kyomip'o (Kenjiho) together has ⅘ of Korea's iron-making capacity. The region's (and the country's) most important industry in value of output is chemicals. The development at Hungnam (Kōnan)* has the largest ammonia-synthesis and sulfuric-acid plants in the Empire, and it produces a number of other important substances. P'yongyang has a small machinery industry, and perhaps the most important arsenal in Korea; it manufactures synthetic fiber, and possibly also aircraft. Sinuiju has a motor-vehicle plant and one of the largest pulp and paper mills in the country; it also may have an aircraft factory.

Ch'ongjin (Seishin), Sinuiju (Shingishu), and Songjin (Joshin) were all active commercial ports before the war. Because they provide the shortest route between Japan and Manchuria, the northeastern ports of Najin (Rashin) and Unggi (Yūki), in addition to Ch'ongjin, are believed to have gained greatly in importance in recent years. The new port of

* Through error, Hungnam is designated on some of the FIGURES under the name of its suburb, Honam-ni (Konan-ri) (PLAN 36).

Dasado (Tashitō), in the extreme northwest, serves both Korea and adjacent Manchuria. Chinnamp'o is one of the largest coal ports in the Far East.

(2) Central Korea.

Central Korea is important both agriculturally and industrially. Rice is the major crop, but a number of others are grown, and more than half of the country's small livestock and dairying industry is here. Its mineral resources include the sole chromium and vanadium mine, and some fluorspar, graphite, and antimony. Copper refining and fabrication are conducted here, and construction-materials industries are important in Kyongsong (Keijō, Seoul) and Inch'on (Jinsen). The chemical industry is minor in comparison with that at Hungnam (Kōnan).

The province of Kyonggi-do has an important concentration of industries in Kyongsong, Inch'on, and Pup'yong (Fuhei). Forty-five percent of the 1937 output of machine tools came from this area, which is also important for the manufacture of ordnance. Inch'on has one of Korea's 2 largest shipyards. These 3 cities produce most of the output of railroad rolling stock and motor vehicles, and may now be expected to have aircraft plants. Yongdungp'o (Ryūgampo) has 2 large textile mills, and there is a third at Inch'on. Central Korea has one major hydroelectric plant and 2 major steam plants, but the area is served by the Northern Korean grid.

Inch'on (Jinsen) is Korea's second commercial port, and Kyongsong had attained importance before the war.

(3) Southern Korea.

Fertile Southern Korea is primarily agricultural, and it has the largest food surpluses of any portion of the country. The main crop is rice, but other cereals and vegetables are grown. The area has 75% of the rice cultivation, 90% of the naked barley, 58% of the barley, and 83% of the sweet potatoes. It is the chief producer of upland American-type cotton, and of silk and tobacco.

The mineral resources are sizable. Most of the molybdenum is found here, and there are deposits also of aluminous shale, zinc, copper, lead, and graphite. There is one important coal field, and there are 2 small petroleum refineries. Pusan is the most important industrial center, and it is perhaps more significant as a port and railway terminus. It has an important machine industry, one of the 2 largest shipyards, a railroad-equipment plant, an explosives plant, and a rubber factory; there may be an aircraft plant on the adjoining island of Mok-to (Makino-tō). Chinhae (Chinkai) is one of Japan's major naval bases, and possesses an arsenal. At Kunsan (Gunzan) are 1 or 2 shipyards and a motor-vehicle plant; a synthetic-fiber plant was planned for this town. Southern Korea has only one major power plant, a thermal station at Pusan, and the region is believed to derive power from the station at Yongwol (Neietsu) in Kangwon-do.

Pusan is the principal port of Korea, and the value of its 1939 trade was twice that of its nearest competitor (Inch'on). Yosu (Reisui) has been developed as an alternate port, and a ferry operates between Yosu and the Japanese home-island of Kyūshū.

Quelpart (Chanju-do, Saishu-to) is a densely populated, undeveloped island, whose residents are principally engaged in raising dry grains, cotton, oranges, winter vegetables, and mulberries, and in sericulture.

C. Japanese-sponsored industrial districts.

The Japanese authorities in 1937 announced a plan for Korean self-sufficiency under which it was proposed to divide Korea into 5 industrial districts. None of these would be self-sufficient, but all would complement each other.

The "Hokusen District" in northeastern Korea has chiefly chemical, petroleum, iron, steel, aluminum, and magnesium industries. Its principal industrial cities are the following: Hungnam (Kōnan), Songjin (Jōshin), Kilchu (Kisshū), Ch'ongjin (Seishin), Aoji-dong (Agochi-do), and Wonsan (Genzan), in Hamgyong-pukto and Hamgyong-namdo.

The "Seisen District" includes P'yongan-pukto, P'yongan-namdo, and Hwanghae-do, all in northwestern Korea. The principal industrial centers are Haeju (Kaishū), Kyomip'o (Kenjiho), Chinnamp'o, P'yongyang (Heijō), and Sinuiju (Shingishū) and its suburbs.

The "Keijin District," in Central Korea, is relatively weak in basic industries, but has important manufacturing establishments in the fields of chemicals, iron and steel, light metals, machinery, and ordnance. It includes Kyongsong (Keijō, Seoul) and Inch'on (Jinsen), and the industrial suburbs of Yongdungp'o (Eitōhō), Pup'yong (Fuhei), and Sihung-ni (Shikō-ri).

The "Nansen District," in Southern Korea, is largely a food-producing area. The principal industrial cities are Samch'ok (Sanchoku) (chemicals), Pusan (Fusan) (shipyards), and Yongwol (Neietsu) (coal and power). The district comprises Kangwon-do, Kyongsang-pukto, and Kyongsang-namdo.

The "Konan District," like the last, is a food-surplus area, and can supply foodstuffs to the more industrialized districts. Its most important cities are Kunsan (Gunzan), Chonju (Zenshū), Mokp'o (Moppo), and Taejon (Taiden), in the provinces of Cholla-namdo, Cholla-pukto, Ch'ungch'on-namdo, and Ch'ungch'ong-pukto. There are a few machine industries here, which may supply other districts.

Thus, the first 2 districts correspond partially to Northern Korea (without Kangwon-do), the third is equivalent to part of Central Korea, and the fourth and fifth comprise Southern Korea, with additions from both Northern and Central Korea.

It is perhaps noteworthy that the scattering of manufacturing installations in the 2 southern districts affords a minor protection against air attack. On the other hand, the iron and steel, chemical, light metals, and machinery industries, the iron and coal mines, and the hydroelectric power installations are heavily concentrated in a few centers.

D. Important illustrative material.

The pattern of industrial concentration is shown in FIGURE IX-45. It should be noted, however, that the degree of concentration is shown for an entire province, although much of its area may be entirely lacking in industrial development. Also, the industrial symbols employed do not clearly indicate the degree of the concentration of different industries in specific centers.

FIGURE IX-46 shows the surpluses and deficits in food production by provinces, and indicates the principal crops under cultivation. The water supply and sewerage systems listed in Topic 92 are indicated in FIGURE IX-47.

The location of the construction-material industries is shown in FIGURE IX-48. The known deposits of nonferrous metals and nonmetallic minerals, together with the mines, refineries, smelters, and processing plants, are indicated in FIGURE IX-50. FIGURE IX-51 shows coal fields, coke ovens, and refineries for natural or synthetic petroleum. The location of mines producing iron ore and ferroalloys, and the principal concentrations of the iron and steel industry are shown in FIGURE IX-49.

The location of the important centers of the chemical industry are shown in FIGURE IX-52, of the machinery, railway-equipment, and shipbuilding industries in FIGURE IX-53, and of the aircraft, motor-vehicle, and munitions industries in FIGURE IX-54.

Power-generating installations, with a capacity of 1,000 kilowatts or more, are shown in FIGURE IX-55.

91. *Food Resources*

Korea is a food-surplus country, although much of its exports of food to Japan are at the expense of the adequate nutrition of its people. The agricultural economy is based on the cultivation of rice, but dry cereals play a much more important role than they do in Japan. Livestock raising is negligible. Fishing supplies an important quantity of protein foods, although far less than do cereals and beans. Production of processed foods is low in comparison with western countries, but ranks as Korea's second industry in value of output.

A. Present food situation.

(1) Production.

The production of rice has declined during the war, but this decline may have been partially offset by expansion of the acreage and production of secondary grains. Chiefly because of a shortage of fertilizer, the rice output has fallen from an average of about 7,000,000,000 pounds before the war to about 6,000,000,000 pounds in 1944. The more rigid controls and severe delivery obligations imposed on rice growers, together with the shortage of fertilizer, may have induced a shift of acreage from rice to other grains. In addition, the total cultivated acreage has probably been expanded.

FIGURE IX - 1. *Cholla-namdo, Haech'ang (Kaisō).* Cultivation of seaweed, an important food crop, in Haech'ang-man (Kaisō-wan). 1931.

TABLE IX - 1

KOREA. ESTIMATED PRODUCTION OF FOODSTUFFS BY ECONOMIC REGIONS AND PROVINCES, CROP YEAR OF 1944, AVAILABLE FOR 1944-45 CONSUMPTION

(millions of pounds)

	All Korea	*Northern Korea*						*Central Korea*			*Southern Korea*			
		NORTHEASTERN REGION			NORTHWESTERN REGION									
		HAMGYONG-PUKTO	HAMGYONG-NAMDO	KANGWON-DO	HWANGHAE-DO	P'YONGAN-NAMDO	P'YONGAN-PUKTO	CH'UNGCH'ONG-NAMDO	CH'UNGCH'ONG-PUKTO	KYONGGI-DO	KYONGSANG-PUKTO	KYONGSANG-NAMDO	CHOLLA-NAMDO	CHOLLA-PUKTO
Rice	5,968	56	208	302	504	294	376	572	244	714	710	602	754	632
Wheat	1,786	0.4	29	136	727	248	1	68	79	119	169	89	84	37
Barley	2,471	80	73	76	32	56	14	202	153	234	550	484	397	120
Naked barley	61	0.0*	0.0*	1	5	11	—	16	1	3	22	82	325	151
Minor grains	1,542	126	182	125	322	297	232	8	29	58	71	10	9	8
Soybeans	1,211	113	93	100	128	91	118	78	55	135	154	49	46	51
Other beans	309	11	22	23	82	60	40	11	10	21	6	5	11	7
Sweet potatoes	1,654	0.0*	4	12	215	184	60	88	12	115	46	206	659	53
Irish potatoes	1,765	225	748	287	35	100	127	32	32	79	48	20	13	19
Vegetables	2,647	90	149	189	226	294	269	244	96	468	147	147	167	121
Fruit	175	5	17	4	36	35	3	5	3	15	16	14	9	13
Sugar	6	—	—	—	6		—	—	—	—	—	—	—	—
Fish	1,983	364	321	254	89	21	58	41	0.2	27	187	333	249	39
Meat	132	6	8	6	10	18	20	7	5	24	7	8	7	6
Milk	7	0.3	0.3	0.4	0.1	0.7	0.2	0.4	0.0*	3	0.4	0.6	0.3	0.2
Butter	6	—	0.4	0.1	—	0.1	0.2	2	—	2	1	0.0*	0.0*	—
Eggs	29	1	2	2	3	3	2	1	1	4	2	2	4	2

* Less than 50,000 pounds.

Since the mid-1930's the production of sweet potatoes has increased more than fourfold, and that of Irish potatoes by about 40 percent. The output of soybeans and other beans appears to be unchanged, but the production of vegetables and fruit is believed to have declined. The raising of seaweed has been encouraged, and total production is believed to have increased from 7,000,000 pounds to 9,000,000 pounds (FIGURE IX-1). The estimated 1944 production of foodstuffs in Korea as a whole and by economic regions and provinces is shown in TABLE IX-1.

(2) Governmental control and foreign trade.

Despite the appreciable drop in rice production, exports of this grain to Japan have been maintained at a fairly high level. This result has been achieved by compelling each grower to deliver his entire crop to the town agricultural association (an official organization); in return, he becomes eligible for a ration of various cereals. The grain is stored in town warehouses from which the farmers receive monthly supplies. In general, the allotments of rice are varied according to the degree of success with which assigned production quotas are met. An association for the control of secondary grains handles imports of other cereals, mainly millet from Manchuria.

As in Japan, rice has been made subject to rationing, the use of rice for *saké* has been curtailed, and the degree of milling has been reduced. Although estimates of wartime rice exports from Korea are subject to a wide margin of error, they are believed to have averaged about 2,000,000,000 pounds per annum during the past 5 years. The surplus in 1944 and 1945 is estimated to be about 1,800,000,000 pounds, or nearly ⅓ of Korean production; perhaps ¼ of this is consumed by Japanese soldiers in Korea and Manchuria. Wheat exports in 1944 and 1945 probably did not exceed the prewar level of about 35,000,000 pounds (about 6% of production), and exports of soybeans about 200,000,000 pounds (about 15% of production). The major import items are about 650,000,000 pounds of secondary grains and about 55,000,000 pounds of sugar.

(3) Consumption.

The diet of Korea is even starchier than the Japanese diet. Grain products, of which an average of 420 grams (14.8 ounces) per capita was consumed daily before the war, contributed 75% of the total food energy, as compared with 65% in Japan. Rice, however, plays a less important role in Korea than in Japan, furnishing only 38% of the total caloric value of the Korean diet as compared with somewhat over 50% in Japan. Barley and millet, on the other hand, supplied 31% in Korea against less than 5% in Japan.

A comparison of estimates of per capita consumption for 1933 to 1936 and 1944 and 1945 shows that a decline in Korean daily rice consumption from 215 grams (7.6 ounces) per person to 180 grams (6.3 ounces) has been offset by an increase in the consumption of other grains from 200 grams to 237 grams (8.3 ounces) per day. The nominal rice ration for the normal consumer† is the same as in Japan, 330 grams (11.6 ounces) per day. In both countries the actual amount of rice received by the consumer is less. It is estimated that about 45% of the average nominal ration in Korea is replaced by other cereals (soybean flour or potato flour), whereas in Japan rice substitutes amount to only about 5% to 10% of the nominal ration.

The consumption of soybeans and other beans, which are second only to grains as a source of vegetable protein,* has declined. Potato consumption has increased from 55 grams (1.9 ounces) to 68 grams (2.4 ounces), and that of sweet potatoes is 4 times higher than in the mid-1930's. Sugar consumption has always been extremely low in Korea. Although nominal rations of foodstuffs are generally uniform, it is believed that actual consumption of sugar in Korea is only a fraction of the Japanese. Consumption of fish has fallen from 58 grams (2.0 ounces) to 38 grams (1.3 ounces) per capita per day, and the consumption of animal products is negligible.

The quality of the diet is poorer than it was before the war, although the total caloric intake has not changed appreciably. The prewar diet (average of the crop years 1933-1934, 1934-1935, and 1936-1937) of the average Korean supplied about 2,000 calories per capita per day, 15% to 20% less than the minimum regarded as necessary for the maintenance of health. Both the consumption of animal proteins (10 grams, or 0.4 ounces), which is only ⅔ as great as before the war, and that of fat (17 grams, or 0.6 ounces) now fall short of the nutritional minimum. Table IX-2 shows the estimated daily per capita food consumption for 1944 and 1945.

B. General characteristics of agriculture.

Despite the rapid industrialization of recent years, about ¾ of the population is engaged in farm work.

(1) Land use.

In 1938, 20% of Korea's land was cultivated, 66% was forested, and 7% was waste. All other categories of land occupied an additional 7% of the area.

Most of Korea's cultivated land is on the south and west sides of the peninsula. The total cultivated area amounted to 10,873,000 acres, or 11,273,000 acres if "firefields"** are added. The amount of cultivated land did not increase significantly between 1919 and 1938, but irrigated land increased substantially; by 1938 about ¼ of the cultivated area was irrigated. Two crops are raised annually on about 34% of the land.

† An adult consumer who receives no additional ration; a system of differential rationing has been introduced in both Japan and Korea. Different types of consumer groups receive different rations according to their needs. Small children and old people obtain less, and workers and adolescents more than the normal consumer.

* Although beans are a better source of protein than are grains, the large amount of grains consumed makes cereals the major source of vegetable protein.

** Burned off and temporarily cultivated forest lands or prairie. No manure is applied, and the plots are deserted when the fertility of the soil is exhausted. This destructive practice prevails mainly in the mountainous districts bordering Manchuria.

TABLE IX - 2

KOREA, DAILY PER CAPITA CONSUMPTION OF FOODS, BY CALORIES AND FOOD CONSTITUENTS, 1944 AND 1945 (ESTIMATE)

	Food per day (grams)	Total calories	Contribution to caloric intake (%)	Proteins (grams)	Fats (grams)	Carbohydrates (grams)
Rice	180	641	32.0	13.5	3.1	139.9
Wheat	32	114	5.7	3.0	0.3	24.7
Barley	97	348	17.4	8.0	1.0	76.8
Naked barley	24	87	4.4	2.0	0.2	19.2
Minor grains	84	294	14.7	7.1	0.8	64.5
Soybeans	39	137	6.9	13.7	7.1	4.7
Other beans	13	40	2.0	2.7	0.2	6.8
Peanuts	0.2	1	0.1	0.1	0.1	0.0
Sweet potatoes	72	77	3.9	1.1	0.4	17.2
Irish potatoes	68	49	2.4	1.2	0.1	10.9
Vegetables	99	35	1.7	0.9	0.1	7.4
Seaweed	0.4	0.04	0.0	—	0.0	—
Fruit	7	4	0.2	0.1	0.0	1.0
Sugar	3	12	0.6	—	—	2.9
Fish	38	48	2.4	8.1	1.7	—
Meat	4	9	0.4	0.8	0.6	—
Milk	0.3	0.2	0.0	0.0	0.0	0.0
Butter	0.3	2	0.1	0.0	0.2	0.0
Eggs	1.2	2	0.1	0.2	0.1	0.0
Miscellaneous (5% of total caloric intake)		103	5.0	3.0	1.0	20.5
Totals		2,000	100.0	65.5*	17.0	396.5
Percent of calories furnished by each food constituent				(13.7%)	(7.6%)	(79.3%)

* 57.9 grams of vegetable protein and 9.1 grams of animal protein.

(2) Size of farms.

Farm units in Korea averaged 3.8 acres per family in 1938, compared with 2.7 acres in Japan. The smallest farms (2.6 acres per family) are in the most fertile and densely populated western and southern provinces. The average is considerably higher (up to 7 acres) in the northern, sparsely settled provinces, where the proportion of wet to dry land is low. In 1938 a little over 63% of all farm households were in the category below 2.45 acres (including 17% averaging less than 0.74 acres), and only 1.4% of the households had over 12 acres.

Of the total number of farming families in 1938, 42% owned land, and 24% of these leased land in addition to their own holdings. More than 52% were landless tenants, almost 4% were farm laborers, and 2% were *kadenmin* (squatters carrying on shifting land-cultivation, mostly on state-owned forest lands). In 1914 landless tenancy was only 35%, but the proportion has increased greatly under Japanese occupation. According to official estimates, however, less than 6% of all agricultural and residential land is Japanese-owned. This may exclude land owned by Japanese-controlled companies incorporated in Korea. Approximately ⅔ of the total acreage in 1938 was held by large landlords (1,000 acres or over), who represented a little over 2% of all farm families. Of the 3,052,400 farm families in 1938, 99.7% were Korean, only 7,300 were Japanese, and 2,300 were Chinese.

(3) Manpower, fertilizer, and agricultural machinery.

A characteristic feature of Korean agriculture is family farming. With a limited supply of animal and machine power, the productivity of Korean farms depends upon the use of family labor; hired workers represent only 3% of the farm labor supply.

The use of fertilizer, as indicated in TABLE IX-3, is relatively high in Korea, but it is less than in Japan. The use of commercial fertilizers has increased, but farm-supplied fertilizer still represented about ⅓ of the total amount consumed

TABLE IX - 3

KOREA AND JAPAN, APPLICATION OF FERTILIZER PER ACRE, 1938
(pure plant-food equivalent)

	Korea	Japan
	(pounds per crop-acre)	
Nitrogen		
Chemical	17	34
Organic	42	48
Total	59	82
Phosphoric Acid		
Chemical	4	22
Organic	26	24
Total	30	46
Potash		
Chemical	2	10
Organic	45	39
Total	47	49

in 1938. Night-soil and night-soil ash represented 6% of the total, or 15% of farm-supplied fertilizer. Nevertheless, the total supply of fertilizer has been inadequate in recent years; several reports indicate serious shortages and the existence of black-market operations in fertilizers.

Farm equipment is simple, and labor is commonly manual. The usual implements are hoes, spades, small wooden plows and harrows, sickles, flails, and small wooden cylinders with wire teeth for threshing rice. The small size of the plots and the presence of dikes and ditches generally preclude the use of modern equipment. In addition, irrigation and rainfall keep the ground too soft to allow the use of heavy machinery. The cheapness of manpower and the prohibitive cost of modern equipment have retarded mechanization. In 1938 only 9% of farming families had improved plows, 0.1% had mechanical pumps, and 0.025% had gasoline engines.

(4) Crop specialization.

The concentration on food crops is a characteristic feature of Korean agriculture. Korea's climate more closely approximates the continental climate of China than the maritime climate of Japan. The annual precipitation is lower than in Japan, but during July and August it is often sufficient to cause destructive floods and resultant crop failures.

(a) Northern Korea. Northern Korea leads in the production of wheat, millet, buckwheat, sorghum, oats, soybeans, other beans, Irish potatoes, vegetables, and fruit. It is divisible into 2 unlike regions, the northeastern and the northwestern.

In the northeastern region—which has 22% of the cultivated acreage of Korea—the provinces of Hamgyong-pukto and Hamgyong-namdo have long, cold, dry winters and short summers. Kangwon-do has a milder climate, which permits double cropping. The region as a whole is the principal producer of oats and Irish potatoes.

The northwestern region—with 30% of the total cultivated acreage—has a varied climate: P'yongan-pukto and P'yongan-namdo have high precipitation in the mountains, but rainfall is low on the coast. Most of the region is suited to single cropping, but in Hwanghae-do double cropping is practiced with winter barley and wheat as second crops. More rice is grown in the interior, and dry crops are predominant on the northwestern littoral. Before the war this area produced most of the wheat and beans grown in Korea.

(b) Central Korea. This section—with 18% of the total cultivated acreage—has a mild temperature and moderate precipitation. Rice is grown chiefly on the plains, often with winter barley as a second crop. Although it does not lead in the production of any crop, its rice (26% of the national total), vegetables, barley, and soybeans are important.

(c) Southern Korea. The south—with 30% of the total cultivated acreage—has mild winters; precipitation is comparatively high, but occasional droughts cause crop failures. There is extensive double cropping. This area ranked first in production of rice, barley, and sweet potatoes.

The proportionate production of the important crops in each of the 3 major areas is indicated in TABLE IX-4.

TABLE IX - 4

KOREA REGIONAL DISTRIBUTION OF CROP PRODUCTION, PERCENTAGE AVERAGES FOR 1933, 1934, 1936

	Northern Korea		Central Korea	Southern Korea
	Northeastern region (1)	Northwestern region (2)	(3)	(4)
Rice	9	20	26	45
Wheat	9	55	15	21
Barley	5	3	14	78
Millet	43	46	4	7
Buckwheat	27	48	10	15
Sorghum	41	47	7	5
Oats	97	1	2	0.03
Soybeans	25	28	22	25
Other beans	18	59	14	9
Sweet potatoes	1	28	13	58
Irish potatoes	71	15	8	6
Vegetables	16	31	31	22
Fruit	15	42	13	30

(1) Hamgyong-pukto, Hamgyong-namdo, and Kangwon-do.
(2) Hwanghae-do, P'yongan-namdo, and P'yongan-pukto.
(3) Ch'ungch'ong-namdo, Ch'ungch'ong-pukto, and Kyonggi-do.
(4) Kyongsang-pukto, Kyongsang-namdo, Cholla-namdo, and Cholla-pukto.

C. Food production.

TABLES IX-1 and IX-6 show the total production of each of the principal foods in 1944 and in the mid-1930's, respectively.

(1) Rice.

Rice, the basic food crop of Korea, occupies nearly 4,000,000 acres, or 26% of the total harvested acreage.* Yields per acre are about 40% to 50% lower than in Japan, largely because of the lower rainfall, the more primitive methods of irrigation, and the less intensive use of fertilizer. In comparison with other countries, however, the use of fertilizer and the yields per acre are high.

* Acreage cropped twice in the same season is counted twice.

Output increased steadily during the 2 decades before the war. There was no appreciable expansion of acreage, but yields per acre increased by more than 20% because of the greater application of fertilizer, an increase of more than 50% in the irrigated area, and the introduction of improved weather-resistant varieties. In the mid-1930's (average of 1933, 1934, and 1936) the production of rice reached a level of nearly 7,000,000,000 pounds.* Yields varied considerably from year to year, and the 1937 crop attained the record figure of 8,600,000,000 pounds; production had fallen to about 6,000,000,000 pounds by 1944.

Rice production is concentrated in the river basins, where soil and water conditions are favorable for this crop (FIGURE IX-2). The 4 provinces of Southern Korea (Kyongsang-pukto, Kyongsang-namdo, Cholla-pukto, and Cholla-namdo), 2 in Central Korea (Ch'ungch'ong-namdo and Kyonggi-do); and Hwanghae-do in Northern Korea, accounted for more than 75% of the prewar total production.

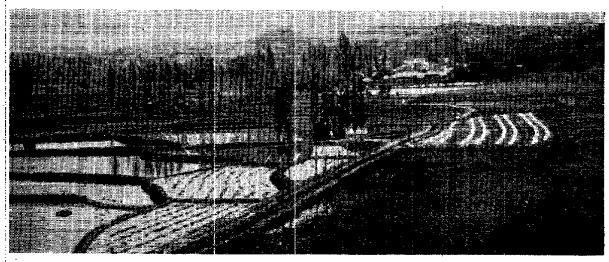

FIGURE IX - 2. *Southwestern Korea.*
Irrigated rice fields, typical of the Double-cropping Rice Area of Southern and Central Korea. 1937.

(2) Other grains.

Grains other than rice play a much greater role in Korean than in Japanese agriculture. In the mid-1930's the dry cereals accounted for about 45% of the total harvested acreage, as compared with 26% for rice. In terms of weight, however, production of dry cereals amounted to less than 3,000,000,000 pounds, less than half the quantity of rice. Barley was the most important of the dry cereals, and was followed by millet, wheat, naked barley, and buckwheat. Corn, oats, and sorghum are used primarily as livestock feed.

(a) Wheat. Wheat accounted for little more than 5% of the total prewar acreage, but it is estimated that production in 1944 was more than 20% greater than the average of 1933 to 1936. This grain is grown on dry land or as a second crop on rice fields. Average yields per acre are relatively low—about 10 to 14 bushels per acre, or less than half of those prevailing in Japan. During the 2 decades prior to World War II, the acreage declined, but yields per acre and production rose by about 10 percent. In the mid-1930's, wheat production amounted to about 500,000,000 pounds. More than 40% was grown in the province of Hwanghae-do, and 14% in the neighboring province of P'yongan-namdo; Kangwon-do and Kyongsang-pukto together accounted for about 17 percent.

(b) Barley. In Southern Korea barley is the staple food of those who cannot afford rice. It is frequently grown as a

* The method of calculating the rice production was changed in 1936, and the Korean authorities published recalculated figures of rice production back to 1929. These recalculated figures, 25.8% higher than the original statistics, have been used for 1933 and 1934.

second crop preceding the planting of rice. Production rose by more than 50% during the two decades prior to World War II, as the result of an increase of more than 30% in acreage and a rise in yield per acre. However, the yield per acre was still only about 20 bushels, or half that obtained in Japan. Average production in 1933, 1934, and 1936 amounted to 1,800,000 pounds, 58% of which was grown in the 3 southern provinces of Kyongsang-pukto, Kyongsang-namdo, and Cholla-namdo; 1944 production is estimated to have been about 2,400,000,000 pounds.

(c) Naked barley. The production of naked or hull-less barley amounted to 340,000,000 pounds between 1933 and 1936; 90% was grown in the 3 southernmost provinces of Kyongsang-namdo, Cholla-pukto, and Cholla-namdo.

(d) Minor grains. Millet is to Northern Korea what barley is to the southern part of the country—a cheap staple food consumed by the poor. In the mid-1930's production of millet amounted to about 1,200,000,000 pounds; millet and buckwheat together amounted to about 1,350,000,000 pounds. More than 80% of this was grown in the 6 northern provinces of Hamgyong-pukto, Hamgyong-namdo, Kangwon-do, P'yongan-pukto, P'yongan-namdo, and Hwanghae-do. An increase of about 10% in millet production has occurred since 1936.

(3) Beans.

Together with rice, soybeans are the most important source of protein in the Korean diet, and they rank second only to rice as an article of export. They are grown throughout the country and account for 13% of the total crop acreage. Acreage as well as yields have remained practically the same since 1920; yields are only half those in Japan. Production averaged about 1,200,000,000 pounds annually between 1933 and 1936.

Production of other beans, amounting to 300,000,000 pounds, is concentrated in the northern provinces of P'yongan-pukto, P'yongan-namdo, Hwanghae-do, Hamgyong-namdo, and Kangwon-do, which together account for nearly 75% of the total.

(4) Potatoes.

The production of sweet potatoes amounted to almost 400,000,000 pounds before the war and to about 1,650,000,000 pounds in 1944. They are grown chiefly in the south and along the west coast. Cholla-namdo alone accounted for 40%; Kyongsang-pukto for 13%; and Kyonggi-do, Hwanghae-do, and P'yongan-namdo together for about 30% of prewar production.

Irish potatoes, on the other hand, are grown principally in the north and east. Of the total production of 1,300,000,000 pounds in the mid-1930's, 70% was grown in the provinces of Hamgyong-pukto, Hamgyong-namdo, and Kangwon-do. Production has now been expanded by about 40 percent.

(5) Vegetables and fruit.

Vegetable production, which amounted to 3,000,000,000 pounds in prewar years, is believed to have declined. It is fairly evenly distributed, with a slight concentration along the west coast of Northern and Central Korea. The provinces of P'yongan-pukto, P'yongan-namdo, Hwanghae-do, Kyonggi-do, and Ch'ungch'ong-namdo raise 58% of the total.

Little fruit is grown in Korea and only about 200,000,000 pounds are produced in a normal year. The northern provinces of P'yongan-namdo, Hwanghae-do, and Hamgyong-namdo produced about half the total; Kyongsang-pukto, Kyongsang-namdo, Cholla-pukto, and Kyonggi-do contribute about 8% each.

(6) Sugar.

Sugar production (from sugar beets) is negligible. About 5,000,000 pounds are produced in P'yongan-namdo and Hwanghae-do.

(7) Animal products.

There is little livestock farming. Cattle constitute the highest percentage of total livestock numbers (FIGURE IX-3). In prewar years 125,000,000 pounds of meat were produced annually. Kyonggi-do accounted for 18%, and Kyongsang-pukto and Kyongsang-namdo together for 29 percent. Milk production was about 7,000,000 pounds, 42% of which was obtained in Kyonggi-do. The production of butter, which amounted to 6,000,000 pounds annually, was concentrated in the Central Korean provinces of Kyonggi-do and Ch'ungch'ong-namdo, each of which contributed ⅓, and Kyongsang-pukto, almost one-fifth.

Egg production, amounting to 28,000,000 pounds, was rather evenly distributed; only Kyonggi-do, Cholla-namdo, and Hwanghae-do produced more than 10% each.

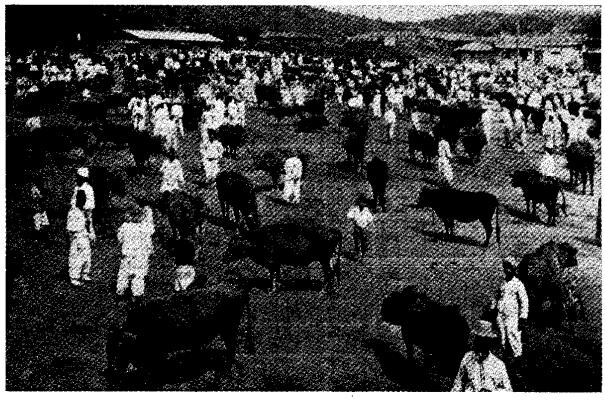

FIGURE IX - 3. *P'yongan-namdo, P'yongyang (Heijō).* Cattle market. Meat is a negligible item in the Korean diet, and protein is obtained chiefly from grains, beans, and fish.

D. Surpluses and deficits.

Prewar surpluses and deficits of food production are shown in TABLE IX-5 and FIGURE IX-46 by area and in TABLE IX-6 by foods. These surpluses and deficits for the country as a whole are actual net exports or imports and do not take into account the actual nutritional requirements of the population. Korea's food surpluses are obtained largely at the cost of inadequate food consumption within the country. Provincial surpluses and deficits are calculated by assuming uniform per capita consumtion of foods in all parts of Korea.

Large quantities of rice are exported each year, almost exclusively to Japan. Exports increased considerably after World War I. By the mid-1930's they had reached about 2,400,000,000 pounds—10 times the level of exports prevailing prior to World War I—or about ⅓ of the total crop.

TABLE IX - 5

KOREA, FOOD PRODUCTION BY PROVINCES, SURPLUSES AND DEFICITS OF ALL STAPLE FOODSTUFFS*, AVERAGE OF 1933, 1934, AND 1936

	Aggregate calories produced annually from all staple foods** (billions)	% of staple food production by food value	% of total population	Annual rice production (millions of pounds)	% of total rice production	Annual aggregate surplus (+) or deficit (—) of all staple food stuffs over requirements (billions of calories**)	Annual aggregate surplus (+) or deficit (—) of all staple food stuffs over requirements (millions of pounds of unmilled brown rice)	Daily per capita surplus (+) or deficit (—) of all staple food stuffs over requirements (calories**)	Daily per capita surplus (+) or deficit (—) of all staple food stuffs over requirements (pounds of unmilled brown rice)
Northern Korea									
Northeastern region									
Hamgyong-pukto	644	3.7	3.6	64	0.9	+ 2	+ 1	+ 4	+ 0.003
Hamgyong-namdo	1,010	5.8	7.4	237	3.5	— 141	— 103	— 230	— 0.167
Kangwon-do	1,010	5.8	6.9	344	5.1	— 34	— 25	— 60	— 0.044
Northwestern region									
Hwanghae-do	2,629	15.1	7.4	575	8.4	+ 739	+ 538	+ 1,196	+ 0.871
P'yongan-namdo	1,706	9.8	6.5	336	4.9	+ 275	+ 200	+ 504	+ 0.367
P'yongan-pukto	1,097	6.3	7.4	428	6.3	+ 41	+ 30	+ 67	+ 0.049
Central Korea									
Ch'ungch'ong-namdo	853	4.9	6.7	653	9.6	+ 299	+ 218	+ 530	+ 0.386
Ch'ungch'ong-pukto	575	3.3	4.2	278	4.1	+ 87	+ 63	+ 248	+ 0.181
Kyonggi-do	1,236	7.1	10.6	815	12.0	+ 154	+ 112	+ 173	+ 0.126
Southern Korea									
Kyongsang-pukto	1,567	9.0	11.2	810	11.9	+ 416	+ 303	+ 444	+ 0.323
Kyongsang-namdo	1,358	7.8	10.1	686	10.1	+ 147	+ 107	+ 173	+ 0.126
Cholla-namdo	2,559	14.7	11.0	861	12.6	+ 478	+ 348	+ 518	+ 0.378
Cholla-pukto	1,167	6.7	7.0	720	10.6	+ 313	+ 228	+ 534	+ 0.389
Total	17,411	100	100	6,807***	100	+ 2,776	+ 2,020	+ 331	+ 0.241

* Difference between production and consumption requirements, the latter assumed to be equal to average prewar (1933-1934, 1934-1935, 1935-1936) consumption. All estimates of surpluses and deficits are subject to a substantial margin of error, because of variations both in production and consumption. The consumption of all foods varies considerably according to age, sex, degree of physical activity, stature, income, and access to food.

** After deductions for waste, seed, feed, and other non-food uses.

*** Figures for 1933 and 1934 were adjusted according to the new method in order to have comparable quantities.

TABLE IX - 6

KOREA, PREWAR FOOD PRODUCTION, SURPLUSES AND DEFICITS, BY FOODS

	Production (average of 1933, 1934, and 1936) (millions of pounds)	Aggregate annual surplus (+) or deficit (—)* (millions of pounds)	Percentage of aggregate surplus (+) or deficit (—) to production (%)
Rice	6,807	+ 2,328	+ 34
Wheat	517	— 134	— 26
Barley	1,778	— 36	— 2
Naked barley	339	—	—
Minor grains	1,349	— 324	— 24
Soybeans	1,206	+ 217	+ 18
Other beans	311	— 31	— 10
Peanuts	6	— 0.6	— 10
Sweet potatoes	388	—	—
Irish potatoes	1,263	—	—
Vegetables	3,026	—	—
Seaweed	7	+ 4	+ 56
Fruit	207	— 19	— 9
Sugar	5	— 60	— 1,155
Fish	2,754	+ 1,100	+ 40
Meat	123	—	—
Milk	7	— 2	— 26
Butter	6	—	—
Eggs	28	—	—

* Difference between production and estimated average consumption in the crop years 1933-1934, 1934-1935, and 1936-1937.

Korean rice contributed about 10% to the total Japanese rice supply. In the crop-year 1944-1945 rice exports are believed to be about 1,800,000,000 pounds, about ¼ of which is probably consumed by Japanese soldiers on the continent.

The spectacular increase in rice exports, which continued up to the crop-year 1941-1942, although associated with a 25% increase in rice production, required a simultaneous reduction by nearly half in per capita consumption in Korea. This decline was only partly offset by imports of millet, wheat, and barley, for in the mid-1930's these imports amounted to only 520,000,000 pounds, or less than ¼ of the food value of the rice exports. If rice exports were stopped, the total food energy available for Korean consumption would increase by more than 10%, or more than 250 calories per capita per day.

Net exports of soybeans before the war amounted to 216,000,000 pounds, or 18% of Korean production, and are now estimated at 200,000,000 pounds. Meanwhile Korea had to import about 30,000,000 pounds of beans. Sugar, the most important import item after minor grains, amounted to about 60,000,000 pounds annually.

The outstanding food-surplus areas within Korea are identified with coastal and river plains of the west coast, from P'yongan-namdo to Cholla-namdo. The province of Hwanghae-do, for example, produced in prewar years an annual surplus equivalent in caloric value to 318 pounds of rice per capita. P'yongan-namdo, Ch'ungch'ong-namdo, Cholla-pukto, and Cholla-namdo produced per capita surpluses equivalent to between 130 and 150 pounds of rice. The national average was about 90 pounds. Only the 2 northeast-coast provinces of Hamgyong-namdo and Kangwon-do have net food deficits.

FIGURE IX - 4. *Kyongsang-namdo, Kadok-to (Kotoku-to) (island).* Cultivating oyster beds. 1931.

E. Fishing.

The junction of cold and warm sea currents off the coast of Korea produces conditions favorable for fishing. The Korean catch is one of the largest in the Japanese Empire; it yielded an average of 2,800,000,000 pounds per year in the mid-1930's. In 1938 there was an abnormally high catch of over 13,000,000,000 pounds. About 400,000 persons were dependent upon fishing for their livelihood. The fishing population has probably decreased considerably in recent years with the increase in war industries.

(1) Kinds of fish.

Many kinds of edible fish occur in Korean waters. There are also shellfish (FIGURE IX-4), seaweeds, and other kinds of sea animals and plants. The most important fish is sardine, which made up approximately 60% of the total 1939 catch. Pollock accounted for 13%; *guchi (Sciaena schlegeli,* or *S. albiflora),* mackerel, *tachi (Trichiurus japonicus),* herring, prawns, and others comprise the remainder of the catch. There is also some breeding of fish in the interior of Korea, which contributes 0.5% of the total catch.

(2) Location of fisheries.

The greater part of the deep-sea fishing is conducted off the east coast, and most of the exports are from this coast. The scale of the west-coast industry is smaller and the equipment is more primitive. The sardine industry, centering on the northeast coast, has been intensively developed by the Japanese since the annexation. In contrast to the sardine industry in Japan, in which small fishermen predominate, the Korean industry has been organized on a modern scale by the Japanese, with a large capital investment. The sardine travel northward to the colder waters in early summer and return in autumn, thus providing 2 fishing seasons in Korean waters.

(3) Fishermen and equipment.

In 1938 there were approximately 10,000 Japanese living in Korea who were dependent upon fishing as compared with 32,400 Koreans. The average value of the catch per fisherman has been much higher in the Japanese-controlled fishing industry than in the native Korean fisheries. Over 200 fishing associations have been organized in Korea by the Japanese. Japanese dominate the deep-sea fishing; Koreans fish mainly in coastal waters with smaller boats. Of the 2,700 motorized fishing vessels in Korea in 1938, the majority were in the northeast, where they had been brought by the Japanese. These vessels were typically of between 5 and 20 tons.

(4) Fishing ports.

Of the total Korean catch between 1933 and 1936, approximately ¾ was accounted for by the 5 east-coast provinces. The more important fishing ports on the east coast are the following:

Hamgyong-pukto (18% of the total catch)
- Ch'ongjin (Seishin)
- Unggi (Yūki)

Hamgyong-namdo (16% of the total catch)
- Wonsan (Genzan)
- Hungnam (Kōnan)
- Sinp'o (Shinho)

Kwangwon-do (13% of the total catch)
- Changjon (Chōsen)
- Chumunjin (Chūmonshin)

Kyongsang-pukto (9% of the total catch)
- P'ohang-dong (Hokō-do)
- Kuryongp'o-ri (Kyūryūho-ri)
- Kamp'o-ri (Kanho-ri)
- Kohung (Kōkō)

Kyongsang-namdo (17% of the total catch)
- Pusan (Fusan)
- Masan (Masan)
- Chinhae (Chinkai)

Pusan (Fusan) is the most important fishing port in the southeast and has the largest fish market in Korea. North of the Tongjoson-man (Korean gulf) the ports are primarily bases for sardine fishing; Ch'ongjin (Seishin) is the most important of these.

There are many small ports along the west coast of Korea (FIGURE IX-5). Chinnamp'o, Inch'on (Jinsen), and Mokp'o

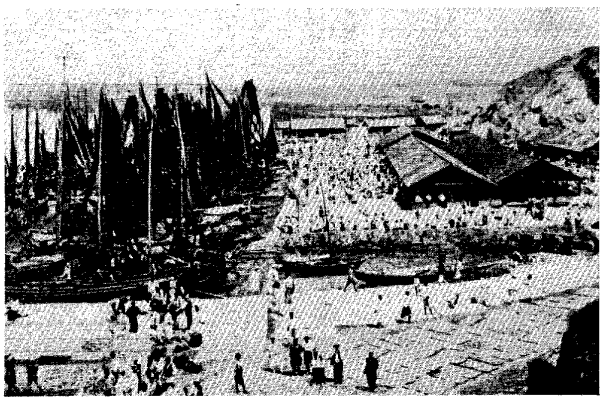

FIGURE IX - 5. *P'yongan-pukto, Yongamp'o (Ryūgampo).* Fishing vessels in the harbor, near the mouth of the Amnok-kang (Yalu River), on the Manchurian border.

(Moppo), the main west-coast ports, are the chief suppliers of fish for the big cities. Cholla-namdo, with 13% of the total Korean catch, is the most important fishing province on the west coast.

(5) Refrigeration.

Ice refrigeration is provided in all the larger ports. Because of transportation and marketing difficulties, it has been more profitable to export or process fish on the east coast than to

ship it inland. A relatively large proportion of the total catch is processed into fish oil and fertilizer, whereas most of the catch in Japan is used for food.

(6) Production.

In the mid-1930's the average annual production of marine products was about 235,000,000 pounds. About 65% of the total was made up of dried or salted marine products. Others were boiled and dried, salt-dried, frozen, or pickled. Hamgyong-namdo and Kyongsang-namdo accounted for 42% of the total production of marine products.

F. Food processing.

Food-products industries, excluding rice polishing, are second only to chemicals in value of factory and household output in Korea. Production of processed foods is, however, low in comparison with western countries. The proportion of household industry in this field is very large, and accounted for about 55% of the gross value of production in 1935 and 45% in 1938.

(1) Beverages.

Alcoholic beverages represented a little over 40% of the total value of manufactured food products in the mid-1930's. The Dai Nippon Beer and the Showa Kirin Beer companies have subsidiaries in Korea, and there are about 130 plants producing *saké* (a Japanese rice wine). These beverages are produced primarily for the Japanese population, inasmuch as most Koreans drink neither beer nor *saké*. Distilled spirits are produced by many small and middle-sized enterprises, and there are about 10 concerns engaged in the manufacture of soft drinks.

(2) Canning.

Canning output is valued at from 3,000,000 to 4,000,000 *yen* per year. Canned fish is the most important product of the industry. There are many plants on the east coast, and around Kyongsong (Keijō, Seoul). Most of the products are exported.

(3) Confectionery.

The principal large producers of confectionery are the Hokoku Seka K. K. and the Keijo Seka K. K. Korea annually consumes confectionery valued at from 13,000,000 to 14,000,000 *yen*.

(4) Sugar refining.

In 1917 the Chōsen Sugar Manufacturing Company was established and later amalgamated with the Japan Sugar Manufacturing Company. A plant with a capacity of about 100,000,000 pounds was constructed at P'yongyang (Heijō). It refined both imported sugar and sugar from beets grown in P'yong-namdo and Hwanghae-do. In 1931 beet cultivation was curtailed, and the plant engaged only in the refining of imported raw sugar. In 1937, 96,000,000 pounds were refined. In view of the present shipping situation, it may be processing domestic beet sugar again, although probably only in small quantities.

(5) Wheat flour.

There are 7 modern flour mills in Korea. The first was built in Chinnamp'o (Chinnampo) in 1919 by the Manshu Seibun K .K. The Chōsen Seibun K. K. has 1 in Chinnamp'o, and the Nippon Seibun K. K. has mills in Kyongsong (Keijō, Seoul) and Inch'on (Jinsen). These mills have a combined capacity of almost 1,000,000 pounds.

(6) Soy sauce and miso (bean paste).

The production of soy sauce and *miso* has grown with the increase of the Japanese population in Korea. The average production of *miso* in the 1930's was approximately 14,000,000 pounds. Production of soy sauce is centered in Kyongsong (Keijō, Seoul), Inch'on (Jinsen), Pusan (Fusan), P'yongyang (Heijō), and Taejon (Taiden). Average production in prewar years was approximately 800,000 gallons.

(7) Rice cleaning.

There are about 6,000 small rice-cleaning mills scattered throughout Korea, with a slight concentration in the principal consuming and exporting cities. The Koreans generally used medium-polished rice, while exports to Japan consisted largely of polished and unpolished rice. In recent years the Japanese have forbidden the use of polished rice in order to retain the maximum food value; this regulation applies to both Japanese and Koreans.

92. *Water Supply*

Water is abundant wherever storage facilities have been provided. Surface waters form the principal source of drinking water; rivers are most commonly utilized, and springs and dug wells are of minor importance. About four-fifths of the country consists of hilly or mountainous slopes. In eastern Korea the narrow gorges of the short rivers extend almost to the coast; in western Korea the streams meander through extensive lowlands before reaching the Yellow Sea. Most of the cities of the south and west coasts have municipal waterworks, and a few have sewerage systems; few inland cities have such facilities. The 85 waterworks (1939) are probably comparable to those of Japan, employing slow sand filters but no chlorination. Irrigation and power dams could be tapped for supplementary supplies. Both raw and treated water throughout Korea should be regarded as contaminated.

A. General availability and quality.

(1) Availability of natural water.

(a) Precipitation and surface runoff. Precipitation in most of Korea varies with the season and the location. Where adequate storage facilities have been provided, rainfall is sufficient to meet all seasonal needs. Much of the rainfall is in the form of torrential monsoonal showers; the lack of vegetational cover permits rapid runoff, and occasional flash floods ruin crops and cause considerable damage.

The western, eastern, and southeastern coastal margins near Inch'on (Jinsen), Kaesong (Kaijō), Wonsan (Genzan), and Pusan (Fusan) normally have an annual rainfall of 35 to 40 inches. Kaesong, which is further inland (FIGURE IX-47), has recorded variations of from 31 to 47 inches. Inch'on's seasonal precipitation ranges from 25 to 66 inches. Both Inch'on and Kaesong have stations which have reported 7 to 10 inches of rainfall in one day, but the average annual fall is 40 inches. The south and east coasts are subject to typhoons which sometimes bring excessive rainfall of 20 or more inches in 3 to 4 days during the summer.

The climate is driest and the precipitation less variable in the north and northeast. The annual spread of rainy days is

high, with a slight maximum in June, and there is an annual average of 28 to 30 inches of rainfall.

Much of the winter precipitation is in the form of snow. Individual falls may be greater in the south than in the north. Thawing occurs throughout the winter in the south, and is rare in the northern and interior highlands; thus, the accumulation is greater in the higher latitudes and higher altitudes. The mountains receive and retain so much of this snowfall that in spring the lowlands are well-watered even in dry years.

(b) Lakes, swamps, groundwater, and springs. The country is well drained with the exception of narrow coastal swamps and marsh lands along the eastern shoreline. The marshes are most conspicuous at the height of the rainy season, when the silt-choked rivers flood their tidal estuaries. Swamps and lakes are relatively minor sources of water. There are, however, several rather large artificial lakes impounded for irrigation and hydroelectric purposes.

The groundwater table is often low and sometimes inadequate because of rapid runoff; this is especially true in the highlands. During times of normal precipitation there is a fairly high groundwater level in the eastern lowlands, but wells often dry up during periods of low seasonal precipitation.

There are approximately 68 spring areas; the principal concentrations are in the northeastern, the north-central, and the extreme eastern portions of the peninsula. About 8 of the hot-spring regions have become popular spas, and borings 20 to 50 feet deep in depth have been made to increase the supply of hot water. One famous spa is located near Tongnae (Tōrai), 8 miles northeast of Pusan. There were 43 borings and seepages in this region in 1924, some of them supplying as many as 8,250 gallons per day.

(2) Availability of water from developed sources.

(a) Number, distribution, and capacity of waterworks. Eighty-four municipalities were supplied by developed waterworks in 1937. These are listed in TABLES IX-3 and IX-4, and their location is shown in FIGURE IX-47. Most of the municipal waterworks are in the cities of the west and south coasts, but there are a few in the interior.

The average daily per capita supply of 18 representative waterworks was 34.5 gallons in 1937. The daily total capacity of the systems ranged from a maximum of 4,500,000 gallons at P'yongyang (Heijō) to 1,870 gallons at Pakch'on (Hakusen).

(b) Wells. Shallow dug wells are second in importance to rivers and streams as a source of water supply. They are more numerous near rivers and on river floodplains, and are often supplemental sources in municipalities which have developed waterworks. There were, for example, more than 3,820 dug wells at Taegu (Taikyū) in 1937. Many of the wells, however, are reported to be unreliable and sometimes to fail completely during the dry season. Those near coastal marsh lands may be brackish.

(c) Irrigation ponds, canals, and ditches. Most of the villages in the lowlands of the west and south have canals and small storage ponds for irrigating rice paddies. These irrigation facilities are constructed and maintained by government-subsidized local water associations. In some cases the facilities include large impounding dams and reservoirs (FIGURES IX-6 to IX-11). These reservoirs are large potential sources of water in time of shortage, as are the large reservoirs built for

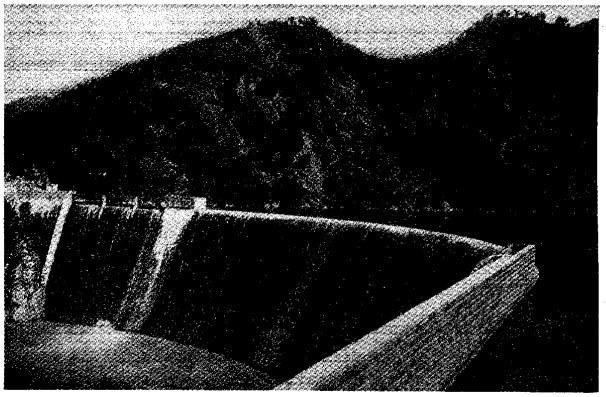

FIGURE IX - 6. *Kangwon-do, Yekiyoku* (approximately 38° 10′ N, 128°00′ E).
Dam of an irrigation reservoir near the Kumgang-san (Kongo-san) (Diamond Mountain). 1935 or before.

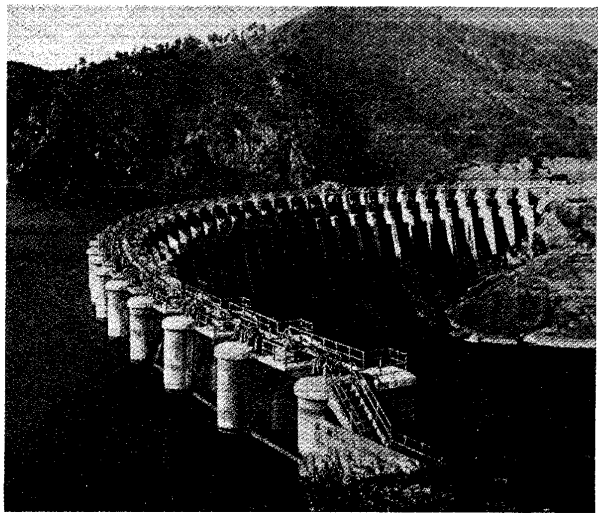

FIGURE IX - 7. *P'yongan-pukto, Uiju (Gishū).*
The Taika irrigation reservoir. 1936 or before.

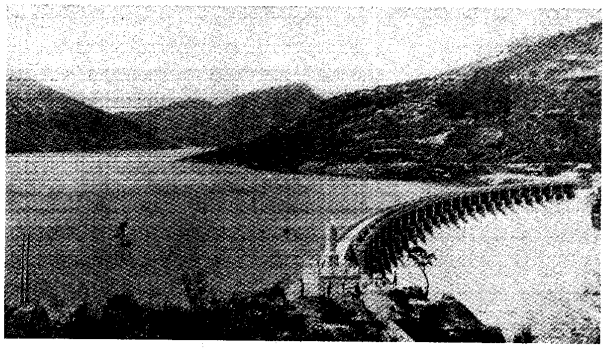

FIGURE IX - 8. *Cholla-pukto, Chonju (Zenshū).*
The Ungan dam of the Toshin Irrigation System. Supplies water to the Kintei district. Before 1930.

FIGURE IX - 9. *Kangwon-do, near Pokkye-ri (Fukukei-ri)* (38° 26′ N, 127° 15′ E).
The Pongnae (Horri) dam of the Central Utility Association, serving the Ch'orwon (Tetsugen) and P'yonggang (Heikō) areas. Before 1930.

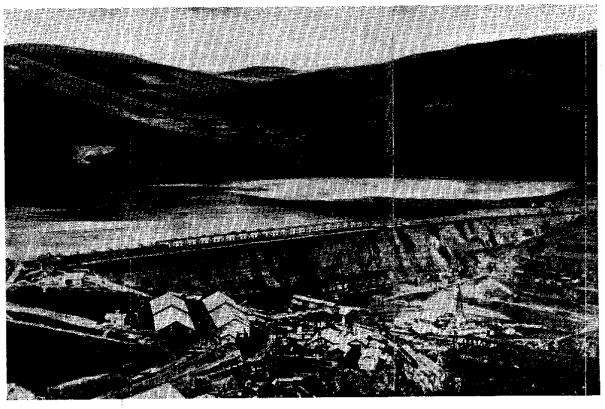

FIGURE IX - 10. *Hamgyong-namdo, near Hungnam (Kōnan).*
The Chōshin-ko dam, serving the Chōshin-kō power development.

In many areas well water also is turbid, highly mineralized, and polluted. The pollution is of an extremely dangerous type and may penetrate deeply because of the fluctuation of the groundwater table; this is especially true in highly agricultural areas.

The water from hot springs is highly mineralized and often is radioactive; it also is subject to pollution. Most of the cold springs are located in the uplands and are pure at the source, but their water is rapidly contaminated. Their discharge varies greatly, and some may fail entirely during the dry season.

(4) Quality of water from developed sources.

(a) Waterworks. The treated water from waterworks, although subject to periodic examination by the health departments of the principal cities, should be regarded as contaminated. This is true of many plants because of the low standards of plant administration, and the unsatisfactory methods of distributing treated supplies.

A few Korean cities have sewerage systems. In these cities the water supply should be less subject to pollution. In 1937 sewage-disposal systems were in operation in the following 18 municipalities (FIGURE IX-47):

Kyongsong (Keijō, Seoul)	Chinnamp'o (Chinnampo)
Pusan (Fusan)	Chonju (Zenshū)
P'yongyang (Heijō)	Kunsan (Gunzan)
Taegu (Taikyū)	Taejon (Taiden)
Inch'on (Jinsen)	Najin (Rashin)
Sinuiju (Shingishū)	Haeju (Kaishū)
Hamhung (Kankō)	Chinju (Shinshū)
Ch'ongjin (Seishin)	Kwangju (Koshū)
Wonsan (Genzan)	Mokp'o (Moppo)

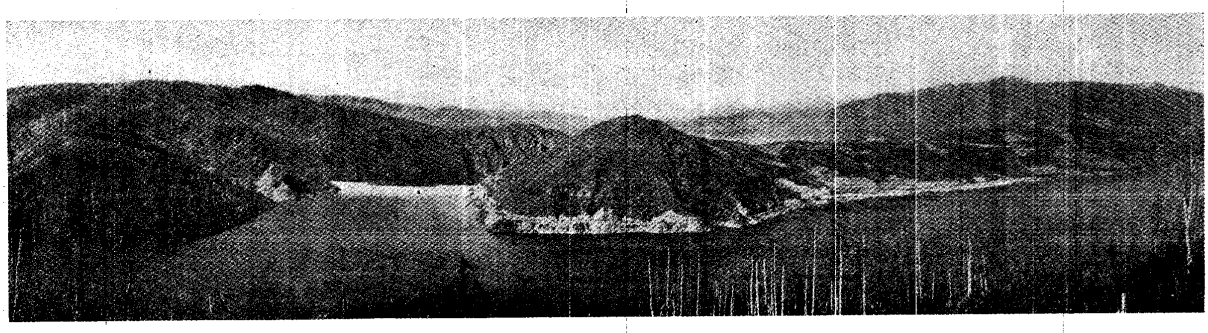

FIGURE IX - 11. *Hamgyong-namdo* (40° 30-40′ N, 127° 30-35′ E).
The Fusen Reservoir, focus of a large hydroelectric power development. Dam in left background.

hydroelectric developments. Some of the reservoirs are now used as sources of water for human consumption. Other less elaborate irrigation projects also are important water sources. This use of irrigation storage reflects the unreliable and variable nature of natural water sources, especially the rainfall.

(3) Quality of water from natural sources.

Surface water in the lowlands is turbid and highly polluted because of the common practice of using night-soil as fertilizer. The water in the highlands of the eastern interior is probably less subject to pollution inasmuch as its streams flow through less populated areas. Many of the rivers are very turbid, and the water reportedly has a high mineral content which makes it unfit for drinking. The upper reaches of the streams and rivers are probably less highly mineralized.

(b) Wells. Shallow wells often supply turbid and highly contaminated water because of poor construction which permits seepage. This condition could be remedied by deeper drilling and casing to a depth of at least 20 feet. The fluctuation of the groundwater level and the occasional drying of the wells is apt to result in water pollution following the dry season. In some places the ground water is highly mineralized and the well water may be unfit for drinking.

(c) Irrigation ponds, ditches, and canals. These are dangerously polluted because of their proximity to agricultural areas fertilized with night-soil. Their water generally is turbid and may be mineralized. Some of the larger irrigation reservoirs in the hills probably contain water of better quality, and they certainly are less subject to pollution.

B. Technical aspects of developed municipal water supply.

(1) Quality of developed systems.

Little positive information is available on the quality of Korean waterworks. Approximately 29 waterworks were apparently in operation in 1927. Approximately 55 plants are reported to have been constructed between 1930 and 1936, and extensive development of more modern irrigation and storage systems probably occurred at about the same time. In 1939 there were 85 waterworks in 84 Korean municipalities. Much of the construction may be assumed to have been done under Japanese supervision, and the quality of the Korean waterworks thus should compare favorably with those in Japan. Waterworks in Japan proper are reasonably modern in most cities; they use slow and rapid sand-filtration methods, but rarely disinfect by chlorination.

The use of slow sand filtration appears to predominate in Korea and there is no definite evidence of the employment of rapid filters. Both raw and treated water, however, should be carefully examined by competent medical men, and then treated on the basis of their recommendations, even though it may have passed through a purification system.

(2) Water sources and source installations.

(a) Sources and intakes. Twenty-nine percent of all the systems for which information is obtainable are known to derive their raw water from rivers or streams. The sources for the remainder are unknown, but it is highly probable that at least 95% of all municipal systems utilize surface runoff. Lakes and deep drilled wells are uncommon sources of raw water.

A few systems are known to have such source installations as intake towers, or underwater pipes in rivers; at least one system uses infiltration galleries for collecting water. Inch'on (Jinsen), and P'yongyang (Heijō) have intake towers in the Han-gang (Kan-kō) and Taedong-gang (Daidō-kō) (rivers), respectively. Kyongsong (Seoul, Keijō) in 1927 had a T-shaped underwater intake pipe (a 22-inch pipe extending perpendicular to the river bed, and a 20-inch pipe paralleling the river), in the Han-gang (Kan-kō). Chinnamp'o (Chinnampo) and Pusan (Fusan) have intake pumping wells. Inch'on, Kyongsong, and P'yongyang are equipped with elaborate pumping stations near their river intakes.

(b) Dams and impounded raw water. Few of the dams were built primarily for supplying water to municipal waterworks. Most were constructed to provide storage reservoirs for irrigation or hydroelectric developmentts. Cut-stone masonry, concrete, and earth-filled dams are the most common forms of construction.

Pusan has 3 major dams and a river intake. The combined storage capacity of the dams is over 201,000,000 gallons of water. Much of this supply is probably used for irrigation, as only 2,300,000 gallons per day were actually supplied for municipal uses in 1939. Kyongsong, on the other hand, drew an average of 7,500,000 gallons per day from its underwater river source in 1939. One of the dams at Pusan (the Seichitani) is the largest on which information is available; it is 94 feet high, 447 feet long, and 12 feet thick at the top, and it impounds 172,000,000 gallons. The Suyong-gang (Suiei-kō) dam in the same area has a capacity of 358,000,000 gallons, but its dimensions are unknown. Chinnamp'o has a dam 55 feet high, 906 feet long, and 16 feet thick at the top, which impounds over 96,000,000 gallons. Chinhae (Chinkai), Mokp'o (Moppo), and Chinnamp'o all have dams directly or indirectly concerned with municipal water supply.

(c) Aqueducts and conduits. Many cities receive raw water by pipe line or conduit over fairly long distances. Most of these pipe lines are cast iron. Kunsan (Gunzan) has 18.1 miles of conduit carrying raw water to the treatment plant, and Pusan has 88.6 miles of conduit (TABLE IX-8).

(3) Purification systems and storage of treated water.

Several of the purification systems are known to be modern in design, and in all likelihood there are others. Inch'on, Kyongsong, P'yongyang, and Taegu (Taikyū) have adequate purification facilities, which include mixing basins, coagulation equipment, sedimentation basins, filters, and chlorinating devices (FIGURE IX-14). There is no indication of the employment of either an aeration process or of rapid sand filters.

Information on purification facilities is available for only 17 of the municipalities with waterworks. The type of equipment and percentage of plants known to employ each type is shown in the following tabulation.

Mixing basins	20.0
Coagulating equipment	20.0
Sedimentation basins	50.0
Filters	93.0
Chlorination devices	1.3
Aeration equipment	0.0

The remaining 70 systems are known to have waterworks, but data on purification equipment are unavailable.

(4) Distribution of municipal water supply.

Treated water is distributed by both pumping and gravity methods. The methods of distribution for the 85 plants are shown in the following tabulation.

Pumps	34.2
Gravity	34.2
Pumping and gravity	3.5
Unknown	28.1

Reservoirs for the storage of drinking water generally have relatively small capacities compared with the total daily consumption of water. At least one city, P'yongyang, is known to have small local concrete cisterns or storage reservoirs at various levels throughout the city, and several have rather long networks of cast-iron distribution mains (FIGURE IX-12). Consumers draw treated water from taps or hydrants which are often located centrally in a city block. One public hydrant, for example, may serve a number of homes in the immediate vicinity. Other homes are supplied by a single, private, conveniently located tap or hydrant.

C. Present water uses and adaptability to military supply.

(1) Present water uses.

Most cities with a population of 10,000 or more are fairly well supplied with drinking water from municipal systems, supplemented by shallow dug wells. The cities with waterworks often have a network of hydrants for fire fighting.

Water is widely used for irrigation, and crop yields have been increased in recent years by utilizing irrigation water from storage reservoirs. In 1937 more than 2,880,000 acres were served by water installations: impounded reservoirs, 21.1%; diversion canals, 51.0%; pumping systems, 5.4%; and more

primitive devices, 22.4 percent. At this time there were 190 irrigation associations in the country. The highest development of irrigation projects is in southwestern Korea, where one-fifth of the entire area is irrigated.

(2) Military adaptability.

The chief problems of military water supply in Korea will involve the following factors:

The seasonal variation of rainfall and groundwater as it affects local water sources;

The quantity of water desired as related to the sources available in a specific locality;

The quality of the water and its relation to the purpose for which it is desired (human consumption, bathing, for boilers and the like).

The dangerous impurities that are likely to be encountered in natural waters are:

Organic pollution in both surface and subsurface waters;

Dissolved minerals (calcium, magnesium, iron salts), often physiologically dangerous;

Contamination by chemical warfare agents.

TABLES IX-7 and IX-8 afford a concise summary of the pertinent available data for adaption of municipal water supplies to military needs. TABLE IX-7 lists the cities which have developed waterworks, but which are not known to have purification facilities; TABLE IX-8 lists the cities which are known to have both waterworks and purification installations.

Cognizance should be taken of the potential water reserve existing in the interior, where reservoirs impound water for irrigation and hydroelectric projects. Wells are too unreliable in quantity of flow to justify dependence upon them as a major source of water. Most are highly polluted, but deeper drilling and proper casing would undoubtedly make them less dangerous. All water sources should be regarded as dangerous, and all water, regardless of its source, should be disinfected before use.

TABLE IX - 7

KOREA, CITIES WITH DEVELOPED WATERWORKS; PURIFICATION FACILITIES UNKNOWN

(NOTE: Japanese names appear in parentheses.)

CITY PROVINCE POPULATION*	DATE OF INFORMATION	AVERAGE DAILY TOTAL CONSUMPTION (GALLONS PER DAY)	DISTRIBUTION FACILITIES	REMARKS
Andong (Antō) Kyongsang-pukto 31,686	1939	—		Waterworks
Anju (Anshū) P'yongan-namdo	1939	92,600	Pumping system 53 public hydrants 227 private hydrants	31 fire hydrants 531 homes served
Chaeryong (Sainei) Hwanghae-do 17,941	1939	93,000	Pumping system 21 public hydrants 219 private hydrants	36 fire hydrants 1,087 homes served
Changhung (Chōkō) Cholla-namdo	1936	—		Waterworks
Changjon (Chōsen) Kwangwon-do 17,510	1939	—		Waterworks
Changsungp'o-ri (Chōshōho-ri) Kyongsang-namdo	1936	—		Waterworks
Chinju (Shinshū) Kyongsang-namdo 35,380 (1937) 43,291 (1940)	1939-1941	79,200	Pumping system 36 public hydrants 374 private hydrants	30 fire hydrants Population served: 5,119 (1937) 1,085 homes served River Intake
Choch'iwon (Chōchiin) Ch'ungch'ong-namdo	1936	40,000	Pumping system 30 public hydrants 156 private hydrants	36 fire hydrants 182 homes served
Ch'onan (Tenan) Ch'ungch'ong-namdo 17,977	1939	120,000	Pumping system 20 public hydrants 206 private hydrants	32 fire hydrants 346 homes served
Ch'onjin (Seishin) Hamgyong-pukto 66,953 (1937) 197,918 (1940)	1939	910,000	Pumping system 1,707 hydrants 162,300 feet of mains	149 fire hydrants 1 ship's service hydrant 8,623 homes served Population served: 37,475 96 dug wells
Chongju (Teishū) P'yongan-pukto 12,502	1939	—		Waterworks
Ch'ongju (Seishū) Ch'ungch'ong-pukto 30,143	1938-1939	72,600	Gravity system 56 public hydrants 498 private hydrants	41 fire hydrants 767 homes served
Ch'orwon (Tetsugen) Kangwon-do	1938-1939	95,000	Pumping system 32 public hydrants 316 private hydrants	505 homes served 46 fire hydrants
Ch'uja-kundo (Shūshi-guntō) (island S of Cholla-namdo)	1936	—		Waterworks
Chunghwa (Chūwa) P'yongan-namdo	1938	—	Pumping system 10 public hydrants	10 fire hydrants
Haeunt'ae (Kaiuntai) Kyongsang-namdo	1936	—		Waterworks
Hoeryong (Kainei) Hamgyong-pukto 22,821	1939	238,000	Gravity system 52 public hydrants 459 private hydrants	3,185 homes served 38 fire hydrants River Intake
Hunghae (Kōkai) Kyongsang-pukto	1936	—		Waterworks
Hungnam (Kōnan) Hamgyong-namdo 58,077 (1937) 140,000 (1941)	1938-1939	720,000	Pumping system 101 public hydrants 426 private hydrants	1,836 homes served 40 fire hydrants
Hwangju (Kōshu) Hwanghac-do	1939	78,400	Pumping system 24 public hydrants 193 private hydrants	425 homes served 22 fire hydrants
I-ri (Ri-ri) Cholla-pukto 21,335	1938-1939	156,000	Pumping system 55 public hydrants 521 private hydrants	647 homes served 50 fire hydrants
Kaesong (Kaijō) Kyonggi-do 72,062 (1940)	1939-1941	518,000	Gravity system 1,412 hydrants 17.5 miles of mains	2,546 homes served 110 fire hydrants Population served: 16,536 1,523 dug wells
Kanggye (Kōkai) P'yongan-pukto 17,898	1938-1939	125,000	Pumping system 27 public hydrants 127 private hydrants	1,314 homes served 29 fire hydrants

TABLE IX - 7 *Continued*

CITY PROVINCE POPULATION*	DATE OF INFORMATION	AVERAGE DAILY TOTAL CONSUMPTION (GALLONS PER DAY)	DISTRIBUTION FACILITIES	REMARKS
Kanggyong (Kōkei) Ch'ungch'ong-namdo 17,009	1938-1939	—	Gravity system 60 public hydrants 321 private hydrants	1,151 homes served 38 fire hydrants 1 ship's service hydrant River source (?)
Kangnung (Kōryō) Kangwon-do 18,431	1939	—		Waterworks
Kohung (Kōkō) Cholla-namdo	1938	6,000	Gravity system 18 public hydrants 22 private hydrants	384 homes served 6 fire hydrants
Kongju (Kōshū) Ch'ungch'ong-namdo 12,054	1939	137,000	Gravity system 96 public hydrants 292 private hydrants	546 homes served 24 fire hydrants Reservoir 1.5 – 2 miles S of city
Konyang (Konyō) Kyongsang-namdo	1936	—		Waterworks
Kosong (Kojō) Kyongsang-namdo	1936	—		Waterworks
Kumch'on (Kinsen) Kyongsang-pukto 18,882	1938–1939	191,000	Pumping system 45 public hydrants 508 private hydrants	736 homes served 50 fire hydrants
Kumch'on (Kinsen) Hwanghae-do	1936	—		Waterworks
Kumhae (Kinkai) Kyongsang-namdo 22,561	1936-1939	—		Waterworks
Kumje (Kintei) Cholla-pukto 17,729	1936-1939	—		Waterworks
Kyongju (Keishū) Kyongsang-pukto 21,787	1938–1939	100,000	Pumping system 4 public hydrants 226 private hydrants	608 homes served 39 fire hydrants
Kyongsan (Keizan) Kyongsang-pukto	1938	—	10 public hydrants	20 fire hydrants
Masan (Masan) Kyongsang-namdo 32,411 (1937) 36,429 (1940)	1939–1941	299,000	Gravity system 48 public hydrants 1,151 private hydrants 72,600 feet of mains	1,287 homes served 78 fire hydrants 4 ship's service hydrants 1,229 dug wells Population served: 6,537
Miryang (Mitsuyō) Kyongsang-namdo 17,548	1939	148,000	Pumping system 28 public hydrants 204 private hydrants	935 homes served 38 fire hydrants
Naeraro-do (Nairaro-tō) Cholla-namdo (island)	1936	—		Waterworks reported on island; location unknown
Najin (Rashin) Hamgyong-pukto 38,319 (1940)	1939	—		Waterworks
Nanam (Ranan) Hamgyong-pukto 21,258	1939	144,000	Gravity system 51 public hydrants 370 private hydrants	1,868 homes served 45 fire hydrants River Source (?)
Nonsan (Ronzan) Ch'ungch'ong-namdo	1938	142,000	Gravity system 31 public hydrants 61 private hydrants	460 homes served 11 fire hydrants
Pakch'on (Hakusen) P'yongan-pukto	1938	1,870	Pumping system 15 public hydrants 61 private hydrants	460 homes served 11 fire hydrants

TABLE IX - 7 *Continued*

CITY PROVINCE POPULATION*	DATE OF INFORMATION	AVERAGE DAILY TOTAL CONSUMPTION (GALLONS PER DAY)	DISTRIBUTION FACILITIES	REMARKS
P'ohang-dong (Hokō-dō) Kyongsang-pukto 15,250 (1937)	1938–1939	141,000	Gravity system 88 public hydrants 427 private hydrants	1,673 homes served 24 fire hydrants 1 ship's service hydrant River intake
Pukchin (Hokuchin) P'yongan-pukto	1944	—		Waterworks supplemented by wells and springs
Pyoktong (Hekidō) P'yongan-pukto	1938	—	Pumping system 7 public hydrants	8 fire hydrants
P'yonggang (Heikō) Kangwon-do	1938	106,000	Pumping system 17 public hydrants 114 private hydrants	583 homes served 8 fire hydrants River intake
Sach'on (Shisen) Kyongsang-namdo	1936	—		Waterworks
Samch'onp'o (Sanzenho) Kyongsang-namdo 20,456	1938–1939	82,300	Gravity system 21 public hydrants 94 private hydrants	296 homes served 5 fire hydrants
Sin'gosan (Shinkōzan) Hamgyong-namdo	1938	7,350	Gravity system 15 public hydrants 60 private hydrants	395 homes served 5 fire hydrants
Sinuiju (Shingishū) P'yongan-pukto 51,347 (1937) 61,143 (1940)	1938–1941	628,267	Gravity system 241 public hydrants 1,276 private hydrants 56,100 feet of mains	4,580 homes served 91 fire hydrants 1 ship's service hydrant 166 dug wells River intake (?)
Sonch'on (Sensen) P'yongan-pukto 19,453	1938–1939	52,400	Pumping system 38 public hydrants 183 private hydrants	740 homes served 30 fire hydrants
Songjin (Jōshin) Hamgyong-pukto 23,496	1938–1939	105,000	Gravity system 109 public hydrants 379 private hydrants 2 reservoirs SW of city (may be raw water)	1,374 homes served 39 fire hydrants 1 ship's service hydrant River intake (?)
Sunch'on (Junten) Cholla-namdo 23,462	1938	247,000	Gravity system 30 public hydrants 494 private hydrants	568 homes served 46 fire hydrants
Taejon (Taiden) Ch'ungch'ong-namdo 40,001 (1937) 45,541 (1940)	1938–1941	342,000 792,000 (maximum)	Gravity system 31 public hydrants 839 private hydrants	930 homes served 81 fire hydrants Population served: 5,503
Tanch'on (Tansen) Hamgyong-namdo	1938	43,800	Pumping system 13 public hydrants 88 private hydrants	418 homes served 11 fire hydrants
T'ongch'on (Tsūsen) Kwangwon-do	1938	46,600	Pumping system 23 public hydrants 93 private hydrants	407 homes served 10 fire hydrants
Tongnae (Tōrai) Kyongsang-namdo 18,985	1939	—		Waterworks Hot spring spa
T'ongyong (Tōei) Kyongsang-namdo 23,826	1938–1939	14,000	Pumping system 64 public hydrants 134 private hydrants	1,878 homes served 31 fire hydrants River intake
Uiju (Gishū) P'yongan-pukto	1939	45,000 67,000 (maximum 1922)	Pumping system 14 public hydrants 37 private hydrants	1,344 homes served 5 fire hydrants River intake
Ulsan (Urusan) Kyongsang-namdo 15,587	1939	—		Waterworks

TABLE IX - 7 *Continued*

City / Province / Population*	Date of information	Average daily total consumption (gallons per day)	Distribution facilities	Remarks
Unggi (Yuki) Hamgyong-pukto 22,085	1939	—	Reservoir in hills W of harbor (may be raw water)	Waterworks Pipe line from reservoir to storage tank, to water tower near railroad tracks
Wan-do (Kan-tō) Cholla-namdo	1938	25,000	Gravity system 21 public hydrants 52 private hydrants	236 homes served 14 fire hydrants
Yonan (Enan) Hwanghae-do 16,167	1938–1939	74,300	Pumping system 27 public hydrants 229 private hydrants	809 homes served 15 fire hydrants
Yongch'on (Eisen) Kyongsang-pukto 17,715	1936 1939	—		Waterworks
Yongdungp'o (Eitōhō) Kyonggi-do	1936	—		Waterworks
Yonghung (Eikō) Hamgyong-namdo	1936	73,700	Pumping system 23 public hydrants 207 private hydrants	623 homes served 14 fire hydrants
Yosu (Reisui) Cholla-namdo 31,259	1936	106,000	Gravity system 93 public hydrants 432 private hydrants	840 homes served 57 fire hydrants 3 ship's service hydrants

* Population as of 1937 unless otherwise specified.

TABLE IX - 8

KOREA, CITIES WITH BOTH DEVELOPED WATERWORKS AND PURIFICATION FACILITIES

City / Province / Population*	Date of information	Population served	Average per capita and daily total consumption (gallons per day)	Source and source installations H: height L: length T: thickness (top)	Purification facilities	Clear-water reservoirs distribution facilities	Remarks
Chinhae (Chinkai) Kyongsang-namdo 18,988 (naval base)	1936–1939	—	— 145,000	River Ma-ch'on (Ba-sen) dam Intake (Kendo-Ri)	Filters	Pure-water reservoir Gravity system 5 public hydrants 400 private hydrants	808 homes served 58 fire hydrants 2 ship's service hydrants
Chinnamp'o (Chinnampo) P'yongan-namdo 48,838 (1937) 68,676 (1940)	1939–1941	23,657 (1939)	18.7 472,000	Dam: 6 miles from city. H: 55.6′, L: 906.5′, T: 16′ (T) Reservoir approximate capacity, 96,450,000 gallons River (Sanwa-Gawa) 5.7 miles from city 3 intake wells	(1) 3 slow sand filters Total capacity 486,000 gallons per day (2) 1 slow sand filter Approximate capacity 30,000 gallons per day	(1) Reservoir capacity 88,350 gallons (2) 2 reservoirs, total capacity 486,000 gallons, pumping and gravity systems 224 public hydrants 1,340 private hydrants 84,000 feet of mains	5,269 homes served 132 fire hydrants 6 ship's service hydrants 95 dug wells
Chongju (Zenshū) Cholla-pukto 42,520 (1937) 47,230 (1940	1939–1941	8,400	— 1,420	River intake, infiltration gallery?	2 slow sand filters	Gravity system 2 reservoirs, total capacity 221,000 gallons	505 homes served 46 fire hydrants
Ch'unch'on (Shunsen) Kangwon-do 16,960	1938–1939	—	— 57,800	River intake	Slow sand filters	Pumping system 124 public hydrants 321 private hydrants	549 homes served 21 fire hydrants
Haeju (Kaishū) Hwanghae-do 48,650 (1937) 62,651 (1940)	1939–1941	9,797	23.8 236,000	River intake	Sedimentation basins Filtration plant	Gravity system 77 public hydrants 544 (or 1,118) ? private hydrants	1,964 homes served 44 fire hydrants 1 ship's service hydrant 72 dug wells
Hamhung (Kankō) Hamgyong-namdo 61,430 (1937) 75,320 (1940)	1939–1941	23,952	33.8 817,000	River intake (Shiro-kawa) and 2 bored wells	Slow sand filters	Pumping system Reservoir total capacity 123,000 gallons 3,753 hydrants	4,627 homes served 159 fire hydrants 493 dug wells
Inch'on (Jinsen) Kyonggi-do 102,453 (1937) 171,165 (1940)	1939–1941	35,845	34.1 1,220,000	Dam (?) Han-gang (Kan-kō) Intake tower (3 inlets) Mixing pond Pumping station (FIGURE IX-12)	3 sedimentation basins, total capacity, 4,120,000 gallons. 4 slow sand filters	2 pure-water reservoirs, total capacity 1,031,000 gallons Pumping system 3 distribution reservoirs, total capacity, 1,220,000 gallons. Located on (Songim) hill Total hydrants 3,323	7,723 homes served 253 fire hydrants 12 ship's service hydrants 755 dug wells 20″ pipe from pure-water storage reservoir 18 miles to Jinsen distribution reservoir Some water to Kyongsong (Keijō, Seoul)
Kunsan (Gunzan) Cholla-pukto 40,553 (1940)	1939–1941	18,138	26.1 477,000	River intake? Reservoir in center of town	Reported to be "purified".	Gravity system 192 public hydrants 1,643 private hydrants 95,700 feet of mains	3,899 homes served 180 fire hydrants 4 ship's service hydrants 250 dug wells
Kwangju (Kōshū) Cholla-namdo 57,461 (1937) 64,520 (1940)	1938–1939	—	— 268,000	Lake (?) (1925)	Slow sand filters 2 sedimentation basins	Gravity system 71 public hydrants 1,310 private hydrants	1,625 homes served 10 fire hydrants

TABLE IX - 8 *Continued*

CITY PROVINCE POPULATION*	DATE OF INFORMATION	POPULATION SERVED	AVERAGE PER CAPITA AND DAILY TOTAL CONSUMPTION (GALLONS PER DAY)	SOURCE AND SOURCE INSTALLATIONS H: HEIGHT L: LENGTH T: THICKNESS (TOP)	PURIFICATION FACILITIES	CLEAR-WATER RESERVOIRS DISTRIBUTION FACILITIES	REMARKS
Kyongsong (Keijō, Seoul) Kyonggi-do 706,396 (1937) 935,000 (1940) (FIGURES IX-12 and IX-13)	1939–1941	356,486	28.2 7,500,000	Han-gang (Kan-kō) (river). 22″ pipe across river bed (intake) 20″ pipe along river bed (intake) Intake: 3.5 miles E of city 2 intake pumping units 34 additional 8″ wells—50′ deep, near waterworks. Supply supplemented by Inch'on (Jinsen) intake across the Han-gang	3 sedimentation basins, capacity 1,350,000 gallons 6 slow sand filters, reinforced concrete Chlorination and mixing pond	Pumping and gravity systems 3,114 public hydrants 35,716 private hydrants Pure-water storage reservoir, capacity 294,000 gallons 3 distribution reservoirs, total capacity, 3,800,000 gallons Cast-iron mains. Unknown number of additional distribution reservoirs within city 801,900 feet of mains	74,459 homes served 1,412 fire hydrants 3,757 dug wells New development in hills reported, details lacking
Mokp'o (Moppo Cholla-namdo 64,256 (1940)	1939–1941	27,659	18.0 498,000	Dam River intake 4 raw-water storage reservoirs (approximately 15 miles from city), total capacity 1,100,000 gallons Small additional auxiliary reservoir on Yudal-san (Yutatsu-san) hill (?)	4 filters (1927) Plant 1 mile N of city	Gravity system Pure-water storage reservoir, capacity 63,500 gallons (1927) 264 public hydrants 1,113 private hydrants 69,300 feet of conduits 113,316 feet of mains	6,125 homes served 98 fire hydrants 2 ship's service hydrants 66 dug wells Pressure on system: 20–50 pounds
Pusan (Fusan) Kyongsang-namdo 213,142 (1937) 249,734 (1940) (Waterworks also reported at Sōryō, suburb of Pusan (Fusan))	1939–1941	86,427	26.1 2,377,007	Dams (1) Seichi-tani dam: H: 94′; L: 447′; T: 12′ (T); capacity 172,000,000 gallons (2) Koenken dam: H: 35′; L: 1,789′; T: 8′ (T); capacity 29,300,000 gallons (3) Torai dam: dimensions unknown; 12 miles N of city; capacity 441,000 gallons (Above list probably includes irrigation reservoirs) City reported in 1936 to draw supply from Naktong-gang (Rakuto-kō), piped to reservoir at Pokpyong-san (Fukuhei-san) 2 well intakes, capacity 718,000 gallons reported on Suiei-gang (1927)	1 sedimentation basin, capacity 1,710,000 gallons (Seichi-tani) 5 slow sand filters (Koenken)	Gravity system 983 public hydrants 6,626 private hydrants (1) 2 pure-water reservoirs, total capacity 118,000 gallons (2) 2 pure-water reservoirs, total capacity 54,800 gallons (3) Pokpyong-san (Fukuhei-san) (mountain) reservoir, capacity 616,000 gallons (4) Makishima reservoir, capacity 15,700 gallons 82,635 feet of cast-iron distribution mains, 3.5″ to 16″ diameter	17,602 homes served 667 fire hydrants 65 ship's service hydrants 2 hot springs Pressure on system: 53–68 pounds
P'yongyang (Heijō) P'yongang-namdo 285,965 (1940) (FIGURE IX-16)	1927–1941	116,746	38.6 4,500,000	Taedong-gang (Daidō-kō) (river): 1.5 miles N of city 2 intake towers 2 pumps, capacity 7,060,000 gallons per day Main raw-water reservoir approximately 3 acres; 3 or 4 additional one-acre ponds for storage	Mixing basin, coagulation 3 sedimentation basins, total capacity 3,530,000 gallons 4 slow sand filters Chlorination	Filtered water crosses river via bridge and tunnel to pump sump, thence to distribution reservoir198′ above river 779 public hydrants 9,797 private hydrants 2 pure-water reservoirs, total capacity, 1,770,000 gallons 2 forwarding pumps, total capacity, 3,530,000 gallons 216,500 feet of mains	24,355 homes served 411 fire hydrants 2,481 dug wells Sunken concrete cisterns, 15′x15′x8′ deep at principal street intersections
Songju (Seishū) Kyongsang-pukto	1927–1936	—	— 85,375	River intake	Slow sand filters	Gravity system	
Taegu (Taikyū) Kyongsang-pukto 110,886 (1937) 178,923 (1940) (FIGURE IX-14)	1927–1941	45,116	25.9 1,176,000	River and hill sources (1) Raw-water reservoir near army barracks (2) Raw-water reservoir near railroad station	2 sedimentation basins 4 slow sand filters	Gravity system 277 public hydrants 3,233 private hydrants 1 pure-water reservoir 155,100 feet of mains	8,107 homes served 270 fire hydrants 3,820 dug wells
Wonsan (Genzan) Hamgyong-namdo 63,996 (1937) 79,320 (1940)	1938–1941	30,310	23.7 718,000	River intake Chokchon-ch'on (Sekiden-sen), 7.3 miles from city Infiltration gallery (?)	2 sedimentation basins, capacity 772,000 gallons 4 slow sand filters	Gravity system 504 public hydrants 3,000 private hydrants Pure-water reservoir, capacity 258,000 gallons 89,100 feet of cast-iron mains	3,844 homes served 205 fire hydrants 12 ship's service hydrants 155 dug wells
Yongsan (Ryūzan) Kyonggi-do 4,000 (1927)	1927	20,000	— 1,210,000	Han-gang (Kan-kō) Inch'on waterworks	3 sedimentation basins, total capacity, 2,720,000 gallons 6 slow sand filters	Pumping system Pure-water reservoir, capacity 765,000 gallons	

* Population data as of 1937 unless otherwise specified.

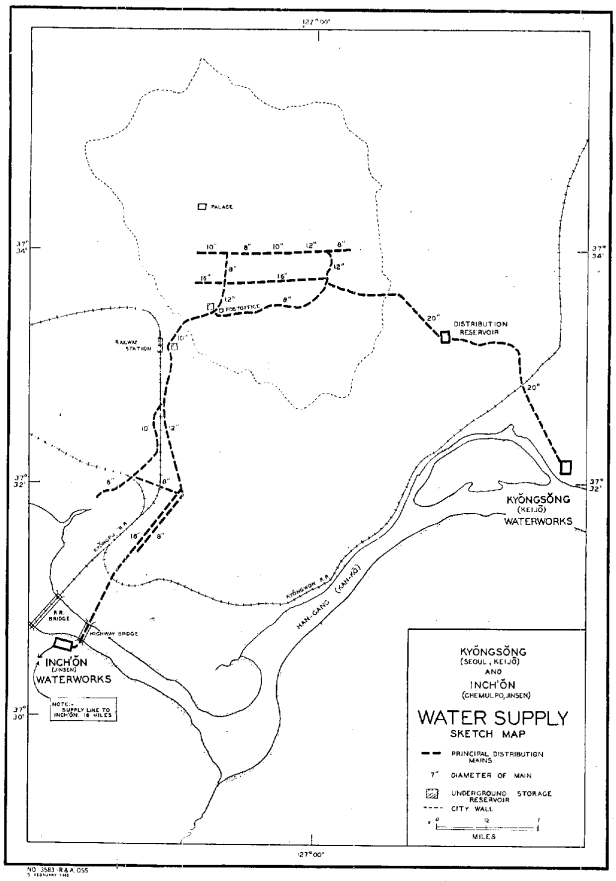

FIGURE IX - 12.

FIGURE IX - 13. *P'yongan-namdo, P'yongyang (Heijō).* Waterworks on the Taedong-gang (Daidō-kō). Pipe bridge in right foreground.

FIGURE IX - 14. *Kyongsang-pukto, Taegu (Taikyū).* Municipal waterworks. 1935.

93. *Construction Materials*

Lumber is found in substantial quantities only in Northern Korea, and imports from Japan have exceeded local production. Korea probably produces enough cement for its own needs, and may have an exportable surplus. Limestone and clay are abundant, and marble, granite, and gravel are available. The metal construction materials and glass manufactured in Central and Northern Korea are normally supplemented by imports.

About 90% of Korea's population live in mud-plastered houses with wooden post frames, and roofed with straw or reeds. In recent years building regulations in the larger cities have required more permanent types of residential construction. A few houses are of brick or stone construction, with tile roofs. Industrial buildings are generally of the same types as those in Japan. Reinforced concrete buildings and steel-frame buildings covered with galvanized iron or board sheathing are the rule in the industrial sections.

A. Lumber.

The lumber industry in Korea is typically composed of small units. The value of the lumber imported from Japan before the war exceeded the value of lumber production within Korea. Two-thirds of Korea is classed as forest land, but only about a third bears commercial forests.

(1) Timber stands.

For many years before the Japanese annexation, much of Korea had been deforested by fuel gatherers. After the annexation a policy of conservation and reforestation was initiated, but in recent years the Japanese have been depleting Korean forests. In 1942 they planned to double Korean timber output the following year, in the hope of increasing the number of boats built with Korean lumber and of reducing Korean import requirements.

Although much of the northern half of Korea is wooded, the quality of these forest resources is poor, except for the dense forests near the Amnok-kang (Yalu River) in the northwest, and along the upper reaches of the Tuman-gang and near Paektu-san (Hakutō-san) in the northeast. Conifers comprise 60% of the timber. In the northern interior, fir, spruce and larch predominate, but are mixed with pine, linden, and birch. In northwestern Korea there are forests of red and Korean pine, with such broadleaf trees as oak and elm. Forests of red and black pine, oak, maple, alder, and bamboo exist in Central and Southern Korea, but these are not important sources of lumber.

Red and Korean pine, fir, spruce, and larch are used chiefly for buildings, telegraph poles, bridges, and shipbuilding. Birch is prized as lumber for vehicles.

In 1937 about 50% of the standing forests were owned by the government, 43% by private owners, 5% by local communities, and 2% by temples.

(2) Production, imports, and exports.

In 1939 Korea produced about 1,200,000,000 board feet of lumber, valued at 37,600,000 *yen*. This was about 8% of the lumber production of the Japanese Empire. Lumber valued at 11,741,000 *yen* was exported, at least ⅔ (by value) to Man-

churia and the Kwantung Leased Territory, chiefly as sawn timber, and ⅓ (by value) to Japan, chiefly as logs. Lumber imports were valued at 40,870,000 *yen;* sawn timber, railway ties, and logs from Japan made up 96% of this figure. Data on total exports and imports for later years are not available. In 1940 the value of imports from Japan was 11% higher than the year before, and there was also a 17% increase in the relatively small exports from Korea to Japan.

(3) Sawmills.

There are 120 sawmills in Korea, many of them on the banks of the Amnok-kang (Yalu River) and Tuman-gang.

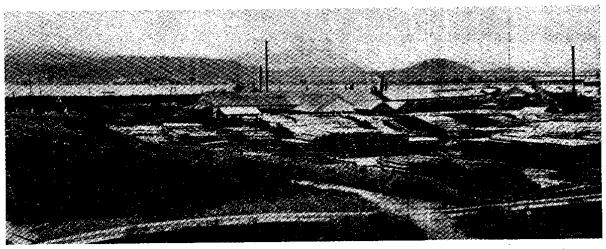

FIGURE IX - 15. *P'yongan-pukto, Sinuiju (Shingishū).* Looking W. Lumber yard of the Japanese Government Forestry Bureau sawmill, the largest in Korea. The Amnok-kang (Yalu River) and An-tung, Manchuria, in background. 1931.

The largest of these sawmills, and reputedly the largest in the Japanese Empire, is the government-operated mill at Sinuiju (Shingishū), P'yongan-pukto, which has an annual capacity of 104,000,000 board feet (FIGURE IX-15). Lumber for this mill is floated down the Amnok-kang from state-owned forests. Other important sawmills, supplied by the state-owned forests along the Tuman-gang, are located at and near Hoeryong (Kainei) in Hamgyong-pukto.

B. Cement.

Limestone and clay suitable for use in cement manufacture are abundant. The 7 large cement plants are all in Northern Korea (FIGURE IX-48).

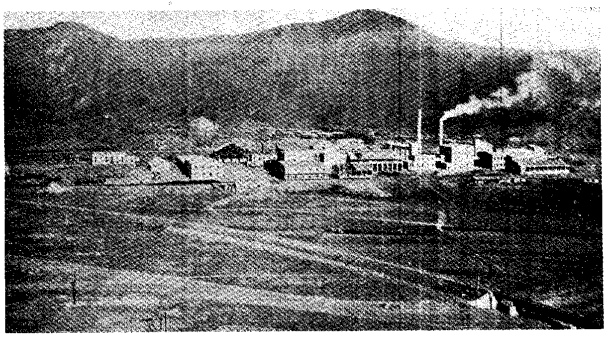

FIGURE IX - 16. *Hamgyong-namdo, Ch'onnae-ri (Sennai-ri).* The plant of the Chōsen Onoda Semento Seizo K. K. (Chōsen Onoda Cement Manufacturing Company), the largest producer of cement in Korea. 1931.

(1) Capacity.

The 1940 capacity of Korea's 7 major cement plants is believed to have been about 1,885,000 metric tons, or roughly 9% of the capacity in Japan, Korea, Manchuria, and Occupied China for that year; this represents more than a quadrupling of the 1934 capacity of 443,000 tons. These plants are listed in TABLE IX-9. The largest of the 4 cement companies is the Chōsen Onoda Semento Seizo K. K. (FIGURES IX-16 and IX-17).

Cement plants can easily be converted to other products; however, no details as to specific conversions are available. General reference has been made in Japanese publications and broadcasts to the use of some plants for the production of alumina and pig iron.

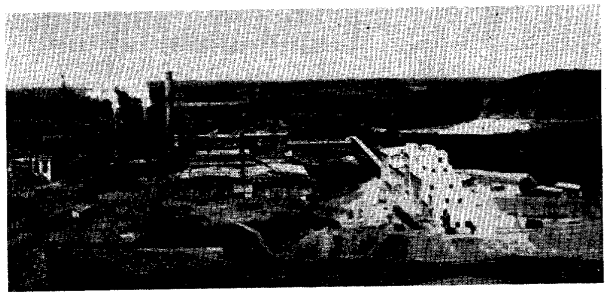

FIGURE IX - 17. *P'yongan-namdo, Sungho-ri (Shōko-ri).* The plant of the Chōsen Onoda Semento Seizo K. K. (Chōsen Onoda Cement Manufacturing Company), one of Korea's major producers of cement.

TABLE IX - 9

KOREA, MAJOR CEMENT PLANTS, 1940*

LOCATION	COMPANY	ANNUAL CAPACITY (METRIC TONS)
Hamgyong-pukto		
Komusan (Komosan)	Chōsen Onoda Semento Seizo K. K.	142,560
Hamgyong-namdo		
Ch'onnae-ri (Sennai-ri)	Chōsen Onoda Semento Seizo K. K.	396,840
Kwangwon-do		
Samch'ok (Sanchoku)	Chōsen Onoda Semento Seizo K. K.	180,000
Hwanghae-do		
Yongdangp'o (Ryūtōho)	Chōsen Semento K. K.	550,000
Yongdam-ni (Ryūtan-ri)	Chōsen Asano Semento K. K.	180,000
P'yongan-namdo		
Sungho-ri (Shōko-ri)	Chōsen Onoda Semento Seizo K. K.	256,080
P'yongan-pukto		
Sakchu (Sakushū)	Chōsen Oryokko Suiryoku Hatsuden K. K.	180,000
	Total	1,885,480

* In addition to the plants listed, there are unverified reports of the construction of another Onoda plant at Mun'gyong (Bunkei) in Kyongsang-pukto.

(2) Production and consumption.

A rapid increase in cement production began in 1935. The last available figure of annual output is 567,000 metric tons for 1936, when capacity had reached 705,000 tons. Prior to 1940 there were substantial imports of cement from Japan, amounting in 1939 to 214,000 tons; these imports may have been eliminated by the growth of the Korean output. Current production may now be at the rate of 1,500,000 metric tons per year, and some cement may be exported to consum-

ing centers on the continent. Approximately 170,000 tons was exported to Manchuria in 1939 and Manchuria's requirements have probably kept pace with her increasing capacity.

The net supply of 621,000 metric tons available in Korea in 1936 was probably devoted chiefly to civilian uses. Wholesale distribution of cement in that year was as follows:

Buildings	31%
Retail sales	15
Railways	14
Electric power projects	14
Harbors, roads, and bridges	12
Other civil engineering works	7
Cement products	4
Mining	2
Other	1
	100%

C. Brick and tile.

Abundant clay of good quality is available. The country is self-sufficient in the production of common bricks, but in peacetime she imported most of her supply of tiles from Japan. Although ceramics is predominantly a household industry, there were about 150 plants working at full capacity before the war, producing bricks, tiles, pipe, building stone, and other construction materials. One of these, a brick plant at Yongdungp'o (Eitōhō), Kyonggi-do, employed more than 200 workers.

TABLE IX-10 lists the companies known to be producing bricks, tiles, and other construction materials as of about 1940. FIGURE IX-48 shows the concentration of these plants in Kyonggi-do, Kyongsang-namdo, and P'yongan-namdo.

D. Other construction materials.

The Kyomip'o (Kenjiho) plant of the Nippon Seitetsu K. K. is the only steel mill in Korea known to have capacity for rolling structural steel shapes. Its capacity is believed to be about 110,000 metric tons, but output in 1936 was only 56,600 tons. Imports of "metal building and bridge construction materials" from Japan in 1939 and 1940 amounted to 29,100 metric tons and 15,100 metric tons, respectively.

The Ryuzan Kosaku K. K. (Ryuzan Construction Company), with plants at Yongdungp'o (Eitōhō), Kyongsong (Keijō, Seoul), and Inch'on (Jinsen), reportedly produces steel girders for bridges at one or more of its plants.

The Showa Plate Glass Company is reported to have planned or built a plant at Inch'on (Jinsen) with an annual capacity for 2,400,000 square feet of sheet glass. In 1940 Korea imported 16,760,000 square feet of sheet glass from Japan and probably an additional quantity from the Kwantung Leased Territory, imports from which had amounted to 4,033,000 square feet in 1939.

TABLE IX - 10

KOREA, PLANTS PRODUCING CONSTRUCTION MATERIALS, 1940

LOCATION	COMPANY	PRODUCT
Northern Korea		
Hamgyong-pukto		
Hoeryong (Kainei)	Iwamura Gumi K. K.	Bricks, earthen pipe
Unggi (Yūki)	Nichiman Kogyo K. K.	Bricks, earthen pipe
Hamgyong-namdo		
Hamhung (Kankō)	Chōsen Yogyo Goshi Kaisha	Bricks
	Kanko Kogyo K. K.	Building stone
Kangwon-do		
Kangnung (Kōryō)	Taisho Kogyo K. K.	Tile pipes, cement products
Hwanghae-do		
Chaeryong (Sainei)	Tohosha K. K.	Bricks
Kyomip'o (Kenjiho)	Unknown	Bricks
	Nippon Seitetsu K. K.	Structural steel
P'yongan-namdo		
P'yongyang (Heijō)	Asahi Shokai K. K.	Construction materials
	Chōsen Tile K. K.	Tiles, tile goods
	Takagi Yogyo K. K.	Bricks
Chinnamp'o (Chinnampo)	Chinnampo Renga K. K.	Bricks
P'yongan-pukto		
Sinuiji (Shingishū)	Shingishū Yogyo K. K.	Bricks, tiles
Central Korea		
Kyonggi-do		
Yongdungp'o (Eitōhō)	Unknown	Bricks
Kyongsong (Keijō, Seoul)	Asahi Seisakusho K. K.	Construction materials
	Daiko Sangyo K. K.	Bricks
	Chōsen Tainetsu Yogyo K. K.	Bricks, tiles
	Chōsen Hayakawa Gumi K. K.	Earthen pipe
	Oishi Gumi K. K.	Building stone
	Keijō Renga K. K.	Bricks, earthen pipe
	Aoki Shokai K. K.	Construction materials
Pup'yong (Fuhei)	Fuhei Yogyo K. K.	Bricks, tiles
Inch'on (Jinsen)	Keijin Shoji K. K.	Construction materials, building stone
	Chōsen Yogyo K. K.	Bricks
	Jinsen Togyo K. K.	Bricks, tiles
	Jinsen Yogyo K. K.	Bricks
Kangwha (Kōka)	Kōka Yogyo K. K.	Tiles
Southern Korea		
Cholla-namdo		
Mokp'o (Moppo)	Chōsen Taika Kogyo K. K.	Bricks
Kyongsang-pukto		
Susong-myon (Jujō-men)	Keihoku Semento Kogyo K. K.	Cement tiles
Taesong-myon (Taijō-men)	Sankyo Bussan K. K.	Construction materials
Kyongsang-namdo		
Pusan (Fusan)	Nippon Koshitsu Toki K. K.	Tiles
	Kurohashi Shoten K. K.	Cement, construction materials
	Koto Sangyo K. K.	Building stone
Miryang (Mitsuyō)	Unknown	Bricks

94. *Industrial Raw Materials and Primary Processing*

Korea's wartime mining shares some of the features of its wartime manufacturing industry. The facts to be emphasized in connection with mining are the control of the major mines by large Japanese companies, the payment of large subsidies because of the strategic character of many minerals, and the utilization of low-grade ores.

The importance of Korea's minerals lies generally in their variety rather than in the quantity of any given mineral. Those found include coal, iron, lead, zinc, copper, tungsten, molybdenum, magnesite, alunite, aluminous shale, fluorspar, graphite, mica, and small amounts of a number of others. In 1944 Korea is believed to have exported to Japan approximately 2,700,000 metric tons of low-grade iron ore concentrated to approximately 1,400,000 metric tons (averaging 65% iron content). Korea now supplies about half of Japan's tungsten requirements, and is the chief producer of molybdenum in the Far East. It is Japan's sole source of graphite and mica (although the quality of the latter may be low), and it is probably the world's leading producer of magnesite ore.

Although Korea lacks coking coal and good bituminous coal, there is an exportable surplus of anthracite coal, the type in which Japan is totally deficient.

Korea may not be self-sufficient in coke. On the basis of known coke-oven capacity, consumption requirements may exceed available output by approximately 100,000 metric tons a year. New coking facilities are reported to have been built at P'yongyang (Heijō) and Kyomip'o (Kenjiho).

A. Minerals.

(1) Iron-bearing ores.

Difficulty in obtaining adequate supplies of iron ore has prevented blast furnaces and steel mills in Japan from operating at full capacity, and thus has constituted a major obstacle to continued growth of Japan's war economy. Before 1937 Korean iron-ore output averaged approximately 600,000 metric tons a year. There has been a very rapid subsequent expansion of production, so that today Korea is one of the main sources of iron ore in Japanese-controlled territory.

Reserves of fairly good ore (averaging 50% iron content) total approximately 20,000,000 metric tons. At Musan (Mozan), Hamgyong-pukto, there are enormous reserves of low-grade and highly siliceous magnetite ores, from which Korea derives the bulk of her ore production. These deposits average 34% to 36% iron content, and have been estimated at several billion metric tons. Deposits of magnetite exist also in the neighborhood of Yangyang (Jōyō) in Kangwon-do, Sosan (Zuisan) in Ch'ungch'ong-namdo, and at Ch'ungju (Chūshū) in Ch'ungch'ong-pukto. Deposits of hematite and limonite have been located in Hamgyong-namdo near Ch'anghung-ni (Shōkō-ri) —the Iwon or Rigen field; in Hwanghae-do at the Ullyul (Inritsu), Hasong (Kasei), Kyomip'o (Kenjiho), and Chaeryong (Sainei) fields; and in P'yongan-namdo at the Kangso (Kōsei) field (FIGURES IX-18 and IX-19).

The total production of iron ore in Korea in 1944 is believed to have been approximately 5,000,000 metric tons, containing about 1,800,000 tons of iron. Assuming that 2 concentration units are in operation, production at Musan may have reached 4,200,000 metric tons of low-grade ore (about

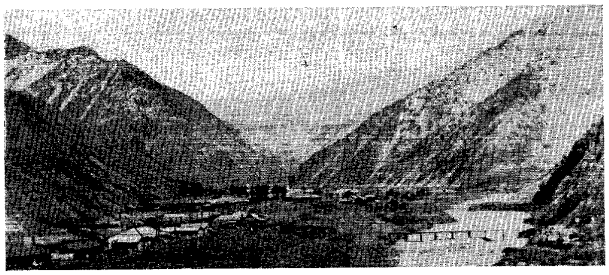

FIGURE IX - 18. *Hamgyong-namdo, Iwon (Rigen).* The Iwon or Rigen iron mine. 1931.

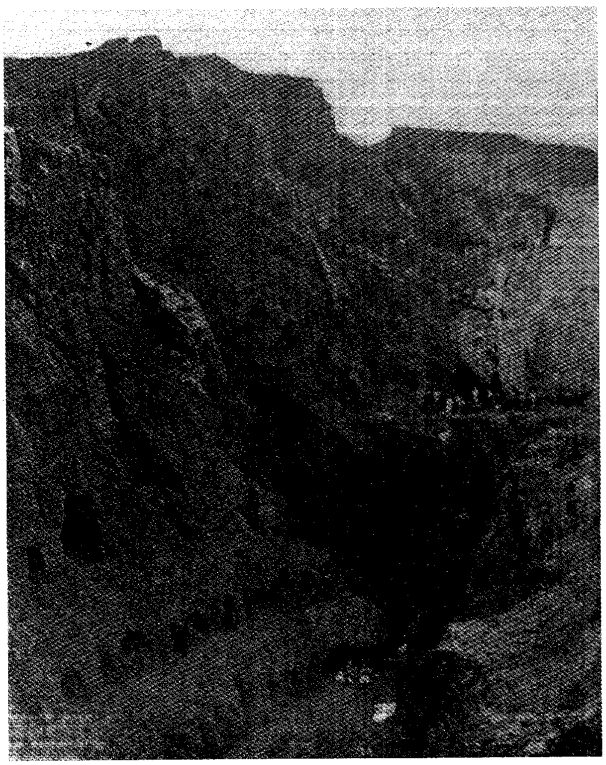

FIGURE IX - 19. *Hwanghae-do, Chaeryong (Sainei).* The Chaeryong or Sainei iron mine. 1931.

2,100,000 metric tons of concentrates with an iron content of 65%). The rated capacity of the existing concentration units is probably only 10% greater than this. In addition, 800,000 metric tons of better-grade ore (averaging 50% iron content) may be produced by the Iwon (Rigen) and Chaeryong (Sainei) mines, and by various smaller mines chiefly in Hwanghae-do and P'yongan-namdo (FIGURE IX-49). Korea was scheduled to supply a quarter of the Japanese Empire's 1944 production of iron ore and the actual proportion has probably gone higher as a result of difficulties in shipping ore to Japan from more distant sources.

Korea's consumption of crude ore in 1944 has been estimated at approximately 2,300,000 metric tons, including 1,500,000 tons of Musan ore (iron content about 500,000 tons) plus 800,000 metric tons of other ore (iron content about 400,000 tons). Thus in 1944 Korea may have been able to export to Japan approximately 2,700,000 metric tons of

Musan ore concentrated to roughly 1,400,000 metric tons (averaging 65% iron content).

Because the Japanese have difficulty in obtaining adequate supplies of iron ore, destruction of the ore-concentrating facilities at Musan would seriously affect the Japanese iron and steel industry.

(2) Ferroalloys.

Japan proper has a general deficiency of ferroalloy ores. Substitutions, proximity to other sources, and accumulated stockpiles are believed to have prevented these deficiencies from becoming serious. Korea is a major supplier of tungsten for Japan, and is the chief producer of molybdenum in the Far East. The country produces also small amounts of manganese, chromium ore, nickel, cobalt, and vanadium. The location of the principal mines is shown in FIGURE IX-49.

(a) Manganese. Very little manganese is produced and only one mine is known—the Kumhwa (Kinka) mine of the Nippon Koshuha Jukogyo K. K. at Kumhwa (Kinka) in Kangwon-do. Early in 1944 Radio Tōkyō announced the discovery of "large deposits of manganese of excellent quality" in the vicinity of Ch'olma-ryong (Tetsuba-rei) (pass) in Kangwon-do. These deposits were claimed to be "several hundreds of thousand tons."

(b) Tungsten. Production of tungsten in Korea during 1943 was perhaps 2,500 metric tons of ore (averaging 60% tungsten content). This is now Japan's major source of tungsten apart from South China.

Korea's premier tungsten mine, the Tongbaengnyon-kwangsan (Tōhyakunen-kōzan) mine in Koksangun, Hwanghae-do, produced 1,000 metric tons in 1936. There is another important mine about 18 miles east of Yongwol (Neietsu), Kangwon-do; and another between the towns of Sakchu (Sakushū) and Ch'angju (Shōshū) in P'yongan-pukto. Mines have been located also at the following places: Kumgang-san (Kongo-san), west of Kosong (Kojō), Kangwon-do; Naesong (Naijō), Kyongsang-pukto; Ch'ong-yang (Seiyō), Ch'ungch'ong-namdo; Munui (Bungi), Ch'ungch'ong-pukto; Mokkye (Bokkei), Ch'ungch'ong-pukto; Namyang (Nanyō), Kyonggi-do; Kumch'on (Kinsen), Hwanghae-do; Yongwon (Neien), P'yongan-namdo; and Yangnim-san (Rorin-zan), P'yongan-namdo.

In 1941 the Kobayashi Kogyo K. K. was reported to be constructing an ore-sorting mill at Yangdok (Yōtoku), P'yongan-namdo, which is about 20 miles north of the Tongbaengnyon-kwangsan (Tōhyakunen-kōzan) mine.

Tungsten mining in Korea is dominated by 3 firms: the Kobayashi Kogyo K. K., the Nippon Kogyo K. K., and the Nippon Koshuha Jukogyo K. K.

(c) Chromium ore. Chrome is produced only in small quantities in either Korea or Japan proper. The chief Japanese source of supply in recent years has been the Philippine Islands. The only mine known to exist in Korea is at Kanghwa (Koka) in Kyonggi-do. Deposits averaging more than 14% chrome content are said to have been discovered recently in Hwanghae-do.

(d) Nickel. Very little nickel ore is mined in Korea. There are nickel mines at the following locations: Tanch'on-gun (Tansen-gun), Hamgyong-namdo; Majon-ni (Maten-ri), Hamgyong-namdo; Kumsong (Kinjō), Kangwon-do; and Choch'iwon (Chōchiin), Ch'ungch'ong-namdo. There are deposits also in P'yongan-pukto. There are believed to be no facilities in Korea for smelting or refining nickel.

(e) Molybdenum. Production of molybdenum in Japan proper is negligible in relation to estimated requirements, but an ample stockpile and imports from the continent can meet irreducible needs. In 1935 Korea produced 52 metric tons (recoverable metal content or ore). Output in 1943 has been estimated at 100 metric tons, as compared with 40 metric tons produced in Manchuria, and 10 metric tons produced in North China.

The 3 most important Korean mines for this metal are at Kumgang-san (Kongō-san), west of Kosong (Kojō), Kangwon-do; southeast of Kumch'on (Kinsen), Kyongsang-pukto; and Changsu (Chōsui), Cholla-pukto. There are mines also at P'yongch'ang (Heishō), Kangwon-do; Sangju (Shōshū), Kyongsang-pukto; Namhae (Nankai), Kyongsang-namdo; Polgyo-ri (Bakkyō-ri), Cholla-namdo; and Tanyang (Tanyō), Ch'ungch'ong-pukto.

(f) Cobalt. Korea is estimated to have produced about 5 tons of cobalt in 1943, a relatively small fraction of Japanese requirements. There are small cobalt mines at Setsu Roku San, Hamgyong-pukto, and Kyongsan (Keizan), Kyongsang-pukto. Deposits with a cobalt content of 3% to 4% have recently been discovered in the region of Shoyo, Tanch'on-gun (Tansen-gun), Hamgyong-namdo, and plans reputedly have been made to exploit this ore on a large scale.

(g) Vanadium. Only one vanadium mine has been reported—the mine at Kangwha (Koka), Kyonggi-do, which also produces chromium ore.

(3) Nonferrous metals (mining, smelting, and refining).

(a) Light metals.

1. ALUNITE AND ALUMINOUS SHALES. Korea has no bauxite, but its alunite and aluminous shales can be substituted for bauxite in the production of alumina, although the substitution involves substantial technical difficulties. Alumina plants have been set up both on the continent and in Japan to employ these materials. As a result of the increasing difficulty of bringing bauxite from the south, it is probable that the Japanese have increased their use of the lower-grade aluminous ores by stepping up production at shale-using plants, converting bauxite-using plants, and possibly setting up new installations.

Alunite deposits of inferior quality exist on the islands near Mokp'o (Moppo), Cholla-namdo. These are believed to contain approximately 25,000,000 metric tons of 20% to 35% alumina. Deposits have been reported also in Hamgyong-pukto, Kyongsang-namdo, and P'yongan-pukto. There is an aluminous-shale mine near Changsu (Chōsui), Cholla-pukto, and there are others in Kyongsang-namdo. In the coal fields near P'yongyang (Heijō), P'yongan-namdo, shale (40% to 50% alumina content) is found in layers; these deposits are estimated to total approximately 40,000,000 metric tons.

In 1936 Korea produced 139,000 metric tons of alumina ores, including 114,000 metric tons of alunite and 25,000 metric tons of aluminous shale.

It is not clear from available information whether Japanese plans for replacement of bauxite are emphasizing the use of alunite—with which experiments beginning in 1934 were not

entirely successful—or the use of shales. One of the alumina plants in northwestern Korea is believed to import shale from North China or Manchuria. More evidence is available of substantial production of shale in North China than in Korea.

2. ALUMINA. Known plant capacity in Korea in 1944 has been estimated at about ⅛ of that of Japan, Korea, Manchuria, and Formosa (thought to be approximately 570,000 metric tons), and Korea's production of alumina was estimated at 64,000 tons in the same year. The principal plants producing alumina and aluminum are listed in TABLE IX-11, and their location is shown in FIGURE IX-50.

TABLE IX - 11
KOREA, ALUMINA AND ALUMINUM CAPACITY, PRINCIPAL PLANTS, 1944 (ESTIMATE)

LOCATION	COMPANY	ANNUAL CAPACITY (METRIC TONS) ALUMINA	ALUMINUM	REMARKS
Hamgyong-namdo				
Hungnam (Kōnan)	Chōsen Chisso Hiryo K. K.	24,000	12,000	Set up to use alunite in 1938; believed converted to shale about 1940
Wonsan (Genzan)	Nichiman Aluminium K. K.	3,000	1,500	Controlled by Chōsen Riken Kinzoku, 1943
P'yongan-namdo				
Chinnamp'o (Chinnampo)	Chōsen Riken Kinzoku K. K.	20,000	5,000	Reported in 1944 to be using shale from North China
P'yongan-pukto				
Sinuiju (Shingishū) - Yangsi (Yōshi) - Yongamp'o (Ryūgampo) area	Toyo Keikinzoku K. K. and affiliates	21,000	18,000	2 or 3 plants. One at Yangsi (Yōshi) was established in 1943 or 1944 to use bauxite

Additional installations for alumina production may possibly have been established at the following places: (1) Pon'gung (Hongū), near Hamhung (Kankō), Hamgyong-pukto; (2) Kowon (Kōgen), Hamgyong-namdo; (3) Wonsan (Genzan), Hamgyong-namdo; (4) P'yongyang (Heijō), P'yongan-namdo; and (5) Sunch'on (Junsen), P'yongan-namdo. It may be significant that all these places are not far from a possible source of shale in the P'yongyang (Heijō) coal fields; also that there are cement plants at the 2nd and 4th of these locations (Topic 93, B (1)), and electric furnaces at the 4th (Topic 95, B, TABLE IX-17). Another possible site of alumina production is Inch'on (Jinsen), Kyonggi-do, where the Chōsen Riken Kinzoku has a sponge-iron plant (Topic 95, B), and the Chōsen Aruminium K. K. has an aluminum-fabrication plant (Topic 95, (3), (a), 4).

If alumina production is being expanded in Korea, using either Korean alunite or shale, or shale from North China or Manchuria, the development would significantly reduce the shipping tonnage necessary to supply raw materials to aluminum plants in Japan.

3. ALUMINUM INGOTS. Korea's known aluminum-reduction capacity, estimated at about 37,000 tons in 1944, was approximately ⅙ of the total available in Japan, Korea, Manchuria, and Formosa. Production is believed to have been fairly close to capacity. There is no positive evidence that possible additional plants such as those mentioned above (Topic 94, (3), (a), 2) produce aluminum ingots. Probably well over ⅘ of Japanese-controlled aluminum production is destined for aircraft and other direct military and naval matériel.

4. ALUMINUM-ROLLING MILLS. An aluminum-fabrication plant owned by the Chōsen Aruminium K. K. has been reported at Inch'on (Jinsen), Kyonggi-do; and it appears probable that rolling facilities are associated either with this plant or with the aluminum-reduction plants at Chinnamp'o (Chinnampo) and Sinuiju (Shingishū) - Dasado (Tashitō).

5. MAGNESIUM. Korea and Manchuria have probably the world's largest reserves of magnesite ore. Korean reserves have been estimated at approximately 3,700,000,000 metric tons. Magnesium is also produced from salt water, especially at Kwangnyang-man (Kōryō-wan), near Chinnamp'o.

There are large deposits of magnesite along the border of Hamgyong-pukto and Hamgyong-namdo: near Paegam (Hakugan), Hamgyong-pukto; along the Puktae-ch'on (Hokudaisen) (river), near the hamlet of Taehwayang-dong (Taikayōdō), Tanch'on-gun (Tansen-gun), Hamgyong-namdo; and at a point about 12 miles downstream and south from Taehwayang-dong (Taikayō-dō). There is also a deposit in the region of the Fusen-kō hydroelectric power development, Sinhung-gun (Shinkō-gun), Hamgyong-namdo. (FIGURE IX-50)

Before the war the Manchurian deposits produced about ⅘ of the total Manchurian - Korean yield. Korea's production in 1937 was approximately 35,000 metric tons, but it is now believed to be roughly 150,000 metric tons of magnesite ore per annum, containing not over 70,000 tons of magnesium oxide. This large increase has probably been made possible by completion of a narrow-gauge railroad connecting Yohaejin (Jokaishin) on the coast with the area of large deposits in Tanch'on-gun. This line was to have been completed in May 1942.

A substantial part of Korea's output of magnesite ore is required for the manufacture of furnace brick vital to Japan's iron and steel industry; the balance is used in the manufacture of metallic magnesium. The plant of the Nippon Magnesite Kagaku Kogyo K. K. at Songjin (Jōshin), Hamgyong-pukto, specializes in the manufacture of refractory furnace brick, of which it produced 7,000 metric tons in 1939. It also produces a small quantity of metallic magnesium.

The magnesium-reduction capacity of the known plants is estimated to be approximately 7,000 metric tons, about ⅓ of the total available to Japan. Although it is believed that in the past Japan's magnesium plants have not been operating at capacity, a shortage of aluminum is likely to lead to increased production of metallic magnesium. The principal magnesium-reduction plants are listed in TABLE IX-12.

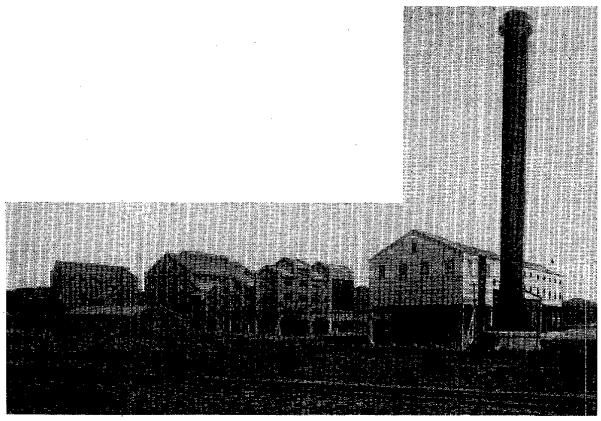

FIGURE IX - 20. *Hamgyong-namdo, Hungnam (Kōnan).* Part of the magnesium-reduction plant of the Nippon Magnesium Kinzoku K. K., the largest producer of metallic magnesium in Korea. Before 1935.

TABLE IX - 12

KOREA, MAJOR MAGNESIUM-REDUCTION PLANTS, 1944

LOCATION	COMPANY	ANNUAL CAPACITY (METRIC TONS)
Hamgyong-pukto		
Songjin (Jōshin)	Nippon Magnesite Kagaku Kogyo K. K.	350
Hamgyong-namdo		
Hungnam (Kōnan) (FIGURE IX-20)	Nippon Magnesium Kinzoku K. K.	5,000
P'yongan-namdo		
Chinnamp'o (Chinnampo)	Chōsen Riken Kinzoku K. K.	1,000*

*By extraction from brine.

In addition to these other installations may possibly have been established at Ch'ongjin (Seishin), Hamgyong-pukto; Tanch'on (Tansen), Hamgyong-namdo; Chinnamp'o (Chinnampo), P'yongan-namdo; and Uiju (Gishū) or Sinuiju (Shingishū), P'yongan-pukto.

(b) Other nonferrous metals. The production and smelting of ores containing copper, lead, and zinc has probably been expanded since the mid-1930's, but little clear and reliable information is available. The relative importance of Korea as a source of these metals for the Japanese war economy has certainly increased with the loss of other major producing areas, but it is doubtful whether the actual tonnages have been greatly enlarged.

A recent report suggests that copper-mine yields in Korea have been declining rather than increasing, and it is possible that smelters in northwestern Korea are using some Manchurian ore. Total production of smelted copper is believed to be on the order of 10,000 to 20,000 metric tons a year; possibly some of this is refined in Korea. Little is known about copper-fabricating facilities in Korea. Aerial photographs confirm the existence of a plant at Sihung-ni (Shikō-ri), near Yongdungp'o (Eitōhō), Kyonggi-do, where it had been planned to produce copper wire.

Mine production of lead and zinc in 1943 has been estimated at 7,000 to 10,000 metric tons of recoverable lead and about 8,000 metric tons of recoverable zinc. Most of the lead output is believed to be smelted within Korea, but some or all of the zinc may be shipped to Japan for processing.

1. NORTHERN KOREA. Two important mines in the northeast are the copper mine near Kapsan (Kōzan), and the Nippon Kogyo K. K.'s Kumdok-san (Kentoku-san) lead and zinc mine, Tanch'on-gun (Tansen-gun), both in Hamgyong-namdo. There probably are smelting facilities for copper (and possibly lead) at Munp'yong-ni (Bunhei-ri) near Wonsan (Genzan), owned by the Sumitomo Kogyo K. K. The Chōsen Chisso Hiryo K. K. development at Hungnam (Kōnan) may also undertake copper and lead smelting. The mine near Yomi-san (Jobi-zan) in Songch'un-gun (Seizen-gun), Kangwon-do, is believed to be an important zinc producer.

Four of the more important mines in the northwest are the copper mines of the Nippon Kogyo K. K. at Huch'ang (Kōshō), P'yongan-pukto, and Suan-kumwang (Suian-kinkō), Hwanghae-do; the lead and zinc mine at Ongjin (Ōshin), Hwanghae-do; and the zinc mine at Changyon (Chōen), Hwanghae-do. There are smaller lead or zinc mines elsewhere in Hwanghae-do and P'yongan-pukto, and in P'yongan-namdo. Aerial photographs have confirmed the existence and the expansion of the Nippon Kogyo K. K. copper and lead smelter at Chinnamp'o (FIGURE IX-21). This installation may have an affiliated sulfuric-acid plant. The Japanese had also planned to install (on adjacent filled-in land) facilities for roasting and smelting zinc, but the existence of these is still in doubt. There may be a smaller copper smelter at Haeju (Kaishū), Hwanghae-do. At Yongamp'o (Ryūgampo), near the mouth of the Amnok-kang (Yalu River), it is reported without confirmation that facilities have been developed for smelting copper, lead, and zinc.

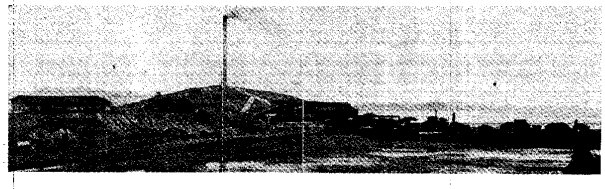

FIGURE IX - 21. *P'yongan-namdo, Chinnamp'o (Chinnampo).* A smelter owned by the Nippon Koryo K. K. This firm produces copper, lead, and zinc. 1931.

2. CENTRAL AND SOUTHERN KOREA. There is reported to be a copper refinery on the coast at Changhang-ni (Chōkō-ri), Ch'ungch'ong-namdo, but it is uncertain whether or not this possesses electrolytic refining capacity.

The Irwol-san mine (Jitsugetsu-san), Kyongsang-pukto, is believed to be an important producer of zinc. One of the more important copper mines is at Haman (Kanan), Kyongsang-namdo. Tsushima (island) has a small zinc mine, and there is a small lead mine east of Chinan (Chinan), in Cholla-pukto. Kyongju (Keishū), Kyongsang-pukto, may be the site of a copper smelter. (FIGURE IX-50)

(4) Nonmetallic minerals and products.

(a) Asbestos. There are small deposits of short-fiber (inferior grade) asbestos in Kangwon-do, Ch'ungch'ong-pukto, and P'yongan-pukto. Korea's current estimated annual production of about 100 metric tons represents less than 1% of Japan's estimated asbestos requirements. The Nippon Asbestos Company manufactures asbestos products at its plant in Kikori, Kwangch'on-myon, Hongsong-gun, Ch'ungch'ong-namdo. The Hanto Sekimen K. K. mines asbestos ores. (FIGURE IX-50)

(b) Fluorspar. This mineral is used in standard electrolytic processes for producing aluminum and magnesium, in steel refining and casting, and in the production of enamels and glassware. Almost the entire current output of the Japanese Empire, estimated at about 40,000 metric tons, comes from Korean deposits, chiefly in Hwanghae-do but also in Kangwon-do, Ch'ungch'ong-namdo, and Hamgyong-namdo. Exports, principally to Japan, rose irregularly from over 8,000 metric tons in 1936 to about 39,000 metric tons in 1939. In 1940, however, they decreased to 23,000 metric tons, possibly because of increased domestic consumption. The Mitsubishi Iron Manufacturing Company operates several mines in Hwanghae-do; the Chōsen Mining Development Company has a sorting mill at its mine in Taejon (Taiden), Ch'ungch'ong-namdo.

(c) Silica sand and feldspar. Until the late 1930's, Korea and Indochina were Japan's principal sources of the high-grade silica sand used in the manufacture of window and plate glass. Similar deposits have recently been discovered in Japan proper, but the west coast of Korea near P'yongyang (Heijō) in P'yongan-namdo, and, to a lesser extent, the province of Cholla-namdo, are still important sources of silica sand for Japan's glass industry. Production of silica sand in Korea in 1936 was about 90,000 metric tons. Considerable quantities of feldspar, also used in glass manufacturing, are mined in Korea, mostly in Ch'ungch'ong-pukto, and shipped to Japan. The Showa Plate Glass Company produces sheet glass at Inch'on (Jinsen) (Topic 93, D).

(d) Graphite. Despite fairly adequate stockpiles, Japan continues to depend chiefly upon Korea for a current supply of graphite to be used principally for foundry facings, self-lubricating bearings, and motor and generator brushes. There are deposits of amorphous graphite in almost every province, but it is mined principally in Hamgyong-namdo, Ch'ungch'ong-pukto, Kyongsang-pukto, P'yongan-namdo, and P'yongan-pukto. Only about 10% to 15% of the total output is of the crystalline type, and this is of an inferior quality which cannot be used for the crucibles needed in steel manufacturing—the chief use for crystalline graphite. In 1936, 41,000 metric tons were produced, but output has been increased substantially since that time. Exports to Japan rose from 34,825 metric tons in 1936 to 72,633 metric tons in 1939, suggesting that production had more than doubled during the period.

(e) Mica. Korea is at present Japan's sole source of mica. Deposits in Hamgyong-pukto, Hamgyong-namdo, Kangwon-do, Kyongsang-pukto, Ch'ungch'ong-namdo, Hwanghae-do, P'yongan-namdo, and P'yongan-pukto have recently yielded between 700 and 800 metric tons of mica annually, or 10 times as much as in 1936 and 1937. Only about 100 tons, however, are of the high quality necessary for insulating electrical equipment, one of the chief strategic uses of the mineral. For this, Japan depends largely upon stockpiles. New discoveries in Hamgyong-namdo and Kangwon-do, reported by the Japanese in 1944, may possibly increase the Korean output of high-grade mica.

(f) Phosphate rock. Deposits near Tanch'on (Tansen) in Kyonggi-do and at Kajito in P'yongan-pukto were expected to yield from 60,000 to 80,000 metric tons of phosphate rock in 1942, a relatively small part of Japanese requirements for fertilizer and other uses. It is unlikely that this level has been reached. (FIGURE IX-50)

FIGURE IX - 22. *Ch'ungch'ong-pukto, near Okch'on (Yokusen).* The Yamano Getsumei graphite mine. 1931.

(g) Salt. In Korea salt is secured chiefly by solar evaporation of sea water. Fields at Chuan (Shuan) in Kyonggi-do and around Kwangnyang-man (Kōryō-wan) near Chinnamp'o, P'yongan-namdo, yielded almost 217,000 metric tons of salt in 1936; in the same year imports amounted to 144,000 metric tons. To supplement the production of the government monopoly, the Dai Nippon Engyo has been collecting salt from the region of the Ch'ongch'on-gang (Seisen-kō) which divides P'yongan-namdo and P'yongan-pukto. With the development of the vast chemical industry at Hungnam (Kōnan), Hamgyong-namdo, salt consumption has increased considerably in recent years, but an effort has been made to keep Korean production and consumption in balance, and to keep imports at a minimum.

B. Fuel.

(1) Coal.

(a) Production. Although Korea has reserves of both bituminous and anthracite coal amounting to 1,750,000,000 metric tons, it produces no high-grade coking coal. The total production of coal in 1944 has been estimated at 6,500,000 tons or about 1/7 as much as that of Japan proper.

The quality of Korean coal varies from poor to medium. In 1932 about 3/5 of the total output was anthracite, but the

ratio of bituminous and lignite to anthracite, has steadily increased in response to rising industrial demands, until by 1939 the output of soft coal had exceeded that of anthracite (TABLE IX-13).

TABLE IX - 13
KOREA COAL PRODUCTION
(thousands of metric tons)

YEAR	ANTHRACITE	BITUMINOUS AND LIGNITE	TOTAL
1932	652	452	1,104
1933	741	566	1,307
1934	982	706	1,689
1935	1,079	920	1,999
1936	1,052	1,230	2,282
1937	1,102	1,247	2,348
1938	1,664	1,536	3,200
1939	2,064	2,417	4,481

Korea is not believed to have reached an announced goal of 12,000,000 tons by 1943 because of shortages of transportation facilities, modern mining equipment, and labor. Nevertheless, production was probably increased more than 40% between 1939 and 1944. Government assistance to the mining companies in securing supplies, equipment, and labor, as well as subsidies to marginal producers, and the mining of new fields by a semi-official company, led to the quadrupling of production between 1932 and 1939; a similar policy was probably followed after 1939.

(b) Fields. Anthracite deposits estimated at 1,340,000,000 tons are concentrated in Northern Korea, in P'yongan-namdo, Hamgyong-namdo, and Kangwon-do, and there are smaller amounts in P'yongan-pukto and Cholla-namdo, the latter in Southern Korea (FIGURE IX-51). The Neinan-Nambu field (FIGURE IX-23) near P'yongyang (Heijō), P'yongan-namdo,

FIGURE IX - 23. *P'yongan-namdo, near P'yongyang (Heijō).* The Jido coal mine, operated by the Chōsen Muentan K. K., in the Neinan-Nambu field.

is the chief producing area; its major mines contributed 80% of the national output of anthracite in 1936. The 4 largest mines in this field are near P'yongyang, an important center of Korea's war industry. In prewar years the anthracite for export was transported by rail chiefly to Chinnamp'o, one of the largest coal ports in the Far East, and shipped from there to Japan. Since the completion of the Heigen Railway in 1937 anthracite may also be exported through Wonsan (Genzan) or possibly Pusan (Fusan) and Yosu (Reisui) on the south coast. The Neietsu field, at the southern border of Kangwon-do and the Sanchoku field in the same province were also probably producing anthracite on a large scale by 1940, chiefly

FIGURE IX - 24. *Hamgyong-pukto, Yongan (Eian).* The Chōsen Sekitan Kogyo (Korea Coal Company) plant in the Kisshū-Meisen field. Possibly includes a synthetic petroleum plant. 1937.

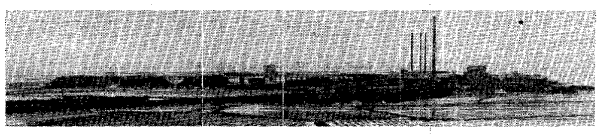

FIGURE IX - 25. *P'yongan-namdo, near Anju (Anshū).* The Anju-Kwangsan coal mine, near the mouth of the Ch'ongch'on-gang (Seisen-kō). 1931.

because of the large demands by newly constructed thermal electric-power plants nearby. Production of 1,000,000 tons at the Neietsu field was planned for 1941. Anthracite mined at the Wajun field in Cholla-namdo is exported through the recently improved southern port of Yosu (Reisui).

The reserves of bituminous coal and lignite in Korea are believed to total about 400,000,000 tons. The Agochi field in the northeast is the largest producer of brown coal. This field, together with 5 others in Hamgyong-pukto, produced 70% of Korea's bituminous and lignite output in 1936 (FIGURE IX-24). Production has probably been increased considerably for industrial uses within Korea and possibly also for export to Japan. Other bituminous and lignite fields are in Hamgyong-namdo, P'yongan-pukto, and P'yongan-namdo (FIGURE IX-25). The location of mine fields is shown in FIGURE IX-51 and production is shown in TABLE IX-14.

(c) Consumption, exports, and imports. Coal consumption in Korea in 1944 has been estimated at 7,500,000 tons, or about 1/7 as much as that consumed in Japan proper. Railroads probably used about ⅕ of the total consumption, thermal electric plants (including those attached to manufacturing plants) ⅛, coke ovens ⅛, and cement kilns and synthetic-fuel plants together another tenth. A substantial part of the remainder was consumed by such industries as iron and steel, aluminum and magnesium, chemicals, and munitions.

The great increase in consumption since 1939, when 5,530,000 tons were used in Korea, has been met principally by increasing production in the area. It is probable that imports, which were 1,975,000 tons in 1939, have remained about the same. Imports in 1944 included coking coal from North China and Manchuria (and possibly also from Karafuto),

TABLE IX - 14

KOREA, PRODUCING COAL FIELDS

PROVINCE AND COAL FIELD (TOWN)	TYPE**	NUMBER OF KNOWN MINES	COMPANY	1936* PRODUCTION	% OF KOREAN TOTAL
Northern Korea					
Hamgyong-pukto				944,606	41.5
Onjō (Omsong)	A	1	Nissan Kagaku Kogyo	N.A.	
Keigen (Kyongwon)	B	1	Unknown	80,791	
Kunjū (Hunyung)	B	1	Unknown	39,578	
Agochi (Aoji-dong)	B	1	Unknown	270,850	
Kainei (Hoeryong)	B	2	Iwamura Kogyo K. K.	234,142	
Kisshū-Meisen (Kilchu-Myongch'on)	B	2	Chōsen Sekitan Kogyo	167,791	
Kyōjō (Kyongsong)	B	2	Unknown	77,780	
Hamgyong-namdo				86,107	3.8
Kankō (Hamhung)	B	1	Unknown	39,996	
Bunsen (Munch'on)	A	1	Chōsen Muentan	46,102	
Kangwon-do				8,833	0.4
Neietsu (Yongwol)	A	1	Chōsen Denryoko	N.A.	
Sanchoku (Samch'ok)	A	1	Sanchoku Kaihatsu	N.A.	
P'yongan-pukto				57,597	2.5
Ryūto (Yongbyon)	A	1	Unknown	57,373	
Kōkai (Kanggye)	A	1	Iwamura Kogyo K. K.	N.A.	
P'yongan-namdo				956,861	42.0
Neinan-Nambu (P'yongyang)	A	10	Chōsen Muentan	715,452	
Heinan-Hokobu (Kaech'on)	A	2	Unknown	62,053	
Anshū (Anju)	B	1	Unknown	62,061	
Kōsei (Kangso)	A	1	Unknown	126,281	
Hwanghae-do				175,323	7.7
Shariin (Sariwon)	B	1	Unknown	175,253	
Central Korea					
Ch'ungch'ong-pukto	Unknown	Unknown	Unknown	195	0.1
Southern Korea					
Kyongsang-pukto				8,325	0.4
Bunkei (Mun'gyong)	A	1	Hosen Muen Tanko	N.A.	
Cholla-namdo				35,146	1.6
Wajun (Hwasun)	A	1	Unknown	N.A.	
TOTAL				2,282,000	100.

* The provincial totals and figures for individual mines have been obtained from different sources.

** A: anthracite coal; B: bituminous coal; N.A.: not available.

NOTE: There are mines also at Hongsan (the Kōzan), Ch'ungch'ong-namdo; Yongch'on (the Eisen), Kyongsang-pukto; the Masan (the Masan), Kyongsang-namdo.

and probably some bituminous coal from Manchuria for general industrial use in Northern Korea; some bituminous coal may have been imported from Kyūshū for use in Southern Korea. Rough estimates of imports are listed in TABLE IX-15.

Exports of coal from Korea, consisting almost exclusively of anthracite, amounted to 926,000 tons in 1939, but little information is available on its use. In general, the industrial uses of anthracite are limited by its slow combustibility. The powdery Korean anthracite can be briquetted and mixed with good-quality bituminous to make a satisfactory industrial fuel, and it is believed that the Korean industrial districts adjacent to the anthracite fields have expanded their consumption of this type of coal. Possible uses of Korean anthracite in Japan include heating of office buildings, naval bunkering, mixing with bituminous for coke-oven charge, and production of water gas in connection with ammonia manufacture and Fischer-Tropsch synthesis of petroleum. It is believed likely that exports of anthracite have decreased since 1939. The general shortage of coal in Japan makes it probable, however, that some of the increased bituminous production in northeastern Korea has been shipped to Japan.

TABLE IX - 15

KOREA, COAL POSITION IN 1939 AND 1944 (ESTIMATE)

(thousands of metric tons)

	1939		1944	
Production		4,481		6,500
Imports		1,975		2,000
From Manchuria	392		1,000	
From Occupied China	286		500	
From Japan proper	1,248		500	
From other sources	49		—	
Consumption		5,530		7,500
Exports		926		1,000

(2) Coke.

Coke is an essential fuel for the smelting of iron in blast furnaces; other uses are believed to be of minor importance in Korea. Of the coke by-products, tar and light oils are raw materials for the manufacture of synthetic petroleum and numerous war chemicals, respectively; coke-oven gas is used as fuel in iron and steel plants and in other industries.

The capacity of known by-product coke ovens in Korea is about 500,000 metric tons a year of furnace-grade coke; 600,000 metric tons are believed to have been required in 1944 (Topic 95, B). New facilities have been reported at P'yongyang (Heijō) and Kyomip'o (Kenjiho). Some expansion may also have occurred in the region of Ch'ongjin (Seishin)—where available data indicate a lack of integrated facilities. It is possible that self-sufficiency in coke output has now been achieved.

The 2 known by-product coke-oven plants are that of the Chōsen Chisso Hiryo K. K. at Hungnam (Kōnan), Hamgyong-namdo, and that of the Nippon Seitetsu K. K. at Kyomip'o (Kenjiho), Hwanghae-do. They had in 1944 the capacity to produce 28,000 and 460,000 metric tons, respectively, of furnace-grade coke. There is some doubt as to the economic significance of the plant at Hungnam (Kōnan). It has been suggested that its coke output is used to generate water gas, and thus indirectly in the manufacture of ammonia; it has not been possible to verify this supposition.

(3) Petroleum.

Korea has no natural petroleum, and her requirements must be satisfied by importation and synthetic production. Annual imports of crude petroleum and products between 1935 and 1939 are estimated to have averaged between 2,500,000 and 3,000,000 barrels. Only a very small part of the imports were reexported as refined products. In 1936, the last year for which detailed import and export statistics are available, net imports were as follows:

1,589,000 barrels of crude and heavy oils
141,000 barrels of diesel oil ("light oil")
115,000 barrels of lubricating oil
265,000 barrels of kerosene ("illuminating oil")
498,000 barrels of gasoline ("volatile oil")
5,000 barrels of other petroleum products

There was no synthetic production in Korea in 1936.

(a) Synthetic petroleum. Korea is believed to have at least 2 plants for making synthetic petroleum—both owned by the Chōsen Sekitan Kogyo (Korea Coal Industries)—with a combined capacity for producing at least 400,000 barrels of petroleum products. Their consumption of coal at this rate of production would be about 350,000 tons a year. The older and smaller plant, located at Yongan (Eian), Hamgyong-namdo (FIGURE IX-23), produces oil products by a Lurgi-process low-temperature carbonization unit from the distillation of coal tar. The capacity of the Yongan plant is believed to be approximately 12,000 tons, or 80,000 barrels of oil products annually. The newer and more productive plant is at Aoji-dong (Agochi-dō), Hamgyong-pukto. This installation, probably completed in 1937, has been described as using the Japanese Navy's "direct liquefaction" process. It is believed to hydrogenate a mixture of tar and coal. The Lurgi-type low-temperature carbonization unit was expected to handle 100,000 tons of coal annually, yielding something under 10,000 tons of tar (FIGURE IX-51). The annual output capacity of petroleum products is reported to be approximately 51,000 kiloliters, or 42,000 metric tons: gasoline, about 22,000 tons, or 190,000 barrels, and fuel oil 20,000 tons, or 130,000 barrels. Although plans were publicized for eventually quadrupling the capacity of this plant, its actual output, at least through 1939, was much below the original capacity. No information is available on possible plant expansion since 1940.

The construction of several other synthetic oil plants has been planned at Hungnam (Kōnan), Hamgyong-namdo; Ch'ongjin (Seishin), Hamgyong-pukto; Mokp'o (Moppo), Cholla-namdo; and Chuuronjang (Shuotsuonjō), but there is no positive evidence that any of these were actually constructed.

(b) Petroleum refineries. By far the most important refinery is that of the Chōsen Sekiyu K. K. (Korea Oil Company) at Wonsan (Genzan), Hamgyong-namdo, one of the largest and best-equipped refineries in Japan or nearby areas, with about 5% of the total capacity of all refineries in Japan, Korea, and Manchuria (FIGURE IX-51). It can produce aviation gasoline and probably also lubricating oil in addition to other refinery products. The annual capacity of the plant is 1,650,000 barrels of crude oil. The capacity of the cracking units is 412,500 barrels, and its capacity for production of iso-octane is 4,300 barrels annually.

Among the smaller refineries is the Tateishi Shoten Sekiyu Koba at Pusan (Fusan), Kyongsang-namdo, which has an annual capacity for refining 65,000 barrels of crude oil, and a refinery of unknown capacity at Mun'gyong (Bunkei), Kyongsang-pukto. There may be other small refineries in various cities.

(c) Commercial petroleum storage. The most important commercial petroleum-storage areas are at Wonsan (Genzan), Hamgyong-namdo, and at Munp'-yong (Bunhei-ri), about 6 miles to the northwest. At Wonsan there are storage tanks and warehouses adjacent to the refinery. The Asahi Sekiyu K. K.'s storage area at Munp'yong has numerous tanks and warehouses, a can plant, and a jetty with good loading facilities, including a pipe line from the tank farm. Some of the cities which have some commercial petroleum storage are Mokp'o (Moppo), Cholla-namdo; Yongan (Eian), Hamgyong-pukto; Ch'ongjin (Seishin), Hamgyong-pukto; Chinnamp'o, P'yongan-namdo; Haenam (Kainan), Cholla-namdo; Musan (Mozan), Hamgyong-pukto; and the island of Wolmi-dō (Getsubitō) near Inch'on (Jinsen), Kyonggi-do. Military and naval storage of petroleum are discussed in Chapter VI, 61 and Chapter VIII, 81.

C. Agricultural and marine materials.

In 1936 approximately 900,000 acres, or about 6% of all harvested acreage in Korea, were cultivated in industrial crops. Of this total acreage, cotton occupied 62%, sericulture 15%, hemp 7%, tobacco 5%, sesame 3%, and other crops the remaining 8 percent. Industrial crops represented about 5% of the value of total crop production in 1938. The geographical distribution of industrial crops in the mid-1930's is indicated in TABLE IX-16.

TABLE IX - 16

KOREA, GEOGRAPHICAL DISTRIBUTION OF CULTIVATION OF INDUSTRIAL CROPS AVERAGE OF 1933, 1934, AND 1936

	Cotton[1]	Cocoons	Hemp	Tobacco	Rushes[2]	Oil-bearing plants[3]	Others[4]
Northern Korea							
Hamgyong-pukto	—	0.6	3.6	—	0.4	2.5	0.0
Hamgyong-namdo	0.0	7.4	7.9	0.0	0.9	4.9	0.0
Kangwon-do	1.4	11.1	18.9	9.3	6.0	8.6	4.2
Hwanghae-do	9.7	5.7	1.7	11.0	4.1	6.9	8.4
P'yongan-namdo	13.7	7.8	2.7	10.2	1.9	3.6	—
P'yongan-pukto	2.9	6.6	13.7	—	3.1	5.7	0.0
Central Korea							
Ch'ungch'ong-namdo	7.2	6.5	3.7	5.4	6.3	11.4	1.0
Ch'ungch'ong-pukto	5.2	6.6	1.1	36.6	9.5	7.4	0.5
Kyonggi-do	2.9	6.3	3.6	2.0	10.7	13.9	70.8
Southern Korea							
Kyongsang-pukto	9.7	19.5	10.6	8.9	26.8	6.3	2.3
Kyongsang-namdo	15.1	5.7	17.8	5.9	9.9	4.0	1.7
Cholla-namdo	26.1	10.1	9.1	1.0	6.1	19.4	5.2
Cholla-pukto	6.1	6.1	5.6	9.7	14.3	5.4	5.9
	100	100	100	100	100	100	100
Total production (thousands of pounds)	198,804	50,221	42,646	39,081	27,300	26,628	1,315

[1] Upland cotton 142,771,000 pounds, native cotton 56,033,000 pounds. Listed as raw cotton unginned, but not consistent with data for cottonseed and ginned cotton output; these figures cannot be reconciled.

[2] Paper mulberry 15,044,000 pounds, reeds 10,992,000 pounds, willow 1,264,566 pounds.

[3] Sesame 8,516,000 pounds, castor beans 2,795,000 pounds, perilla (a mint) 9,645,000 pounds.

[4] Ginseng (a medicinal herb) 1,228,472 pounds, pyrethrum (an insecticide) 86,622 pounds.

Industrial crops have considerable value as a source of subsidiary income to the farmers, who process many of the products at home. Household work was important in the processing of cocoons, in silk reeling, and in weaving hemp; pressing vegetable and fish oils, with fish fertilizer as a by-product, and making medicines from domestic herbs were important home industries.

(1) Cotton.

In 1937 there were 428,895 acres under upland cotton and 117,874 acres under native cotton. After the annexation of Korea, Japan introduced an American upland variety which could be cultivated in areas previously unused. This was produced chiefly in Southern Korea: Cholla-namdo (36%), Kyongsang-namdo (21%), and Kyongsang-pukto (13%). The centers for native cotton were in the western part of Northern Korea: P'yongan-namdo (49%), Hwanghae-do (34%), and P'yongan-pukto (10%).

Under the 20-year Plan inaugurated in 1933, the area under cotton was to be increased to 1,470,000 acres by 1953; in 1941 it is thought to have reached 800,000 acres. The yield per acre has shown a decrease from its peak year—187 pounds per acre in 1937—to 130 pounds per acre in 1940; this was slightly below the 1920 to 1924 average of 134 pounds per acre.

Production of ginned cotton in 1940-1941 amounted to 93,000,000 pounds, only slightly higher than the 1935-1936 output. Korea normally imports an amount of cotton about equal to ⅓ of its own production.

(2) Sericulture.

Sericulture is one of the most important subsidiary occupations of the farmers, and silk cocoons constitute one of their principal cash crops. Before the annexation by Japan, sericulture was not of great importance, mainly because of the inferior quality of the silkworms reared. Since the annexation the Japanese have introduced better silkworms, distributed mulberry seedlings, and given instructions in improved methods. This encouragement is reflected in the number of families engaged in sericulture, and in the production figures. In 1911 the number of farm families engaged in cocoon raising was estimated at 76,000 and cocoon output at about 1,000,000 pounds; in 1940 there were 841,000 families raising silkworms and 321,172 families reeling silk. Production of cocoons amounted to 50,000,000 pounds in the latter year.

Although cocoons are produced in all provinces, Kyongsang-pukto, Kangwon-do, and Cholla-namdo account for over 40% of the total output.

(3) Hemp.

The prewar production of hemp fiber (1933 to 1936) amounted to about 43,000,000 pounds per year. Kangwon-do, Kyongsang-pukto, Kyongsang-namdo, and P'yongan-pukto produced over 60% of the total. Imports were small.

(4) Tobacco.

The prewar average annual production (1933 to 1936) amounted to 39,000,000 pounds, of which Ch'ungch'ong-pukto produced 37 percent. By 1939 increases in acreage and yield had raised the total output to about 69,000,000 pounds. Imports amounted to only 2,000,000 pounds in 1938.

Although no data are available after 1940, cultivation of tobacco has probably been maintained at least at the 1940 level. Some tobacco is apparently used as a source of insecticide. In 1940 the Tobacco Monopoly Bureau began operation of a nicotine factory in Yongdungp'o (Eitōhō), Kyonggi-do; this was reported to be the only one of its kind in the Japanese Empire at the time. At the end of 1940 there were 7 factories in Korea engaged in manufacturing cigarettes.

(5) Vegetable-oil crops.

Korea exports both vegetable oils and the seeds from which they are obtained. There are numerous small enterprises employing primitive methods for processing vegetable oils, and some modern plants which produce hardened oils and derivative chemical products (Topic 95, C).

(a) Cottonseed. Korea is a net exporter of cottonseed. Production in 1940 amounted to 217,000,000 pounds, about 20% higher than that in 1935. Cottonseed-oil production was almost 7,000,000 pounds in 1937. The Japan-China Oil Manufacturing Company has a factory for processing cottonseed oil in Mokp'o (Moppo), Cholla-namdo.

(b) Sesame. Sesame production averaged 8,500,000 pounds annually in the prewar period. Korea imported about 14,000,000 pounds of sesame seed and produced about 6,000,000 pounds of oil, all of which was exported.

(c) Castor beans. Production of castor beans averaged 2,795,000 pounds per year between 1933 and 1936, and about 1,000,000 pounds of castor oil were produced annually. Because of the importance of castor oil as a lubricant, output may have been maintained or expanded in recent years.

(d) Other crops. The reported annual production of soybean oil between 1933 and 1936 averaged over 4,000,000 pounds; this did not include the soybean oil used as a raw material in the plants which processed it. During the same period about 35,000,000 pounds of soybean refuse were converted into fertilizer annually, and unknown but probably larger amounts of bean cake were manufactured. In 1944 Korea is believed to have supplied Japan with 96,000,000 pounds of soybean cake and meal for fertilizer, food products, and industrial uses.

Prewar production of perilla averaged almost 10,000,000 pounds per year. Apart from its importance as an industrial oil, there is recent evidence that perilla is being utilized for production of a synthetic sugar, which is stated to be a hundred times sweeter than cane sugar. It was first issued in Japan for human consumption in October 1944.

Peppermint was produced chiefly in Cholla-namdo (62%), annual production averaging almost 6,000,000 pounds between 1933 and 1936. Korea produced more than 5,000,000 pounds of hempseed oil in both 1935 and 1937, probably processed from both domestically grown and imported seeds.

No production figures for chrysalis oil—obtained from the pupae of silkworms—are available, but in view of the importance of sericulture in Korea it is probable that some is being produced. Before the war it was used mainly in soap manufacture, but recent reports suggest that "butter" is being produced from mashed chrysalises.

(6) Marine products (non-food uses).

The prewar (1933 to 1936) output of marine products for non-food uses averaged approximately 520,000,000 pounds annually, including about 279,000,000 pounds of fish fertilizer. These by-products were produced mainly in Hamgyong-pukto, Kangwon-do, and Hamgyong-namdo (about 86% of the total). During the same period about 160,000,000 pounds of fish oil were produced annually. A considerable proportion was utilized for production of hard oils, glycerine, fatty acids, and soap, and a smaller proportion was used in the manufacture of margarine and medicaments. The 1944 fish

catch is believed to have been 30% below the prewar level, so the production of fish oils has probably decreased.

95. *Manufacturing Plants*

Although Korean industry has been greatly expanded during the past 15 years, much of its output is still furnished by small plants; household industry remains sizable in many fields, and accounted for about ⅕ of the gross value of industrial production in 1939. In 1938 only 3% of the population was directly dependent upon industry, as compared with 7% on commerce, 1% on mining, and 74% on agriculture.

In 1939 more than 80% of the 6,953 factories with 5 or more workers had less than 30 workers. Only 17 factories had more than 1,000 workers; these were 10 spinning and weaving mills, 2 metalworking plants, 2 machinery plants, and 3 chemical plants. Factories employing 200 or more workers represented only 2% of the total number, but they employed 40% of all factory workers.

In terms of value of product, the rank of principal Korean industries in 1939 was as follows: chemicals, food processing, spinning and weaving, metal working, and machinery and tool making.

A. Iron and steel.

(1) Capacity and production.

Korea is important to Japan's iron and steel industry because of its production of iron ore and its conversion of a substantial part of this ore into iron; this reduces the shipping tonnage required to supply raw materials to the steel industry in Japan.

Japan's total steel production, in the islands and on the continent, is less than a tenth as large as that of the United States. The strategic weakness of the industry is its heavy dependence upon iron ore and coking coal mined on the continent. This has affected the distribution of the 3 segments of the industry—blast furnaces, steel furnaces, and rolling mills—as between Japan proper and the Asiatic mainland. Thus Japan, with ⅘ of Japanese-controlled steel-making capacity and ⅞ of the capacity of rolling mills, has only ⅓ of the pig-iron capacity. Korea, on the other hand, has at least 7% of the iron-making capacity, 3% or 4% of the steel-making capacity, and a still smaller proportion of the rolling-mill capacity. Korea, then, has substantially greater capacity to produce iron than steel ingots, and more ingot facilities than her rolling mills can handle.

At no time during the war have the Japanese been able to obtain enough iron ore to utilize the full capacity of all their blast furnaces and steel furnaces, and the shortage of ore had become severe by 1944. Korea, however, has a surplus of iron ore and it is believed that Korean iron furnaces are used much more fully than those in Japan. Rough estimates of the 1944 production and consumption of iron and steel at the various stages in Korea are shown in TABLE IX-17.

The total production of iron ore in Korea in 1944 may have reached approximately 5,000,000 metric tons (Topic 94, B, (1)). Roughly half of this was utilized in Korea for the manufacture of about 900,000 metric tons of iron; the rest of the ore was exported to Japan. Approximately half the iron and a third of the steel produced in Korea was probably exported to Japan, principally from northeastern Korea.

TABLE IX - 17

KOREA, IRON AND STEEL CAPACITY, PRODUCTION, AND REQUIREMENTS, 1944 (estimate)[1]

	Pig and sponge iron	Steel ingots	Rolled products
	(thousands of metric tons)		
Capacity[2]	1,200	600	300
Production	900	500	225
Requirements	450[3]	350[4]	225
Surplus[5]	450	150	—

[1] In round numbers; capacity estimates include an allowance for unknown and unverified plants in addition to those shown in TABLE IX-18.
[2] Capacity for iron is rated capacity, from which an average of 15% should be deducted for time lost in relining and repairs.
[3] Approximately 400 for steel ingots and 50 for iron castings.
[4] Approximately 300 for rolled products and 50 for steel castings.
[5] Surplus was probably shipped to Japan proper.

The production of metallurgical coke may now be sufficient to meet requirements. In so far as scrap is used in steel furnaces in this area, it probably comes from associated rolling mills and from scrap created in the metal-using industries within Korea. It is possible that some steel furnaces in Korea operate with a charge of pig iron and/or sponge iron only.

Blast-furnace capacity in Korea represents approximately ⅔ of total iron-making capacity. The remaining ⅓ is provided by installations producing various types of sponge iron.

(2) Location of principal installations.

Korea's iron and steel production is highly concentrated in the 2 industrial districts of Ch'ongjin (Seishin) in Hamgyongpukto, and Kyomip'o (Kenjiho) in Hwanghae-do. The large Nippon Seitetsu plants at these locations are believed to have about ⅘ of Korea's iron-making capacity. Neither plant, however, is quite large enough to rank among the 10 largest iron and steel plants in the Japanese Empire. The capacities and locations of all known plants in the area are shown in TABLE IX-18. The location of the major industrial concentrations is indicated in FIGURE IX-45.

The large plant at Ch'ongjin (Seishin) is only partially integrated. There are 2 large blast furnaces built between 1939 and 1942, and probably 4 Krupp-Renn furnaces for making sponge iron. Information on steel-ingot capacity is meager. There is considerable doubt as to whether this plant should be credited with two or three 120-ton open hearth furnaces, and even some doubt as to whether any steel furnaces have been completed here. The accepted estimate of 2 such furnaces is provisional. Plans in 1937 called for an eventual steel-ingot production of 500,000 metric tons and a rolling-mill capacity of 400,000 metric tons. Because evidence on the realization of the plans for rolling mills is lacking, this location is not credited with rolling-mill facilities at the present time.

The large plant at Kyomip'o (Kenjiho) is believed to have 3 blast furnaces and four 50-ton open-hearth steel furnaces (FIGURE IX-26). Rolling-mill capacity is in excess of ingot capacity. This is a relatively old plant and has apparently not been expanded since 1933. The Hungnam (Kōnan) plant employes the Basse process of manufacturing iron in rotary

kilns, using sinter from iron pyrite processed in the sulfuric-acid plant nearby. The Chōsen Riken Kinzoku plant at Inch'on (Jinsen) uses the Riken rotary-kiln sponge-iron process. The so-called "high-frequency" method of sponge-iron production is used at Songjin (Jōshin).

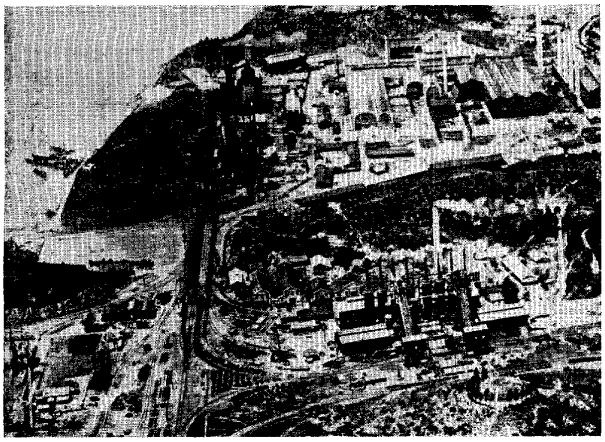

FIGURE IX - 26. *Hwanghae-do, Kyomip'o (Kenjiho).* Iron and steel plant of the Nippon Seitetsu K. K., on the Taedong-gang (Daidō-kō). The largest completely integrated iron and steel plant in Korea.

TABLE IX - 18

KOREA, IRON AND STEEL PLANT CAPACITIES, 1944 (ESTIMATE)

(thousands of metric tons)

LOCATION	COMPANY	PIG IRON[1]	STEEL INGOTS	ROLLED PRODUCTS
Hamgyong-pukto				
Songjin (Jōshin)	Nippon Koshuha Jukogyo	58[2]	50[3]	37[5]
Ch'ongjin (Seishin)	Nippon Seitetsu	365	163[4]	—
		180[2]		
		545		
Hamgyong-namdo				
Hungnam (Kōnan)	Chōsen Chisso Hiryo	23[2]	21[3]	—
Hwanghae-do				
Kyomip'o (Kenjiho)	Nippon Seitetsu	310	136	180[6]
P'yongan-namdo				
P'yongyang (Heijō)	Chōsen Daido Seiko	—	21[3]	—
Kyonggi-do				
Pup'yong (Fuhei)	Nippon Koshuha Jukogyo	—	7[3]	—
Inch'on (Jinsen)	Chōsen Kikai Seisakusho	—	17[3]	—
	Chōsen Riken Kinzoku	55[2]	50	—
Kyongsang-namdo				
Pusan (Fusan)	Chōsen Denki Kogyo	—	7[3]	—
	Chōsen Jukogyo	—	7[3]	—
Total		991	479	217

[1] Rated annual capacity, from which an average of 15% should be deducted for time lost in relining and repairs.
[2] Produced by equipment other than blast furnaces.
[3] Produced in electric furnaces.
[4] Provisional estimate based on assumption of 2 open-hearth furnaces.
[5] Plates and bars.
[6] Structural shapes and plates.

Most steel furnaces in Korea, except at the 2 largest plants, are electric. There may be an open-hearth furnace at the Chōsen Kikai Seisakusho plant at Inch'on (Jinsen).

The 2 plants at Pusan (Fusan) specialize in the manufacture of castings, forgings, wrought steel, railroad and mining machinery, steam-boiler pumps, and similar equipment. The Chōsen Kikai Seisakusho plant at Inch'on (Jinsen) manufactures castings, forgings, mining machinery, and ordnance equipment. No information is available on fabricating facilities associated with any of the other minor plants.

In addition to the above installations, preliminary interpretation of aerial photographs suggests that 26 new small blast furnaces have been built at the following locations: 10 at Kyomip'o (Kenjiho), Hwanghae-do; 4 at Chinnamp'o, Pyongan-namdo; and 12 at P'yongyang (Heijō), P'yongan-namdo. These are believed to have an aggregate rated capacity of 190,000 metric tons a year.

B. Chemicals.

Chemicals were Korea's largest industry before the war, accounting for ⅓ of the value of manufactured products in 1939. The output of the chemical industry in 1939 was valued at 502,000,000 *yen*, about 16 times as large as that in 1931. Capacity has probably continued to expand since that time. An important factor in this expansion has been the large hydroelectric power potential of the country, developed primarily by the Chōsen Chisso Hiryo K. K., the leading chemical producer in Korea.

Korea's proportion of the total capacity available to Japan is greatest in industries closely associated with munitions manufacture—especially nitrogen fixation and glycerol refining, of which Korea has ⅕ and ¼, respectively, of the capacity of Japan, Korea, Manchuria, and Formosa. The products of these industries are used in whole or in part by munitions plants within Korea (Topic 95, E). The most important chemical-plant development in Korea and one of the most important in Japan's Inner Zone* is at Hungnam (Kōnan) and the nearby town of Pon'gung (Hongū, Motomiya), usually discussed with Hungnam. Aerial photographs show the Pon'gung (Hongū) plant to have been greatly expanded since about 1941. At these locations the Chōsen Chisso Hiryo K. K. has the largest ammonia-synthesis and sulfuric-acid plants in the Japanese Empire, as well as installations for the production of nitric acid, caustic soda, chlorine, calcium carbide, calcium cyanamide, calcium superphosphate, glycerol, hardened oil, and other chemicals (FIGURE IX-27). The development includes nonferrous metal smelting, and alumina and aluminum installations. Power is supplied by the Changjin-gang (Chōshin-kō) and Pujon-gang (Fusen-kō) hydroelectric plants and the Hungnam (Kōnan) steam plant, all of which have been developed by and are controlled by the Chōsen Chisso Hiryo K. K. (Topic 96, B). (FIGURE IX-52)

(1) Nitrogen compounds.

Nitrogen compounds, including ammonium sulfate and calcium cyanamide, are used in peacetime chiefly for fertilizer. Nitric acid, essential to the manufacture of explosives, is the most important nitrogen compound for war purposes. The Japanese have pubilcized intentions of expanding the nitrogen-fixation industry of Korea far beyond its known previous capacity, which constituted about ⅕ of that of Japan, Korea, Manchuria, and Formosa. Plans for the building of numerous plants have been discussed, capital has been raised for some, and some have been claimed to be under construction. Only plants of well-recognized existence before the war are listed in TABLE IX-19.

* The Inner Zone consists of Japan, Korea, Manchuria, North China, and Formosa.

FIGURE IX - 27. *Hamgyong-namdo, Hungnam (Kōnan).*
Panoramic view of the installations of the Chōsen Chisso, Hiryo K. K. The Tongjoson-man (Higashi - Chōsen-wan) or Gulf of Korea, in background. The most important chemical plant in Korea and one of the most important in the Empire. 1935.

TABLE IX - 19

KOREA, CAPACITIES OF KNOWN NITROGEN-FIXATION PLANTS, 1941 (ESTIMATE)

LOCATION	COMPANY	PRODUCT	ESTIMATED CAPACITY (METRIC TONS)	EQUIVALENT IN METRIC TONS OF NITROGEN
Hamgyong-namdo				
Hungnam (Kōnan)	Chōsen Chisso Hiryo K. K.	Ammonium sulfate	505,000	104,000
	Chōsen Chisso Hiryo K. K.	Calcium cyanamide	55,200	11,600
Kangwon-do				
Samch'ok (Sanchoku)	Sanchoku Kaihatsu K. K.	Calcium cyanamide	30,000	6,300
P'yongan-namdo				
Sunch'on (Junsen)	Chōsen Kagaku Kogyo K. K.	Calcium cyanamide	30,000	6,300
Total			620,200	128,200

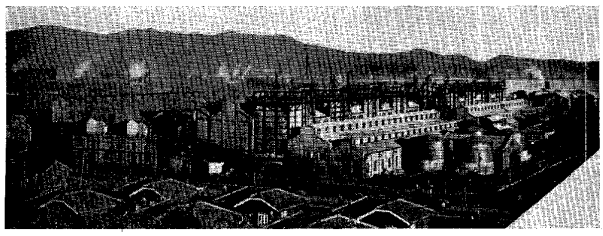

FIGURE IX - 28. *Hamgyong-namdo, Hungnam (Kōnan).*
The ammonium-sulfate plant of the Chōsen Chisso Hiryo K. K. The largest nitrogen-fixation plant in the Empire. Before 1935.

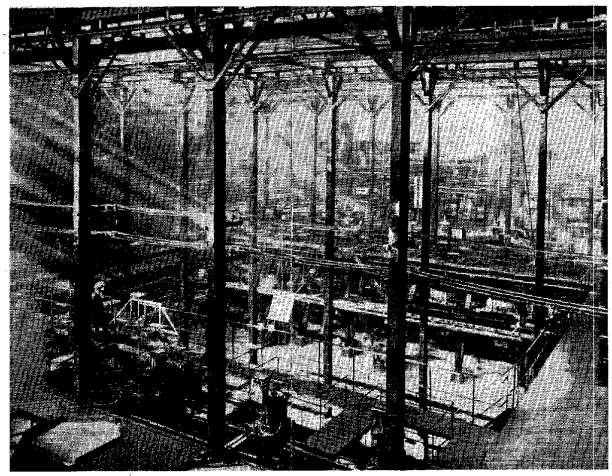

FIGURE IX - 29. *Hamgyong-namdo, Hungnam (Kōnan).*
Interior of the ammonium-sulfate plant of the Chōsen Chisso Kiryo K. K. 1937.

The preceding discussion ignores a minor source of fixed nitrogen, the recovery of ammonia produced as a by-product of coking. If the 2 by-product coke-oven plants in Korea operate at the capacities estimated (Topic 94, C, (2)), 7,592 tons of ammonium sulfate (containing 1,564 tons of nitrogen) should be produced at the Kyomip'o (Kenjiho) plant of the Nippon Seitetsu, and 465 tons of ammonium sulfate (containing 95 tons of nitrogen) at the Hungnam (Kōnan) plant of the Chōsen Chisso Hiryo (FIGURES IX-28 and IX-29).

The only known nitric-acid plant is the Chōsen Chisso Hiryo K. K. plant at Hungnam (Kōnan).

The extent to which Korean nitrogen compounds for explosives are at present supplied to Japan is unknown. It appears probable that military requirements of nitrogen will be met at the expense of the normally large fertilizer supplies. In 1938 Korea consumed nitrogenous chemical fertilizers totaling about 112,000 tons of nitrogen, and exported a small amount of nitrogenous fertilizer to Japan.

(2) Sulfuric acid.

Sulfuric acid is used in peacetime primarily for the manufacture of fertilizers, principally ammonium sulfate and calcium superphosphate. In wartime its use in the manufacture of explosives and other chemicals increases greatly. The Chōsen Chisso Hiryo plant at Hungnam (Kōnan), Hamgyong-namdo, has the largest capacity of any Japanese plant, 525,000 metric tons of chamber acid annually, or about 8% of the total capacity in Japan, Korea, Manchuria, and Formosa (FIGURE IX-32). The plant's military importance is limited despite its size, because explosives require sulfuric acid of at least 100% concentration (monohydrate), which can be produced only by the contact process. It is probable that some capacity, now unidentified, is available for the manufacture of monohydrate. There is no other known important

sulfuric-acid plant in Korea, but aerial photographs show installations adjacent to the Nippon Kogyo K. K.'s nonferrous metal smelter at Chinnamp'o, P'yongan-namdo, which are possibly used for the production of sulfuric acid.

(3) Chlorine and electrolytic caustic soda.

The Chōsen Chisso Hiryo plant at Hungnam (Kōnan) is the only one making chlorine and electrolytic caustic soda (FIGURE IX-30). This plant can produce 17,700 metric tons of chlorine and 20,000 metric tons of caustic soda annually, 8% of the total capacity in Japan, Korea, and Manchuria.

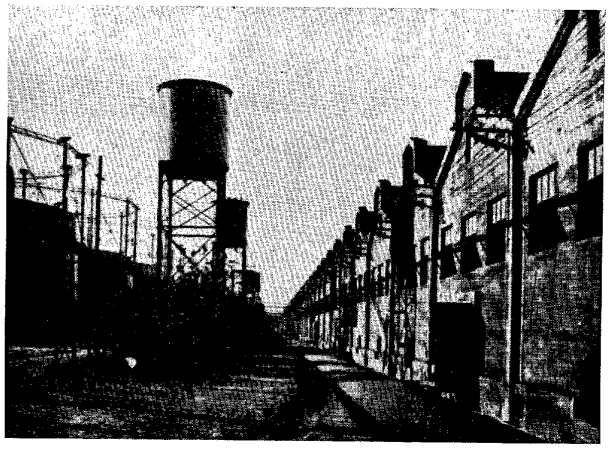

FIGURE IX - 30. *Hamgyong-namdo, Hungnam (Kōnan).* The electrolytic hydrogen and oxygen plant of the Chōsen Chisso Hiryo K. K. This is the only plant in Korea known to manufacture chlorine and caustic soda. 1937.

(4) Alcohols.

Important war uses of alcohols are in the manufacture of explosives and plastics, as a general-purpose solvent, and as fuel. Korea has plants for the production of all 3 kinds of commercially important alcohol—ethanol, methanol, and butanol.

In Korea ethyl alcohol is derived from wood. TABLE IX-20 lists the principal Korean ethyl-alcohol plants, representing about 6% of the total capacity in Japan, Korea, Formosa and Manchuria.

TABLE IX - 20

KOREA, CAPACITIES OF ETHYL-ALCOHOL PLANTS, 1941 (ESTIMATE)

LOCATION	COMPANY	ANNUAL CAPACITY (METRIC TONS OF ABSOLUTE ALCOHOL)
Hamgyong-pukto		
Kilchu (Kisshū)	Hokusen Seishi Kagaku Kogyo K. K.	2,900
	Shotoku Kogyo K. K.	4,300
P'yongan-pukto		
Sinuiju (Shingishū)	Nihon Musei Shusei K. K.	3,400
	Oriental Development Co.	4,300
Kusong (Kijō)	Oriental Development Co.	5,700
	Total	20,600

All plants in Korea making methyl alcohol synthesize it by passing a mixture of carbon monoxide and hydrogen over a catalyst at high temperature and pressure. These plants, which have 18% of the estimated methyl-alcohol capacity of Japan, Korea, and Manchuria, are listed in the following tabulation.

LOCATION	COMPANY	ANNUAL CAPACITY, 1941 (METRIC TONS)
Hamgyong-pukto		
Yongan (Eian)	Chōsen Sekitan Kogyo K. K.	3,000
Kyonggi-do		
Kyongsong (Keijō, Seoul)	Toyo Koatsu Kogyo K. K.	1,500
P'yongan-pukto		
Ch'angsong (Chōjō)	Showa Kiryo K. K.	3,000
	Total	7,500

There is only one known butyl-alcohol plant in Korea, the Hungnam (Kōnan) plant of the Chōsen Chisso Kiryo, where butanol is probably synthesized from acetylene. This plant can manufacture about 400 metric tons of butyl alcohol annually, or about 5% of the capacity in Japan, Korea, and Formosa.

(5) Oils, fats, and glycerine.

Korea is abundantly supplied with fish and seed oils which yield glycerol, an essential to munitions manufacture. In 1936 Korea produced 132,000 metric tons of animal and vegetable oils, including 108,200 tons of sardine oil (Topic 94, D); 32,660 metric tons of this amount were exported to Japan.

Hungnam (Kōnan), Hamgyong-namdo, has a large sardine-oil processing plant, and others are scattered along the east coast. Among the important seed-oil plants are the Chōsen Chisso Hiryo K. K. at Hungnam, which makes soybean oil; the Dai Nippon Celluloid Company at Mokp'o (Moppo), Cholla-namdo, which makes cottonseed and other oils; the Nippu Koshi K. K. at Sinuiju (Shingishū), P'yongan-pukto, making soybean oil; and the Chōsen Seiyu K. K. at Kyongsong (Keijō, Seoul), Kyonggi-do, which makes rice-bran oil. (FIGURE IX-52)

Oil hardening (hydrogenation) converts oils to fats which have such industrial uses as the making of hard soaps and lubricants, for which the original oils were unsuitable. The Chōsen Chisso Hiryo K. K. has an oil-hardening plant at Hungnam (Kōnan), Hamgyong-namdo; and the Chōsen Yushi K. K. and the Kyodo Yushi Kaisha have plants at Ch'ongjin (Seishin), Hamgyong-pukto.

Because of the comparative abundance of oils and fats, Korea has 25% of the glycerol-refining capacity of Japan, Korea, and Manchuria. The plant at Hungnam (Kōnan) is one of the largest under Japanese control (FIGURE IX-31). The glycerol-refining plants are listed in the following tabulation.

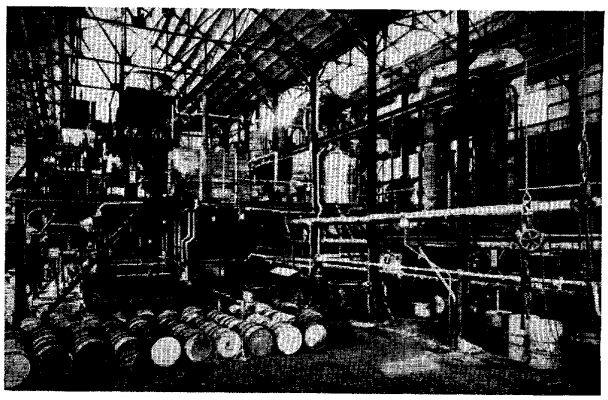

FIGURE IX - 31. *Hamgyong-namdo, Hungnam (Kōnan).* Interior of the plant of the Chōsen Chisso Hiryo K. K., one of the largest producers of glycerine under Japanese control. 1937.

Location	Company	Annual capacity, 1941 (metric tons of refined glycerol)
Hamgyong-namdo		
Hungnam (Kōnan)	Chōsen Chisso Hiryo K. K.	2,000
Kyonggi-do		
Inch'on (Jinsen)	Chōsen Yushi K. K.	1,200
	Chōsen Kyodo Yushi K. K.	1,800
Hwanghae-do		
Haeju (Kaishū)	Chōsen Kayaku Seizo K. K.	500
	Total	5,500

C. Machinery and tools.

Korea apparently continues to depend upon imports from Japan for much of her machinery, although there has been a substantial increase in machinery production in Korea since 1937. While the total value of industrial production almost doubled from 1937 to 1940, the output of machinery and tools increased 375%, reaching a total value of 77,000,000 *yen*. (The value of machinery production in Japan was about 6,000,000,000 *yen* in 1940.) Requirements, however, have apparently increased even more rapidly, and imports from Japan in 1940 were almost 164,000,000 *yen* compared with 54,520,000 *yen* in 1937.

Mining equipment is believed to have been the chief type of machinery produced in Korea before 1941. Since then 2 important Japanese manufacturers of electrical equipment, the Tōkyō Shibaura Denki and the Hitachi Seisakusho, have built factories in Inch'on (Jinsen), Kyonggi-do, and the Koyo Seiko—one of Japan's 3 largest producers of anti-friction bearings—has reportedly established a plant at Pup'yong (Fuhei), Kyonggi-do. Leading plants are listed in Table IX-21, and their location is shown in Figure IX-53.

The areas of machinery production follow fairly closely the pattern of general industrial concentration in Korea (Figure IX-53). Kyonggi-do, in Central Korea, produced about 45% of the value of machinery and tool manufactures in 1937. Other important areas were Kyongsang-namdo, in Southern Korea (14%), and P'yongan-namdo (10%), in Northern Korea. There is now perhaps an even greater concentration in Kyonggi-do, because of the industrial development of the Inch'on (Jinsen), Kyongsong (Keijō, Seoul), and Pup'yong (Fūhei) areas. Pusan (Fusan), Kyongsang-namdo, is also an important center.

Table IX - 21

KOREA, PLANTS MANUFACTURING MACHINERY

Location of Plant	Company	Known products	Remarks
Northern Korea			
Hamgyong-namdo			
[Hungnam (Kōnan)] [Pon'gung (Hongū)]	Chōsen Chisso Hiryo K. K.		At the Hungnam and Pon'gung plants there are machine plants with almost 6,000 square yards of floor space, employing 3,000 workers. The original precision machine tools were reportedly supplied by Japanese companies in Japan; the main purpose of these plants is presumably to repair machines used in other enterprises of this company.
Ch'onnae-ri (Sennai-ri)	Hokusen Seikosho K. K.	Mining machinery, steel, and cast iron	
Hwanghae-do			
Haeju (Kaishū)	Seisen Jukogyo	Mining machinery, cement-manufacturing machines, precision machines	Established in 1939, with 1,300,000 *yen* capital.
P'yongan-namdo			
Chinnamp'o (Chinnampo)	Chōsen Shoko K. K.		Plant greatly expanded in 1938 and 1939.
P'yongyang (Heijō)	Taiden Steel	Steel drilling equipment for mining industry	Established jointly by Taiden Steel and Japan Gold Production Development Company.
	Chōsen Kikai Seisakusho	Hoists, pumps, crushing machines, grinding mills, melting furnaces, vacuum filters, compression filters, floating ore-selecting machines (ore-sorters), machine tools	6,000,000 *yen* capital; site 170,000 square yards; plant facilities include machine-tool plant, forging factory, storage building, gear-cutting plant. Probably one of the most important plants.
	Chōsen Chuo Denki	Electric motors and machinery	Plant constructed in 1940.
P'yongan-pukto			
Sinuiju (Shingishū)	Toyo Tokushu Imono K. K.	Chilled bores	This company has 3 plants in Japan proper.
Central Korea			
Kyonggi-do			
Inch'on (Jinsen)	Chōsen Kogyo Kaisha	Steel cable for communications	Capitalized at 1,000,000 *yen;* plant under construction in 1940, completion not confirmed.
	Chōsen Kako K. K.	Electric welding machines and rods	Capital 500,000 *yen*. New plant constructed in 1940.
	Chōsen Seikosho K. K.	Mining machinery, cast iron and steel	Capital 500,000 *yen*.
	Shoko Tekkosho K. K.	Mining machinery	Capital 1,000,000 *yen*.
	Tōkyō Shibaura Denki	Electric motors, dynamos, transformers, and other electric machinery	Expanded in 1941.
	Hitachi Seisakusho	Aircraft motors and bearings	Output reported "doubled" in 1941.
	Chōsen Shoko K. K.	Industrial machinery	Established in 1919. Capital 2,000,000 *yen*. Two plants in P'yongyang.

TABLE IX - 21 *Continued*

LOCATION OF PLANT	COMPANY	KNOWN PRODUCTS	REMARKS
Kyongsong (Keijō, Seoul)	Koshu Commerce and Industry Company	Machinery	
	Nippon Seiko K. K.	Rock drills, other machines and appliances	Affiliated with Chōsen Kayaku Juho K. K.
	Hironaka Shoko K. K.	Machine tools, mining machines, cast iron and steel, rolling stock	This is a branch factory, 2 plants indicated in Kyongsong. Hitachi Seisakusho reported to have bought them in 1942.
	Chōsen Sakuganki Seisakusho K. K.	Rock drills, air-pressure machines	5,000,000 *yen* capital in 1940.
	Chōsen Keiki K. K.	Mining machinery, measuring instruments	600,000 *yen* capital and 100 workers in 1940.
	Kanto Kikai Seisakusho	Mining machinery	
Pup'yong (Fuhei)	Koyo Seiko K. K.	Bearings, machinery	Koyo Seiko absorbed Toyo Koki in 1941. 30,000,000 *yen* capital in 1943. Gets bearing steel from Nippon Koshuha K. K. Koyo Seiko is one of the most important producers of bearings in Japan.
	Hironaka Shoko K. K.	Machine tools, mining machinery, rolling stock	Factory site 270,000 square yards. Supplies machinery to Chōsen Chisso Hiryo and Oryoko hydroelectric companies. In 1940 Company increased capital from 3,000,000 to 6,000,000 *yen* to expand the Korean plants. Reportedly bought by Hitachi Seisakusho in 1942. This is the main plant of Hironaka.
Sosa (Sosha)	Japan Enterprise Co.	Rock-drilling machines	
Southern Korea			
Cholla-pukto			
Kunsan (Gunzan)	Chōsen Kinzoku Kogyo	Mining machinery	
	Gunzan Zosen Tekko K. K.	"Shipbuilding machines", steam boilers, motors	Established in 1939, with 500,000 *yen* capital.
Kyongsang-namdo			
Pusan (Fusan)	Tanaka Zosen K. K.	Internal-combustion engines	
	Chōsen Jukogyo K .K.		Capital 3,000,000 *yen* in 1940, reportedly increased to 15,000,000 in 1943. Promoters are Mitsubishi Jukogyo, Chōsen Yusen Kaisha, and Tōkyō Takushoku.
	Chōsen Denko K. K.	Mining equipment, wrought-iron and steel castings	
	Nippon Diesel Kogyo K. K.	Diesel engines	Reported complete in 1941.

At least in earlier years the machinery industry operated on a smaller scale in Korea than in Japan. The trend, however, was towards larger units, as is shown by an increase in the average number of workers per factory from 23 in 1937 to 40 in 1939. Meanwhile the proportion of output value coming from household units fell from 20% to 8 percent.

D. Ordnance.

The munitions industry in Korea apparently is small. The army arsenal at P'yongyang (Heijō), P'yongan-namdo, a branch of the Inch'on (Jinsen) Arsenal, has been greatly expanded in recent years, and is probably the most important ordnance plant in the country. It produces small arms and ammunition, and also serves as a central depot for loading shells.

The output of military explosives is unknown, but production is probably being carried on at many locations which have not been reported. Inasmuch as explosives plants can be constructed within a year, many new plants may have been built since the beginning of the war. It is also likely that plants formerly manufacturing nitrogeneous fertilizer and industrial explosives now manufacture military explosives. The most important explosives plants are in Hungnam (Kōnan), Hamgyong-namdo; Haeju (Kaishū), Hwanghae-do, and Inch'on (Jinsen), Kyonggi-do.

TABLE IX-22 and FIGURE IX-54 indicate, in addition to the known arsenals and plants producing explosives, a number of other munitions plants, the precise nature of whose products is not known,

TABLE IX - 22

KOREA, MUNITIONS AND EXPLOSIVES PLANTS

LOCATION	COMPANY	REMARKS
	I *Arsenals*	
P'yongan-namdo		
Chinnamp'o (Chinnampo	Army	Produces small arms and light artillery.
P'yongyang (Heijō)	Army	Branch of Inch'on Arsenal.
Kyonggi-do		
Inch'on (Jinsen)	Army	Produces small arms and is a repair receiving-center for light ordnance.
Kyongsong (Keijō, Seoul)	Army	Branch of Inch'on Arsenal.
Pup'yong (Fūhei)	Army	May be called Keijo Rikugun Kojo.
Kyongsang-namdo		
Chinhae (Chinkai)	Navy	
	II *Explosives plants**	
Hamgyong-pukto		
Yongan (Eian)	Chōsen Sekitan Kogyo K. K.	Hexogen.
Hamgyong-namdo		
Hungnam (Kōnan) (FIGURE IX-32)	Nissan Powder Company	Unidentified explosives.
	Chōsen Chisso Kayaku K. K. (Nippon Chisso Hiryo K. K.)	Ammonium nitrate, industrial explosives, black powder, detonators or blasting caps, fuses (largest production of industrial explosives, probably now important for military explosives), ammonium nitrate 1,000 (1936); black powder 1,000 (1936); industrial explosives 21,000 (1939).

TABLE IX - 22 *Continued*

II Explosives plants (Continued)*

LOCATION	COMPANY	REMARKS
Hwanghae-do		
Haeju (Kaishū)	Chōsen Kayaku Seizo K. K.	Plant about 7 miles SW of Haeju. Gunpowder, industrial explosives, black-powder detonators or blasting caps, fuses (reported recently expanded); industrial explosives 9,000 (1939).
Sariwon (Shariin)	Chōsen Chisso Kayaku K. K. (Nippon Chisso Hiryo K. K.)	Industrial explosives, detonators or blasting caps, fuses (perchlorate-type explosives).
P'yongan-namdo		
P'yongyang (Heijō)	Chōsen Kayaku Juho K. K.	Gunpowder and percussion caps.
Kyonggi-do		
Inch'on (Jinsen)	Chōsen Yushi K. K.	Plant about 10 miles SE of Inch'on. Industrial explosives, detonators or blasting caps (reported expanded 1939 to 1942).
Kyongsong (Keijō, Seoul)	Chōsen Kayaku Juho K. K.	Propellants, industrial explosives, black powder, unidentified explosives.
	Showa Kayaku K. K.	Unidentified explosives.
Kyongsang-namdo		
Pusan (Fusan)	Fusan Powder Company	Gunpowder, black powder.
	III Other "munitions" plants	
P'yongan-namdo		
Kyomip'o (Kenjiho)	Nippon Seitetsu K. K.	Armor plate and ordnance.
P'yongyang (Heijō)	Kanegafuchi Boseki K. K.	Former rayon factory now said to produce "munitions".
P'yongan-pukto		
Sonch'on (Sensen)	Name unknown	Light ordnance and shells.
Kyonggi-do		
Inch'on (Jinsen)	Chōsen Kosaku K. K.	Machines and appliances for military use.
	Chōsen Aluminum K. K.	Aluminum articles for military use.
Kyongsong (Keijō, Seoul)	Nippon Seiko Kogyo K. K.	Military machinery and instruments.
Cholla-pukto		
Chonju (Zenshu)	Kanegafuchi Boseki K. K.	Textile factory converted to "munitions".

* Figures refer to production of designated explosives (metric tons) for the latest year available.

FIGURE IX - 32. *Hamgyong-namdo, Hungnam (Kōnan).* The Chōsen Chisso Kayaku gunpowder works, one of the most important explosives factories in Korea. 1937.

E. Shipbuilding and repair.

Korea's shipbuilding and repair facilities are of minor significance in Japanese total capacity in this field. Nevertheless, they have assumed some importance because of the magnitude of Japanese shipping losses. About a dozen yards are known, most of which are capable of producing or making repairs only on small and medium-sized vessels.

(1) Steel shipbuilding.

The Chōsen Jukogyo Kaisha has 2 of the largest installations, one at Pusan (Fusan), Kyongsang-namdo, and the other at Inch'on (Jinsen), Kyonggi-do. The Pusan yard, located in an industrial center only 120 miles from Japan proper, has relatively easy access to materials and equipment. It builds ships up to 5,000 gross registered tons and is reported to have launched one of 7,000 gross registered tons, although its construction required 2 years. Three smaller shipyards have been in production since the late 1930's: the Seisen Jukogyo Kaisha at Haeju (Kaishū), Hwanghae-do; the Gunzan Zosen Tokko K. K. at Kunsan (Gunzan), Cholla-pukto; and the Tanaka Zosen Kaisha at Pusan (Fusan), Kyongsang-pukto. Four new yards were reportedly either under construction or planned in 1940. These were the Chōsen Kinzoku Kogyo Kaisha at Kunsan (Gunzan), the Chōsen

TABLE IX - 23

KOREA, PRINCIPAL SHIPYARDS

LOCATION	COMPANY	REMARKS
P'yongan-pukto		
Dasado (Tashitō)	Chōsen Riken Kogyo Kaisha	Producing 25-h.p. motorboats since 1939.
Hwanghae-do		
Haeju (Kaishū)	Seisen Jukogyo Kaisha	Producing small ships and mining machinery since 1937.
Kyonggi-do		
Inch'on (Jinsen)	Chōsen Zosen Zotetsu Kaisha	Under construction 1939 and 1940. Produces small ships.
	Chōsen Kyodo Kaiun Kaisha	Under construction 1940. Produces small motorboats.
	Chōsen Jukogyo Kaisha	Graving dock under construction 1938; able to take ships of up to 8,000 tons.
Cholla-pukto		
Kunsan (Gunzan)	Chōsen Kinzoku Kogyo Kaisha	Established 1940. Produces small ships and mining machinery.
	Gunsan Zosen Tekko K. K.	Capital 500,000 *yen* in 1940. Produces small ships, machines, steam boilers.
Kyongsang-namdo		
Pusan (Fusan)	Chōsen Jukogyo Kaisha	Established 1937. Capital in 1940: 3,000,000 *yen*. Builds ships up to 3,000 GRT, repairs ships of up to 8,000 GRT. 3 building ways (330'). 2 drydocks (No. 1: 510' x 74'; No. 2: 385' x 58').
	Fusan Deizēru Enjin Kaisha	Projected construction was announced in 1940. To repair ships and diesel engines.
	Tanaka Zosen Kaisha	Established in 1931. Capital 100,000 *yen*. Shipbuilding and building of engines. One 253' drydock handling vessels of up to 1,500 GRT. Another drydock reported under construction.
Chinhae (Chinkai)	Naval Base	One floating dock 250' long with lifting power of 800 GRT. One obsolete floating dock with capacity of 1,800 GRT.

Kyodo Kaiun Kaisha at Inch'on (Jinsen), the Fusan Deizêru Enjin Kaisha at Pusan (Fusan), and the Chōsen Zosen Zotetsu Kaisha at Inch'on (Jinsen). Only the last has actually been reported as building vesels recently. All these shipyards are located in industrialized areas. One of Japan's major naval bases is Chinhae (Chinkai), in Kyongsang-pukto. This yard has building facilities for smaller vessels, and can handle repairs to destroyers and torpedo boats, but is limited to minor repairs on larger vessels.

Shipbuilding and repair facilities are listed in TABLE IX-23. The yards are concentrated in Southern Korea and along its west coast, as indicated in FIGURE IX-54.

(2) Marine engines and equipment.

The Fusan Deizêru Enjin Kaisha at Pusan (Fusan), Kyongsang-namdo, is the main producer of marine engines. This company, founded in 1940, builds ships, engines, steam-boilers, and other marine equipment. Recent information indicates that there is considerable activity at the yard. Other companies listed as producing marine engines are the Gunzan Zosen Tekko K. K. and the Tanaka Zosen Kaisha, both of which have been mentioned as recently entering the shipbuilding fields.

(3) Wooden shipbuilding.

Korean lumber has not been considered suitable for the building of wooden vessels. However, it was reported in April 1944 that the Korean Forestry Bureau was contributing 1,600,000 cubic feet of lumber. This apparently is taken by Korean shipyards, so some construction may be taking place.

F. Railroad equipment.

Although contributing substantially to production of rolling stock for the Japanese war economy, Korea's facilities have not been significantly enlarged during the war. The condition of equipment was reported in 1941 to be rather poor and in need of replacement and modernization, and a general shortage of rolling stock was said to prevail. The principal government plants were in Pusan (Fusan) and Kyongsong (Keijō, Seoul). (Repair shops are discussed in Chapter VII, 71.) There are no reports of construction of new government or private plants since 1940, although the Inch'on (Jinsen) plant of the Ryusan Kosaku K. K. may have been expanded.

Korea's capacity to produce standard-gauge equipment has been estimated at 25 locomotives and 2,000 freight cars annually.

Production is concentrated in Central Korea, principally at Inch'on (Jinsen) and Kyongsong (Keijō, Seoul) (FIGURE IX-53). The principal producers of rolling stock are listed in TABLE IX-24.

TABLE IX - 24

KOREA, PRODUCERS OF ROLLING STOCK, 1944

LOCATION	COMPANY	REMARKS
Hamgyong-pukto		
Ch'ongjin (Seishin)	Chōsen Government Railway Shop	Rolling stock.
P'yongan-namdo		
P'yongyang (Heijō)	Chōsen Government Railway Shop	Freight cars.
Kyonggi-do		
Inch'on (Jinsen)	Ryusan Kosaku K. K.	Rolling stock.
	Nippon Sharyo	Rolling stock (production started in 1937).
Yongdungp'o (Eitōhō)	Ryusan Kosaku K. K.	Rolling stock, steel girders for bridges.
Kyongsong (Keijō, Seoul)	Chōsen Government Railway Shop	Freight and passenger cars, and locomotives.
	Hironaki Shoko	Rolling stock.
	Keijo Denki Kosakusho	Rolling stock (employed more than 100 workers in 1939).
Pup'yong (Fuhei)	Hironaki Shoko	Freight cars (2 per day September 1940).
Kyongsang-namdo		
Pusan (Fusan)	Chōsen Government Railway Shop	Freight cars, passenger ferries. Latest reports mention also locomotives.

NOTE: It is believed that Government shops produce only standard-gauge rolling stock, and that privately owned shops produce narrow-gauge and standard-gauge rolling stock.

G. Motor vehicles.

As in Japan, the production of motor vehicles is on a very small scale. The industry was never very important and the higher priority-rating of other war materials has further reduced its significance. The production of replacement parts is now reported to be the principal activity of the industry.

The 6 plants believed to be the most significant are listed in TABLE IX-25; their location is shown in FIGURE IX-54.

TABLE IX - 25

KOREA, MOTOR-VEHICLE PLANTS

LOCATION	PLANT	PRODUCTS AND REMARKS
P'yongan-pukto		
Sinuiju (Shingishū)	Toa Jiyo K. K.	Automobiles, trucks, aircraft fuselages.
Kyonggi-do		
Pup'yong (Fūhei)	Diesel Jidosha Kogyo K. K.	Automobile assembly, manufacture of parts. Expansion plan was accomplished with help of the army. Planned to invest 5,000,000 to 10,000,000 *yen*. Plant constructed in 1939 and 1940.
Kyongsong (Keijō, Seoul)	Kokusan Jidosha K. K.	Automobiles.
	Kusunomoto Jidosha Kojo	Automobile bodies.
Inch'on (Jinsen)	Nippon Sharyo K. K.	Vehicles; reported also to manufacture railroad equipment.
Cholla-pukto		
Kunsan (Gunzan)	Nippon Diesel Kogyo K. K.	Diesel automobiles. Main plant is in Japan.

H. Aircraft.

Korea is believed to play a relatively small role in the Japanese production of combat aircraft. Several plants have been reported to manufacture aircraft and aircraft parts, but their activities cannot be confirmed. Available sources do not permit any evaluation of production of trainer and other non-combat types.

It is almost certain that Korea does, however, engage in aircraft repair, overhaul, and modification, and recent information suggests that the Army Air Arsenal Branch Depot at P'yongyang (Heijō), P'yongan-namdo, is one of the two or three largest installations for this type of work on the Asiatic mainland.

There is also reported to be a Mitsubishi aircraft plant at P'yongyang (Heijō), and it is possible that the Army Branch

Depot may have taken over this plant. The Showa Aircraft Company formerly had a plant in the same city, but in 1942 it was reported to have been purchased by the Mitsui Kozan K. K., with the intention of developing large-scale manufacturing.

Thus, although there is no definite knowledge of aircraft production in Korea, it should be emphasized that nearly every repair and modification center (and undoubtedly there are others in addition to the depot at P'yongyang) is potentially a production center. It is quite possible that as a result of the recent bombing of aircraft plants in Japan, production may be or has already been dispersed to some of these installations. TABLE IX-26 lists plants in Korea reported to produce or repair aircraft or aircraft parts. They are shown in FIGURE IX-54.

TABLE IX - 26
KOREA, REPORTED AIRCRAFT PLANTS

LOCATION	PLANT
Hamgyong-pukto	
Ch'ongjin (Seishin)	Name unknown
P'yongan-pukto	
Sinuiju (Shingishū)	Toa Joyo K. K.
P'yongan-namdo	
P'yongyang (Heijō)	Army Air Branch Arsenal
	Mitsubishi Hikoki Seisakusho K. K.
	Showa Hikoki Kogyo K. K. (Mitsui Kozan K. K.)
Kyonggi-do	
Inch'on (Jinsen)	Hitachi Seisakusho K. K.
Pup'yong (Fuhei)	Name unknown
Yongdungp'o (Eitōhō)	Chōsen Hikoki Kogyo K. K.
Kyongsang-namdo	
Pusan (Fusan) at Mok-to (Makino-tō) (island)	Chōsen Kogyo K. K.

I. Rubber products.

The major portion of the rubber-processing industry is located in Japan proper, and that in Korea is apparently very small. The Sanwa Gomu K. K. plant in Pusan (Fusan), Kyongsang-namdo, is known to produce rubber tires, and several other plants produce various rubber goods. It is reported that the Yokohama Gomu Seizo K. K. planned to establish a large rubber factory in Southern Korea.

J. Textiles.

Korea's principal contribution to Japanese textile supplies is as a producer of raw materials, primarily cotton, of which Japan has an acute shortage (Topic 94, D). The prewar textile industry of Korea, which consumed roughly 1⅓ times as much raw (ginned) cotton as was produced domestically, may have been partially converted to munitions production. Synthetic fiber probably forms a larger proportion of textile consumption than before the war.

(1) Spinning and weaving.

(a) Cotton and synthetic fiber. The textile industry as a whole, with about 13% of the gross value of all manufacturing production, ranked third among the 10 principal industrial groups in 1939. Household industry supplied over ⅕ of the total. Over 60% of the total value was contributed by cotton textiles, production of which was expanded sharply between 1934 and 1938. In 1938, 3 large mills were located at Yongdungp'o (Eitōhō), Kyonggi-do; and one each at Pusan (Fusan), Kyongsang-namdo (FIGURE IX-33); Kwangju (Koshū), Cholla-namdo; and Inch'on (Jinsen), Kyonggi-do. By 1938 Korea had developed a net export-surplus of cotton yarn and piece goods.

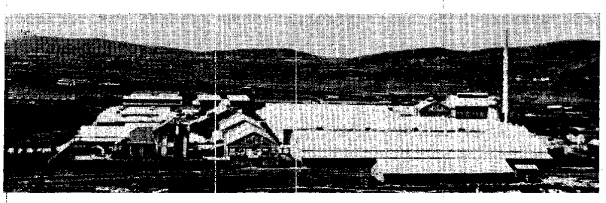

FIGURE IX - 33. *Kyongsang-namdo, Pusan (Fusan).* Textile mills of the Chōsen Boseki Kaisha (Korea Spinning Company).

Currently, the lack of raw cotton imports and the possible diversion of Korean cotton to mills in Japan proper is compensated for only in part by the use of staple fiber in spinning and weaving cotton-type goods.

(b) Silk. Silk reeling accounted for 1/7 of the total value of textile production in 1938. There were 20 large-scale filatures employing over 200 workers each. The raw-silk output of about 2,000 metric tons was largely exported to Japan. There was relatively little weaving of silk or rayon fabrics in Korea, but large and growing quantities of rayon goods were imported from Japan until 1938.

(2) Synthetic fiber.

In 1938 there were rayon and staple fiber plants at P'yongyang (Heijō), P'yongan-namdo; and Ch'ongjin (Seishin), Hamgyong-pukto; another was under construction at Hungnam (Kōnan), Hamgyong-namdo; and a fourth had been planned at Kunsan (Gunzan), Cholla-pukto. The total actual and planned capacity was about 35,000 metric tons a year, roughly 5% as great as the total capacity attained in Japan proper before the war. Current production is probably of staple fiber rather than rayon, and is limited by the quantity of rayon pulp available for non-munitions use. Output is roughly estimated at 20,000 tons, or approximately half the tonnage of the raw (ginned) cotton produced in Korea.

K. Pulp and paper.

(1) Rayon pulp.

Production of high-grade pulp for the manufacture of rayon and staple fiber was carried on in prewar years at Kilchu (Kisshū), Hamgyong-pukto, by the Hokusen Seishi Kagaku Kogyo K. K. The capacity of this plant in 1938 was 30,000 metric tons. The total Korean output, possibly including some from other plants, was 26,700 metric tons in 1939. Before the war efforts were made both in Korea and Japan to develop the use of materials other than wood for making rayon pulp. The Kanegafuchi Jitsugyo K. K. was reported to have a plant at Sinuiju (Shingishū), P'yongan-pukto, with an annual capacity of 7,000 metric tons, using river reeds as raw material, and the Kainei Godo Mokuzai K. K. was said to produce rayon pulp on a small scale from sawmill waste.

A major part of the rayon pulp was exported to Japan before the war. Korean production, is probably now being

used within the country, either as raw material for explosives or as synthetic fiber.

(2) Paper pulp and paper.

The only major paper mill, making its own pulp, was the Oji Seishi K. K. plant at Sinuiju (Shingishū), P'yongan-pukto (FIGURE IX-34). The 1936 pulp output of this factory was 17,550 tons. Statistics of total Korean paper-pulp production and of production and exports of foreign-style paper suggest that this plant converted all its pulp output into wrapping paper and exported about ⅔ of the final product. The Korean annual consumption of foreign-style paper of all types, estimated at roughly 30,000 metric tons, was supplied chiefly by Japan.

Many small plants manufactured Korean-style paper for domestic use. Japanese-style paper was imported, and was also produced by at least 2 companies within Korea.

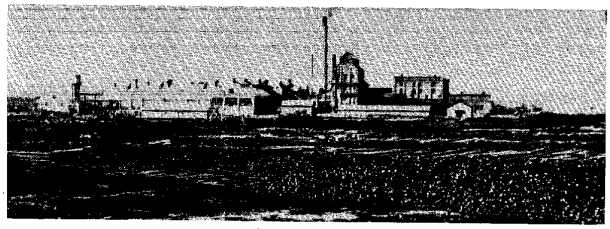

FIGURE IX - 34. *P'yongan-pukto, Sinuiju (Shingishū).* The mill of the Oji Seishi K. K. (Oji Paper Manufacturing Company). One of the chief manufacturers of paper in Korea.

96. *Electric Power*

The development of electric power in Korea since 1935 has afforded an important base for the industrialization of the country. In 1943 Korea accounted for about 10% of the estimated installed generating capacity and power production of Japan, Korea, and Manchuria.

TABLE IX - 27

KOREA, MAJOR ELECTRIC POWER GENERATING PLANTS, 1944
(Capacity at least 10,000 kilowatts)

LOCATION	NAME OF PLANT		CAPACITY (KILOWATTS)
Hamgyong-pukto			
Pur'yong-gun, Pur'yong-myon	Fuhei No. 1 Hydroelectric Plant		13,100*
Ch'ongjin (Seishin)	Seishin Factory Steam Plant		16,000
Hamgyong-namdo			
Hamju-kun, Hagich'on-myon, Chinhung-ni	Choshinko No. 1 Hydroelectric Plant	Changjin-gang or Chōshin-kō Development	144,000
Tonghung-ni	Choshinko No. 2 Hydroelectric Pant		120,000
Hadae-ri	Choshinko No. 3 Hydroelectric Plant		46,500*
Sondang-ni	Choshinko No. 4 Hydroelectric Plant		36,350*
Hungnam (Kōnan)	Konan Steam Plant		13,000
Sinhung-gun, Yonggo-myon, Songhung-ni	Fusenko No. 1 Hydroelectric Plant	Pujon-gang or Fusen-kō Development	129,600
Songha-ri	Fusenko No. 2 Hydroelectric Plant		41,400
Tonghung-ni	Fusenko No. 3 Hydroelectric Plant		18,000
Sinhung-myon, Singhung-ni	Fusenko No. 4 Hydroelectric Plant		12,375
P'ungsan-gun, Ch'ollam-myon, Kanggun-ni	Kyosenko No. 1 Hydroelectric Plant	Hoch'on-gang or Kyosen-kō Development	144,000*
Tanch'on-gun, Suha-myon, Kosong-ni	Kyosenko No. 2 Hydroelectric Plant		72,000*
Sangnong-ni	Kyosenko No. 3 Hydroelectric Plant		66,600*
Hada-myon, Koum-ni	Kyosenko No. 4 Hydroelectric Plant		72,000*
Kangwon-do			
Hwach'on-gun, Hwach'on-myon, near Hwach'on (Kasen)	Kanko Kasen Hydroelectric Plant		108,000*
Yongwol-gun, Pung-myon, Mach'a-ri (Masa-ri)	Neietsu Steam Plant		100,000
Samch'ok-kun, Samch'ok (Sanchoku)	Sanchoku Steam Plant		50,000
P'yongan-namdo			
P'yongyang-bu, Songyo-ri	Heijo Steam Plant		18,000
Sunch'on-gun, Sunch'on (Junsen)	Junsen Factory Steam Plant		10,000*
Kangdong-gun, Mandal-myon, Sungho-ri	Shokori Factory Steam Plant		10,200
P'yongan-pukto			
Kanggye-gun, Kanggye (Kōkai)	Kokai No. 1 Hydroelectric Plant	Kanggye or Kōkai Development	135,000*
	Kokai No. 2 Hydroelectric Plant		54,000*
	(Kokai No. 3 Hydroelectric Plant)		(32,400**)
	(Kokai No. 4 Hydroelectric Plant)		(75,000**)
Sakchu-gun, Kugok-myon, Sup'ung-dong (Suihō-dō)	Suiho Hydroelectric Plant		450,000***
Kyonggi-do			
Kap'yong-gun, Oeso-myon, Ch'ongp'yong-ni	Kanko Seihei Hydroelectric Plant		59,400*
Kyongsong-bu, Won-jong	Keijo Ryuzan Steam Plant		11,000
Tangin-jong	Keijo Tojinri Steam Plant		22,500
Kyongsang-namdo			
Pusan-bu, T'osong-jong	Fusan Steam Plant		12,600*

* Estimated capacity.
** Planned capacity; not believed to be completed, and excluded from totals.
*** Plans for 630,000 kilowatts not believed to have been carried out; 180,000 kilowatts capacity believed available for generation of 60-cycle current for use in Korea.

Northern Korea has a much greater power capacity than the southern part of the country, as a result of the development of its abundant water resources for its power-consuming industries.

Three-fourths of Korea's hydroelectric power capacity and over 60% of all hydroelectric and steam capacity is controlled by the Chōsen Chisso Hiryo K. K. and other subsidiaries of the Nippon Chisso chemical interests. These companies also operate a large part of the public utility transmission facilities.

A. Capacity and production.

The electric power generating capacity available to Korea in 1944 is believed to have totaled about 1,800,000 kilowatts, over 3 times as much as in 1936. Of this, 1,480,000 kilowatts were hydroelectric and the remainder thermal. Virtually all of this capacity was accounted for by 49 plants with capacities of at least 1,000 kilowatts (FIGURE IX-55). Twenty-eight of these plants, listed in TABLE IX-27, had capacities of more than 10,000 kilowatts each, and afforded 95% of the total capacity. Output by all plants is estimated at about 7,000,000,000 kilowatt-hours in 1943, compared with less than 2,500,000,000 kilowatt-hours in 1936. The potential maximum output is even greater.

By far the largest is the Sui-hō hydroelectric plant, with a large dam on the Amnok-kang (Yalu River) about 40 miles northwest of Sinuiju (Shingishū), P'yongan-pukto. This development, serving both Manchuria and Korea, is believed to have been completed in 1944 with a capacity of 450,000 kilowatts, 180,000 kilowatts of which was probably available for generation of 60-cycle current for use in Korea. Original plans called for a capacity of 630,000 kilowatts.

There are 3 groups of 4 hydroelectric plants each in the mountains of Northern Korea, and another group in which only 2 plants are believed to have been built, although others have been planned (FIGURES IX-35 to IX-40). Within each group the plants are connected by aqueducts in series, a single dam serving each group. Water storage is believed to be adequate to maintain full production capacity during the relatively brief dry season. Capacities of the groups are estimated to be as follows:

Changjin-gang (Chōshin-kō)	347,000 kilowatts
Pujon-gang (Fusen-kō)	202,000 kilowatts
Hoch'on-gang (Kyosen-kō)	355,000 kilowatts
Kanggye (Kōkai)	189,000 kilowatts

There is a 50,000-kilowatt steam plant on the east coast at Samch'ok (Sanchoku), in Kangwon-do, and there are other thermal plants at Aoji-dong (Agochi-dō), Chongjin (Seishin), Nanam (Ranan), Myongch'on (Meisen), Sinuiju (Shingishū), Wonsan (Genzan), Sunch'on (Junsen), and P'yongyang (Heijō).

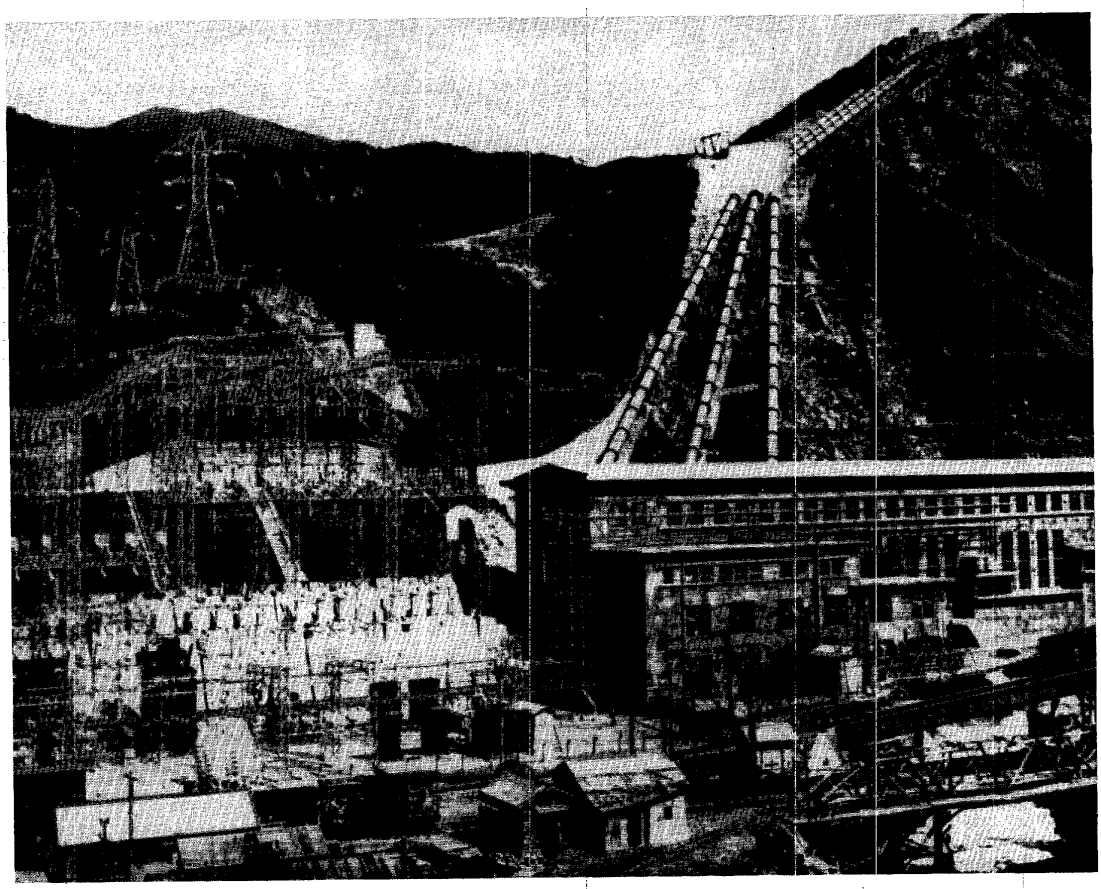

FIGURE IX - 35. *Hamgyong-namdo, near Chinhung-ni*
The Choshinko No. 1 Hydroelectric Plant. Three of the 5 completed penstocks in right background. Part of the Changjin-gang, or Chōshin-kō hydroelectric development.

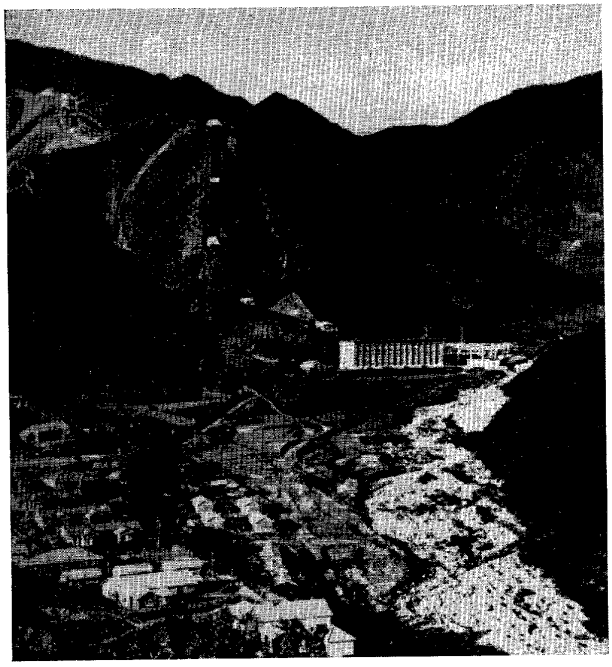

FIGURE IX - 36. *Hamgyong-namdo, near Songhung-ni.*
The Fusenko No. 1 Hydroelectric Plant. Penstocks and outdoor transformer station in right background. Part of the Pujon-gang or Fusen-kō hydroelectric development.

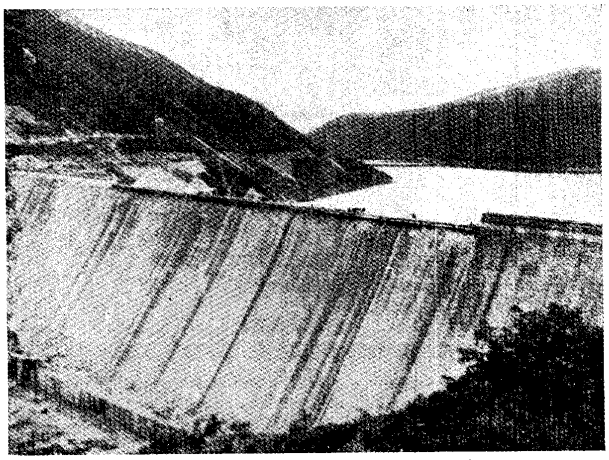

FIGURE IX - 37. *Hamgyong-namdo, near Songhung-ni.*
Dam of the Fusenko No. 1 Hydroelectric Plant. 1938.

Most of the other major plants of Northern Korea are older steam plants, located in industrial areas. It is possible that their use has been largely discontinued.

In Central Korea there are 2 hydroelectric plants with capacities of 108,000 kilowatts and 59,000 kilowatts, respectively, about 60 miles northwest of Kyongsong (Keijō, Seoul).* There are steam plants at Kyongsong (Keijō, Seoul), Haeju (Kaishū), Kaesong (Kaijō), and Kyomip'o (Kenjiho).

* There is some uncertainty as to the completion of construction and installation at the second of these plants.

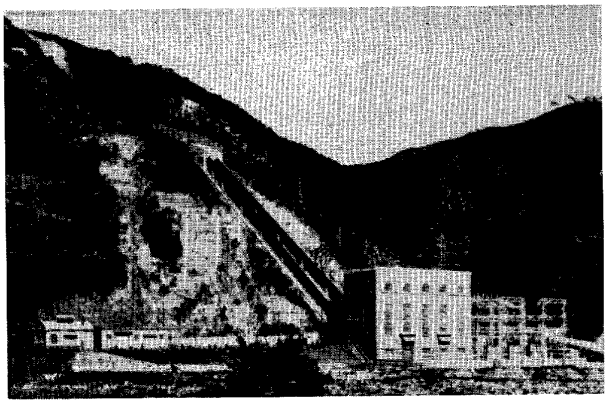

FIGURE IX - 38. *Hamgyong-namdo, near Songha-ri.*
The Fusenko No. 2 Hydroelectric Plant.

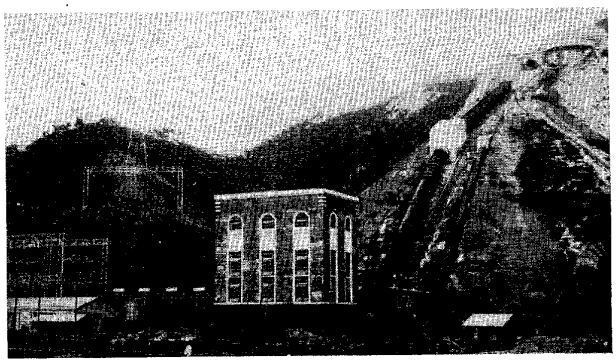

FIGURE IX - 39. *Hamgyong-namdo, near Tonghung-ni.*
The Fusenko No. 3 hydroelectric plant. Before 1935.

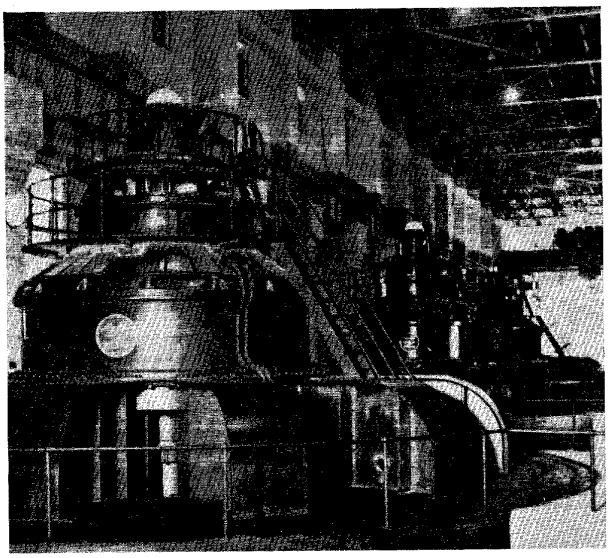

FIGURE IX - 40. *P'yongan-pukto, near Sup'ung-dong (Suihō-dō).*
Interior of the Suiho Hydroelectric Plant, on the Amnok-kang (Yalu River), at the Manchurian border. Equipment consists of Shibaura turbo-generators. This plant, the largest in the Far East, supplies power to both Korea and Manchuria. 1943.

The interior of Southern Korea, a relatively unindustrialized area with little power-generating capacity of its own, is believed to receive a large part of its current from a 100,000-kilowatt steam plant at Yongwol (Neietsu) in Kangwon-do. There are smaller steam plants at various coastal and inland points, including Kunsan (Gunzan), Mokp'o (Moppo), Naju (Rashū), and Taejon (Taiden), but the most important is the 13,000-kilowatt plant at Pusan (Fusan).

B. Transmission and distribution.

All current publicly sold and almost all current privately generated is 3-phase, 60-cycle, alternating current. It is transmitted at voltages of from 33 to 220 kilovolts, distributed at 2.3 to 22 kilovolts, and generally used at 200 volts in factories and at 100 volts in residences and commercial establishments. For electrolytic processes and variable-speed industrial motors, the energy is converted to direct current by rotary converters or mercury-arc rectifiers in the factories.

Transmission and distribution lines are generally overhead, the former of steel-tower and the latter of wooden-pole construction. Lines are made of both aluminum and copper.

Little detailed information is available on transmission or distribution lines. It is known, however, that transmission facilities in Northern Korea form an integrated grid system. High-voltage transmission lines (reportedly 220 kilovolts and 154 kilovolts) connect the Sup'ung-dong (Suihō-dō) and Changjin-gang (Chōshin-kō) developments with the P'yongyang (Heijō) and Kyongsong (Keijō, Seoul) industrial areas. A 220-kilovolt line and other lines parallel the northeast coast from Hungnam (Kōnan) to the northeast and are connected with the Changjin-gang (Chōshin-kō), Pujon-gang (Fusen-kō), and Hoch'on-gang (Kyosen-kō) developments.

Yongwol (Neietsu) is believed to be connected by 154-kilovolt lines to Sangju (Shōshū) in Southern Korea, and Sangju (Shōshū) with Taejon (Taiden) and Taegu (Taikyū).

97. *Commerce*

Japanese domination has determined the structure of the Korean economy and of its foreign trade. Korea's agricultural and mineral resources, and its geographical proximity to Japan, were important factors in the Japanese determination to control the country. One phase of this control has been the erection and maintenance of a tariff wall which guards Japanese industry in Korea against intrusion of non-Japanese goods, while goods from Japan enter duty-free.

In 1939, 73% of Korea's exports (by value) went to Japan proper and 89% of her imports came from Japan, as indicated in TABLE IX-28. In prewar years imports usually totalled more than ⅓ and exports about ¼ of the total gross value of Korean production; the present proportion of imports is probably smaller. As a result of strict Japanese controls, Korea's trade with areas outside the *yen*-block in 1938 was less than 1% of exports and 5% of imports (mainly machinery and materials for expanding Korea's heavy industry).

TABLE IX - 28

KOREAN TRADE, 1939
(values in thousands of *yen*)

EXPORTS	TOTAL TRADE	TRADE WITH JAPAN AS % OF THE TOTAL FOR EACH COMMODITY GROUP
Foodstuffs, beverages, and tobacco	302,559	74.6
Minerals, ores, and metals*	222,697	94.6
Textile raw materials	60,478	98.2
Textiles (including clothing)	84,102	38.3
Fertilizers	53,783	99.0
Fish meal	14,013	78.7
Oils, fats, and waxes	53,647	82.5
Chemicals, dyes, and drugs	33,489	50.4
Machinery	25,735	24.3
Paper, pulp, and products	22,290	72.2
Furs, skins, and leather	8,047	88.6
Postal parcels	14,717	75.9
Metal manufactures	20,932	30.2
Lumber	11,741	18.9
Animals	16,820	50.7
Other commodities	61,744	41.9
Total exports	1,006,794	73.2
IMPORTS		
Textiles	184,164	99.8
Clothing	80,562	100.0
Textile raw materials	53,408	54.1
Machinery	137,897	95.5
Metal manufactures	102,698	99.7
Vehicles	51,519	97.5
Instruments	17,030	99.8
Minerals, ores and metals**	208,388	91.7
Foodstuffs, beverages, and tobacco	185,783	71.8
Chemicals, drugs, and dyes	63,510	91.2
Paper and pulp	47,100	98.9
Fertilizers	26,448	72.9
Oils, fats, and waxes	44,927	50.9
Lumber	40,968	95.7
Postal parcels	19,523	97.5
Pottery and glass	24,988	96.1
Hides, skins, and leather	6,197	98.9
Animals	5,881	82.5
Other commodities	87,457	80.9
Total imports	1,388,448	88.6

* Includes cement pottery, glass, and glass manufactures.
** Includes cement.

A. Exports.

Korea has long served as a source of foodstuffs for Japan. Rice exports in recent years have averaged about 2,000,000,000 pounds annually, about a quarter of which is used by Japanese soldiers in Manchuria. Probably three-quarters of the rice exported is obtained from Southern Korea (FIGURE IX-41). Other foodstuffs shipped in quantity include soybeans, fish, and fish products, mostly from Northern Korea.

With the expansion of strategic mining and manufacturing industries in Korea, the export of war materials has been substantially increased in recent years. During 1944 about 1,400,000 tons of iron concentrates (65% iron content) are believed to have been shipped to Japan from the Musan (Mozan) mines in Hamgyong-pukto, northeastern Korea. Although it has insufficient good coking coal, Korea probably exported 1,100,000 metric tons of anthracite and steam coal to Japan in 1944.

FIGURE IX - 41. *Cholla-pukto, Kunsan (Gunzan).* The harbor and the rice wharves. About 1930.

Other strategic metals and minerals shipped to Japan, although small in tonnage, represent significant portions of the total supply available to Japan (Topic 94, B). Over 500,000 tons of pig iron and steel ingots may have been exported to Japan during 1944.

Next to Japan, Manchuria is by far the largest consumer of Korean exports. In 1939 exports to Manchuria and the Kwantung Leased Territory amounted to about 250,000,000 *yen*, out of a total of 270,000,000 *yen* exported to countries other than Japan. The principal commodities in this trade in terms of value were machinery, marine products, textiles, and rice. From a tonnage standpoint, cement ranked highest with 144,000 tons.

The principal exports to China were rice, flour, apples, and marine products.

B. Imports.

Such consumer goods as textiles, clothing, foodstuffs, beverages, and tobacco, and raw materials for consumer goods, accounted for nearly half the total imports in 1939. Metal manufactures and vehicles represented about ¼ of the total value, and coal, other minerals, and metals comprised an additional one-sixth. The largest tonnages were in coal, cement, and coke. As the war economy developed, imports of consumer goods probably decreased, while shipments of machinery and strategic materials increased. Despite attempts to increase the degree of Korean self-sufficiency in manufactured goods, it is believed that substantial tonnages of steel products are imported from Japan. Shipments of Japanese coal and coke, on the other hand, have probably decreased sharply as requirements in the home islands have increased; as a result, Korea is believed to be relatively more dependent now upon coal from North China and Manchuria.

As with exports, Manchuria is by far the largest source of imports after Japan, although receipts from areas outside the *yen*-bloc have been fairly substantial. In 1939 about 390,000 tons of coal were obtained from Manchuria. Millet, imported as a substitute for rice shipped to Japan, was also a sizable item; Manchuria supplied over 100,000 tons in 1939.

Coal, principally of coking grade, was also the largest tonnage item received from China—285,000 tons in 1939, about ½ of the total value of imports from China; this has probably increased to 500,000 tons. Cotton and salt were next in importance.

Most of Korea's petroleum requirements until recently have been met by shipments from the Netherlands East Indies. As Japan's shipping position continues to deteriorate and as Allied operations impede the movement of vessels along the route, this source of crude oil will be cut off.

C. Transit trade.

As a result of the serious shipping situation, it is believed that Korea is becoming increasingly important as a transit zone for goods moved between North China and Manchuria, and Japan. Military shipments from Japan to the mainland through Korea are believed to be smaller than the southbound traffic through Korea, in which iron ore, coking coal, and agricultural products bulk very large. Most of this traffic moved through ports in northeastern Korea before the war, but the proportion handled through Pusan (Fusan) in Southern Korea, has probably risen sharply, because movement over the entire length of the peninsula saves the maximum amount of shipping.

D. Internal trade.

Railroads handle much greater tonnages of commodities in internal trade than does coastwise shipping, which is of small importance in Korea, but most of this traffic moves relatively short distances. The lines serving the western half of the peninsula originate a little more than half the total tonnage, with particularly heavy concentration around P'yongyang (Heijō) in Northern Korea, and Kyongsong (Keijō, Seoul) in Central Korea. Coal mining in the P'yongyang area and miscellaneous agricultural and industrial traffic in the Kyongsong area account for much of this concentration.

Mine products constitute the largest major category of railroad traffic. Most of this traffic is hauled relatively short distances from the mines to industrial consuming centers, although substantial tonnages of anthracite coal are exported to Japan from the P'yongyang area, and large quantities of iron ore and possibly bituminous coal are shipped from northeastern Korea.

Northern Korea, plus the Kyongsong (Keijō, Seoul) area of Central Korea, originates about 90% of the railroad traffic in industrial products. The lines in the P'yongyang (Heijō) and Wonsan (Genzan) areas together account for about 60% of the traffic. Heavy tonnages of steel, cement, and miscellaneous metals and metal products represent a major portion of the total.

Roughly ¾ of the agricultural traffic on railroads originates in the west. In the south much of this is taken to the ports for shipment to Japan, but in Central Korea and the eastern part of Northern Korea, distribution to consuming centers is relatively more important. In 1938 less than ¼ of the total agricultural output moved by rail, the balance being consumed on the farms or moved by cart to nearby consuming centers.

Although most of the fish catch is obtained on the east coast very little moves by rail to interior points. On the other hand, fish and fish products move from west-coast ports to the big consuming centers nearby. From a rail-traffic standpoint, the Kyongsong (Keijō, Seoul) area is by far the most important. The lines in the Wonsan (Genzan) district of northeastern Korea also handle sizable tonnages of fish prod-

ucts, although these products represent only a minor fraction of the fish catch.

Lumber and forest products originate principally in the P'yongyang (Heijō) and Songjin (Jōshin) areas of Northern Korea.

E. Ports.

The industrial development of Korea and her geographical position between Japan and Manchuria have accelerated the development of her ports in recent years. Aerial photographs suggest, however, that progress by 1944 had not been as great as expected in some instances. (Chapter VI and Chapter XIII).

The principal port of Korea is Pusan (Fusan), Kyongsangnamdo located on the southeastern tip of Korea and only about 120 miles from Japan. In 1939 the value of trade through Pusan (Fusan) totaled 732,000,000 *yen*, twice as much as that of Inch'on (Jinsen), Kyonggi-do, Korea's second port (FIGURES IX-42 and IX-43). Other ports of major consequence in the prewar years were Ch'ongjin (Seishin), Sinuiju (Shingishū), and Songjin (Jōshin), all in Northern Korea, and—in addition to Inch'on—Chinnamp'o (FIGURE IX-44) and Kyongsong (Keijō, Seoul), both in Central Korea.

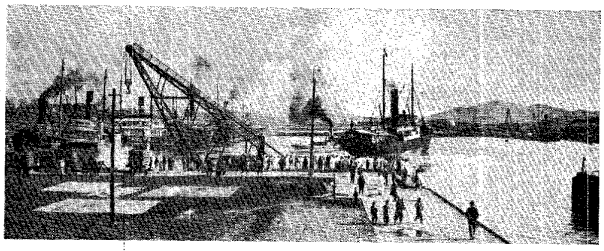

FIGURE IX - 42. *Kyonggi-do, Inch'on (Jinsen).*
The harbor of Korea's second commercial port. Unloading facilities, the lock-gate dock, and several small vessels.

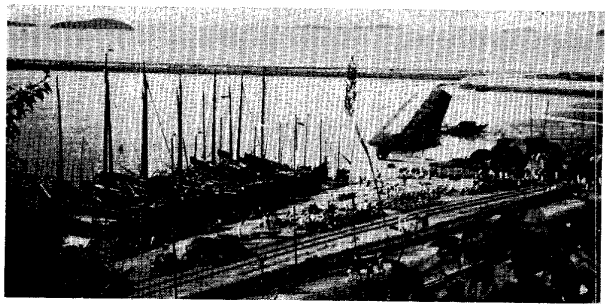

FIGURE IX - 43. *Kyonggi-do, Inch'on (Jinsen).*
Looking SW. Inch'on-hang harbor from the British Consulate.

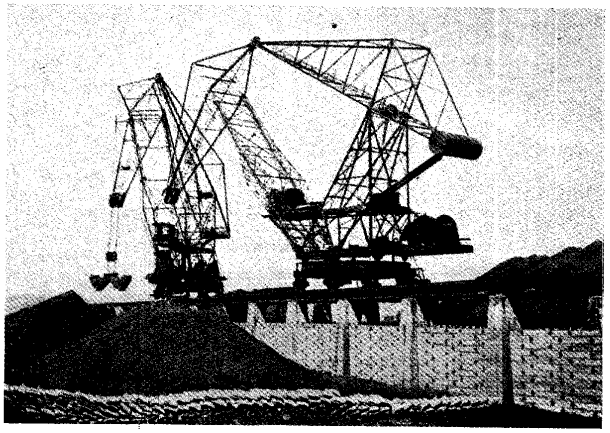

FIGURE IX - 44. *P'yongan-namdo, Chinnamp'o (Chinnampo).*
Cranes for loading and unloading coal from train or ship. 1940.

Three ports in northeastern Korea, Najin (Rashin), Ch'ongjin (Seishin), and Unggi (Yūki), provide the shortest route from the heart of Japan to the interior of Manchuria; their role is believed to have increased greatly in recent years. In 1943 Najin (Rashin) is believed to have had facilities for handling over 3,000,000 tons of shipping annually. The development of the chemicals and light-metals industries has increased the volume of shipments through Hungnam (Kōnan), also in Northern Korea.

The new ice-free port of Dasado (Tashitō) at the mouth of the Amnok-kang (Yalu River), on the northwestern border of Korea, serves the growing industrial area of An-tung and the Tung-pien-tao ore fields in Manchuria, and the Korean centers of Sinuiju (Shingishū) and Yongamp'o (Ryūgampo).

Yosu (Reisu), on the south coast, has been developed as an alternate port to Pusan (Fusan); ferry service is available between Yosu and Hakata, Kyūshū. Also on the south coast is the port of Masan (Masan).

98. *Finance*

A. Currency.

The monetary unit of Korea, as of Japan, is the *yen* (symbol ¥), which is divided into 100 *sen* or 1,000 *rin*. The currency in circulation consists mainly of paper notes issued by the Bank of Chōsen in denominations of 1, 5, 10, 20, and 100 *yen*. Paper notes in denominations of 10, 20 and 50 *sen* are now reportedly also issued. Notes of the Bank of Japan *(Nippon Ginko)* and to a limited extent, Japanese State fractional currency (coins and notes), are legal tender in Korea. Notes of the Bank of Taiwan *(Taiwan Ginko)*, although legal tender only in Formosa, circulate freely in Korea. Conversely, notes of the Bank of Chōsen have been circulated throughout the Japanese Empire.

Subsidiary coins of 1, 5, 10, and 50 *sen* are also in use in Korea. TABLE IX-29 indicates the nature and circulation status of these coins in 1942.

TABLE IX - 29

KOREA, DENOMINATIONS OF SUBSIDIARY COINAGE

Coin (*sen*)	Metal	Approximate corresponding size of U.S. coins	1942 circulation status
50	silver	quarter	Almost all withdrawn
10	aluminum	nickel	Replacing nickel coins
10	nickel	nickel (hole in center)	Almost all withdrawn
5	aluminum	dime	Replacing nickel-copper coin
5	nickel-copper	dime, but thicker (hole in center)	Almost all withdrawn
1	aluminum	smaller than dime	Replacing copper coins
1	copper	quarter	Almost all withdrawn

More recently tin has reportedly been substituted for aluminum in the smaller coins, but it is now announced that currency of 5 and 10 *sen* will displace even tin. The old bronze Korean

yupchun, similar to the Chinese "cash," may occasionally be found in country districts. The value of the *yupchun* was fixed at 2 *rin* per piece.

At the end of 1941, immediately after the outbreak of war with the United States, the circulation of Bank of Chōsen notes amounted to over 740,000,000 *yen;* by the end of December 1943 the volume had increased to nearly 1,500,000,000 *yen,* or about twice that in circulation at the end of 1941. It is reported that at the end of 1944 the issue totaled 3,500,000,000 *yen.* In June 1941 the amount of subsidiary currency in circulation was 24,700,000 *yen* as compared with 10,500,000 *yen* at the end of 1937. Use of checks is not common in Korea, and most financial transactions are performed with cash.

B. Foreign-exchange value of the *yen.*

The theoretical gold content of the *yen* is 0.75 gram of pure gold (1 *yen* = U.S. $0.844). However, the foreign-exchange value of the *yen* is strictly controlled. In 1932 and 1933 foreign-exchange control was introduced into Korea in order to limit the withdrawal of capital. The law in 1937 was changed to require government permission not only for capital remittances but also for remittances in payment for imported commodities. Effective 1 August 1941, virtually all forms of transactions with out-of-the-country interests involving more than a very limited amount of exchange were, as in Japan, subject to foreign-exchange control. But for the exchange controls in Korea and Japan, the exchange value of the *yen* would have gone much lower than the officially pegged rate of 23-7/16 cents. Within Korea the purchasing power of the *yen* for domestic products and labor was generally greater before the war than would be indicated by the foreign-exchange value of the *yen* and the costs of similar commodities in the United States.

C. Banking system.

The ownership of banking institutions is chiefly in Japanese hands, and the policies of the Japanese Ministry of Finance govern the entire financial system.

Little information is available concerning the number or status of banks now in operation in Korea. Reports indicate extensive merger or amalgamation of the individual banking institutions in Japan proper; this practice may possibly have been extended to those in Korea.

In 1940 the banking system of Korea consisted of the following categories of institutions: (1) special banks (the Bank of Chōsen, the Industrial Bank, and the national policy companies); (2) ordinary banks; (3) savings institutions; (4) credit cooperatives, and (5) other institutions. In addition, 3 Japanese banks—the First Bank *(Daiichi Ginko),* the Yasuda Bank, and the Sanwa Bank—had branches in Korea. In 1943 the First Bank merged with the Mitsui Bank to form the Imperial Bank *(Teikoku Ginko).*

Statistics issued by the Bank of Chōsen show that at the end of 1943 bank deposits in Korea totalled 2,600,000,000 *yen,* compared with 1,400,000,000 *yen* at the end of 1941.

(1) Special banks.

(a) Bank of Chōsen. The Bank of Korea, later called the Bank of Chōsen *(Chōsen Ginko),* was established in 1909 as the central bank of Korea. In addition to issuing legal-tender currency and performing ordinary banking functions, it has been a financial instrument for Japanese imperialistic ambitions. In the latter capacity, its operations have been primarily concerned with financing the import and export trade of Japanese firms in northeastern Asia. In 1943 it was reported that the Bank of Chōsen would act with the Yokohama Specie Bank *(Yokohama Shokin Ginko)* and the Bank of Formosa *(Taiwan Ginko)* in the financing of a new bank, the Greater East Asia Bank, whose main task would be the financing of foreign trade.

In mid-1941 the paid-up capital of the Bank of Chōsen totalled 35,000,000 *yen.* This capital was jointly owned by such parties as the Japanese Government, the Imperial Household, the Government-General of Chōsen, financial institutions in Korea (the Chōsen Trust Company, the Chōsen Commercial Bank, and the First Bank), and Japanese nationals.

(b) Chōsen Industrial Bank (Chōsen Shokusan Ginko). The Chōsen Industrial Bank was organized in 1918 by amalgamation of the Agricultural and Industrial Banks. Its activities included the granting of long-term loans on the security of real estate, loans on the security of fishing rights, and unsecured loans to groups of farmers or manufacturers, credit associations, fishery associations, and other groups. Its total resources at the end of 1940 were 1,100,000,000 *yen.* Branches were maintained throughout Korea, with the head office at Kyongsong (Keijō, Seoul).

(c) National policy companies. National policy companies have engaged in colonization and development within the Japanese Empire.

1. Oriental Development Corporation. The Oriental Development Corporation *(Toyo Takushoku Kabushiki Kaisha)* was established in 1908 to provide financial and technical assistance for the development of agriculture and to exploit other natural resources in Korea. After 1917 it extended its activities to Manchuria, Mongolia, North China, the Philippines, the Malay Peninsula, and the South Sea Islands. It supplied funds, materials, and other necessities for colonization, and managed land on trust. In 1940 ⅔ of its loans and advances of over 200,000,000 *yen* were in Korea and more than ¼ were in Manchuria.

2. Chōsen-Manchoukuo Colonization Company *(Sen-Man Takushoku Kabushiki Kaisha).* This company was established in 1936 for the joint development of Korea and Manchuria. It sought to promote the emigration of Korean farmers to Manchuria, and it advanced loans to enable them to engage in independent farming.

3. Chōsen Industrial Raw Materials Mutual Trade Corporation. This organization was established in 1943 with a reported capital of 10,000,000 *yen* provided by the government. Its functions were to be the purchase of investments of persons transferring or discontinuing their businesses because of the war, and the control and distribution of materials for important raw-material industries. It was also to encourage the people to join special metal-collection drives.

(2) Ordinary banks.

In 1940 there were 6 ordinary banks incorporated in Korea with 115 branches and agencies. In addition, there were 6 offices maintained in Korea by the big Japanese banks: First Bank, Yasuda Bank, and Sanwa Bank. All of the ordinary banks were Japanese-owned and Japanese-operated, and subject to the supervision of the Governor-General of Korea under

banking laws and regulations specially promulgated for the country by the Japanese.

The most important of the ordinary banks was the Chōsen Commercial Bank, established in 1899 with head offices in Kyongsong (Keijō, Seoul). TABLE IX-30 shows the position of these ordinary banks in mid-1940 in the order of their importance.

TABLE IX - 30

ORDINARY BANKS INCORPORATED IN KOREA, 1940

	Capital and reserves	Deposits	Loans and advances	Securities held
	(millions of yen)			
Chōsen Commercial Bank (Chōsen Shogyo Ginko), Kyongsong (Keijō, Seoul), 44 branches	12.7	130.3	90.7	24.9
Kanjo Bank (Kanjo Ginko) Kyongsong (Keijō, Seoul), 23 branches	2.7	81.8	79.7	13.2
Tohitsu Bank (Tohitsu Ginko) Kyongsong (Keijō, Seoul), 23 branches	3.9	38.4	44.1	4.6
Kōnan Bank (Kōnan Ginko) Kwangju (Kōshū), 8 branches	2.7	11.2	14.6	1.0
Taikyu Commercial and Industrial Bank (Taikyu Shoko Ginko) Taegu (Taikyū), 8 branches	0.4	8.3	9.8	0.3
Keishu United Bank (Keishu Godo (Ginko), Taegu (Taikyū), 9 branches	1.7	8.0	8.6	0.7

(3) Savings institutions.

(a) Postal Savings Bank (Yubin Chokin Ginko). This was the banking institution most used by the Korean people. It covered the entire metropolitan, colonial, and mandated area of the Japanese Empire, receiving deposits and transferring funds through the widespread system of local postoffices. In 1940 there were more than 1,000 local postoffices in Korea offering the services of the Postal Savings Bank to nearly 7,000,000 Koreans.

(b) Chōsen Savings Bank (Chōsen Chochiku Ginko). This bank was established in 1929 to function primarily as a local lending agency, particularly in financing agricultural pursuits.

(c) Chōsen Trust Company (Chōsen Shintaku Kabushiki Kaisha). Organized in 1932, this became after 1934 the only trust company in Korea. The Bank of Chōsen and the Chōsen Industrial Bank each owned 30% of its capital. The Chōsen Trust Company's functions included the provision of long-term funds for agriculture and industry and for development projects.

(4) Credit associations.

A cooperative credit system was organized in Korea in 1907 to extend credit to small farmers and foster their economic development; in 1918 it was reorganized along lines similar to the system then in existence in Japan. The credit associations *(Kinyu Kumiai)* made loans to members, provided warehouses for commodities, and performed agricultural marketing services.

(5) Other financial institutions.

(a) Mutual loan associations. At the end of June 1939 there were 16 mutual loan associations *(Mujin Kaisha)* with a total paid-up capital of 4,600,000 *yen*. These companies provided mutual credit primarily for the middle and lower classes.

(b) Clearing houses. Clearing houses were located in Kyongsong (Keijō, Seoul), Inch'on (Jinsen), Pusan (Fusan), P'yongyang (Heijō), Wonsan (Genzan), Taegu (Taikyū), Mokp'o (Moppo), Gunzan (Kunsan), Chinnamp'o(Chinnampo), and Ch'ongjin (Seishin).

(c) Exchanges. In 1943 the only exchange in Korea was the Korea Exchange at Kyongsong (Keijō, Seoul), which handled transactions in securities. The rice exchanges, which had been organized in Gunzan (Kunsan), Mokp'o (Moppo), Taegu (Taikyū), Pusan (Fusan), and Chinnamp'o (Chinnampo), were dissolved in 1939.

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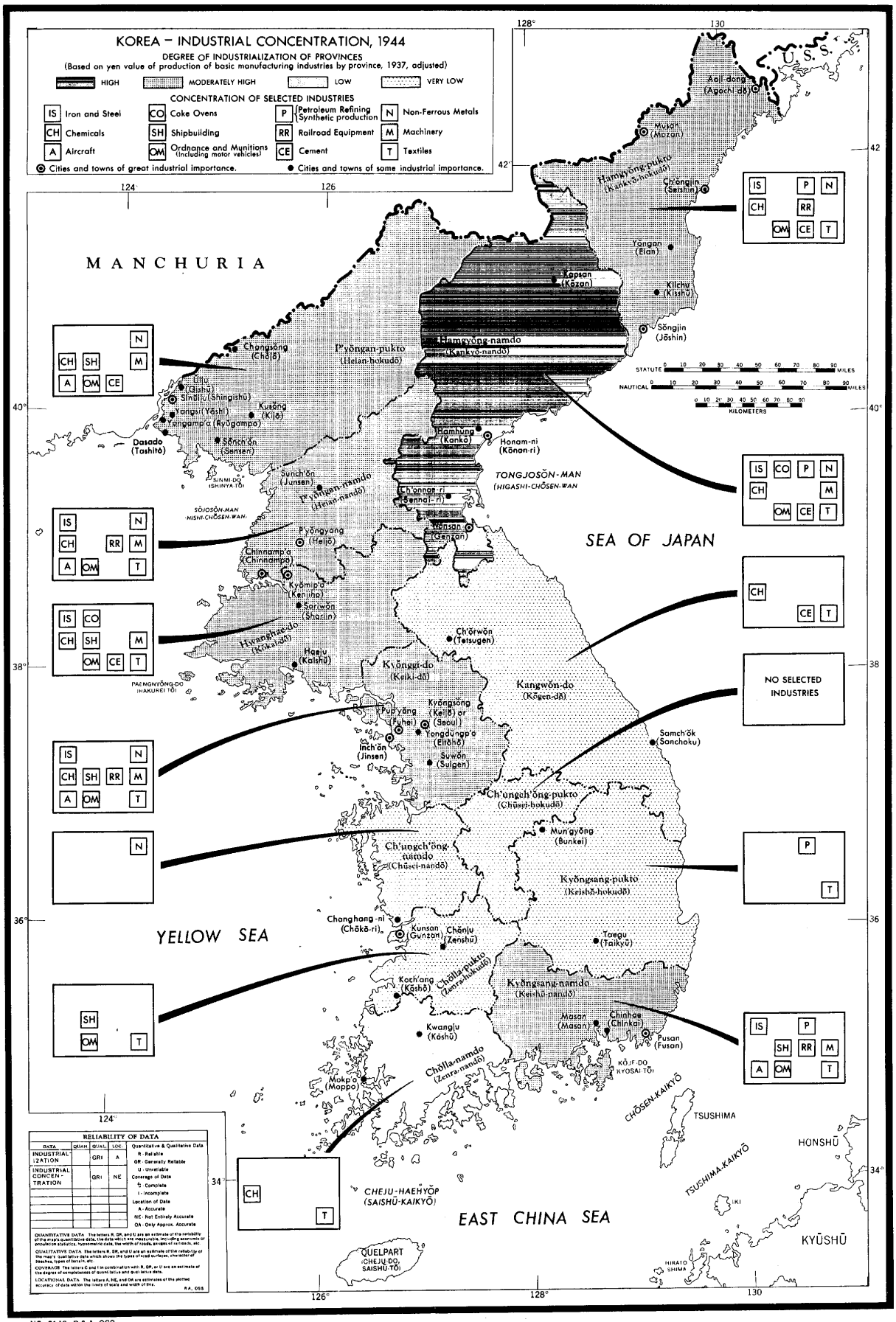
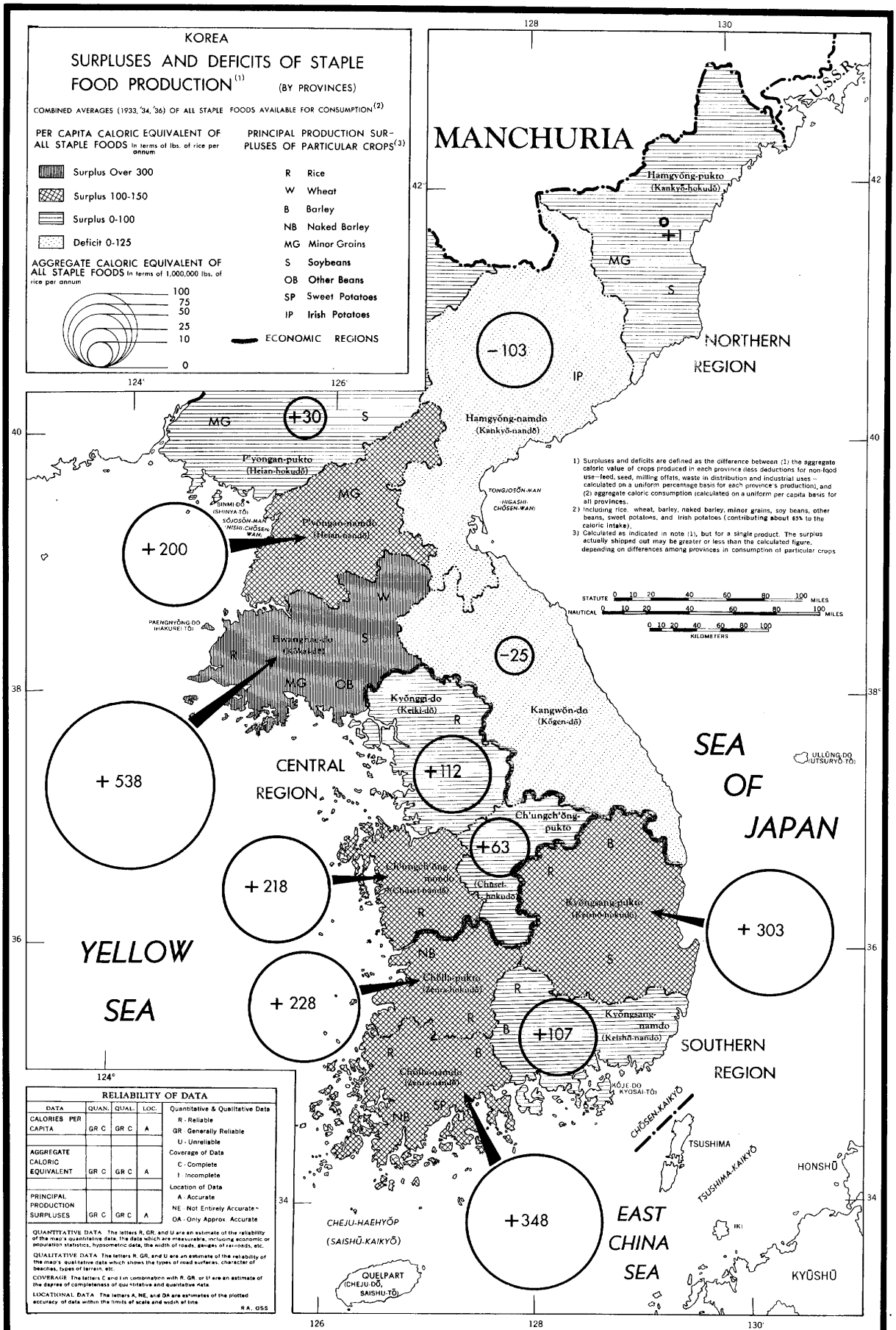
FIGURE IX - 45
JANIS 75
CONFIDENTIAL





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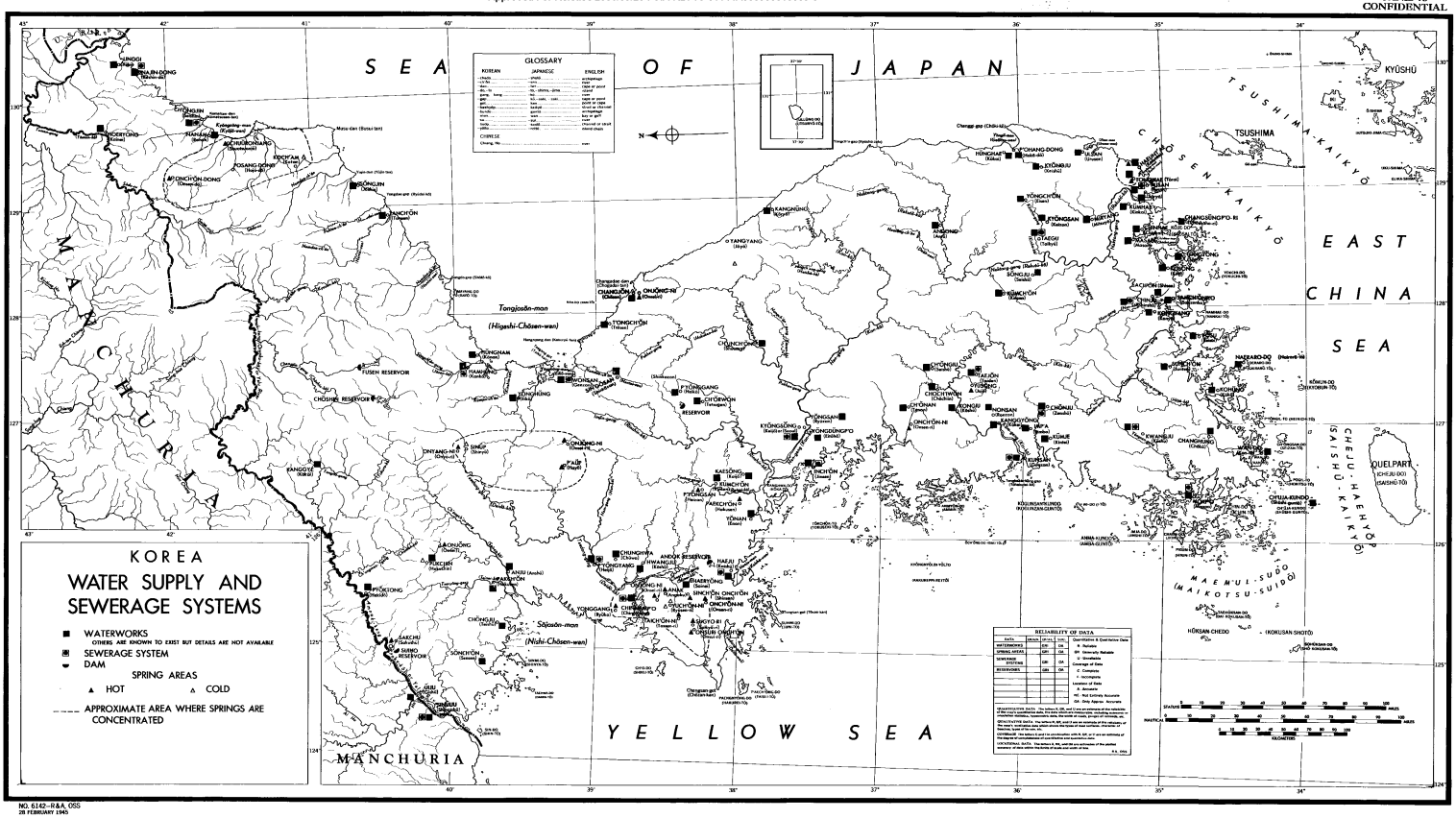

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FIGURE IX - 48
JANIS 75
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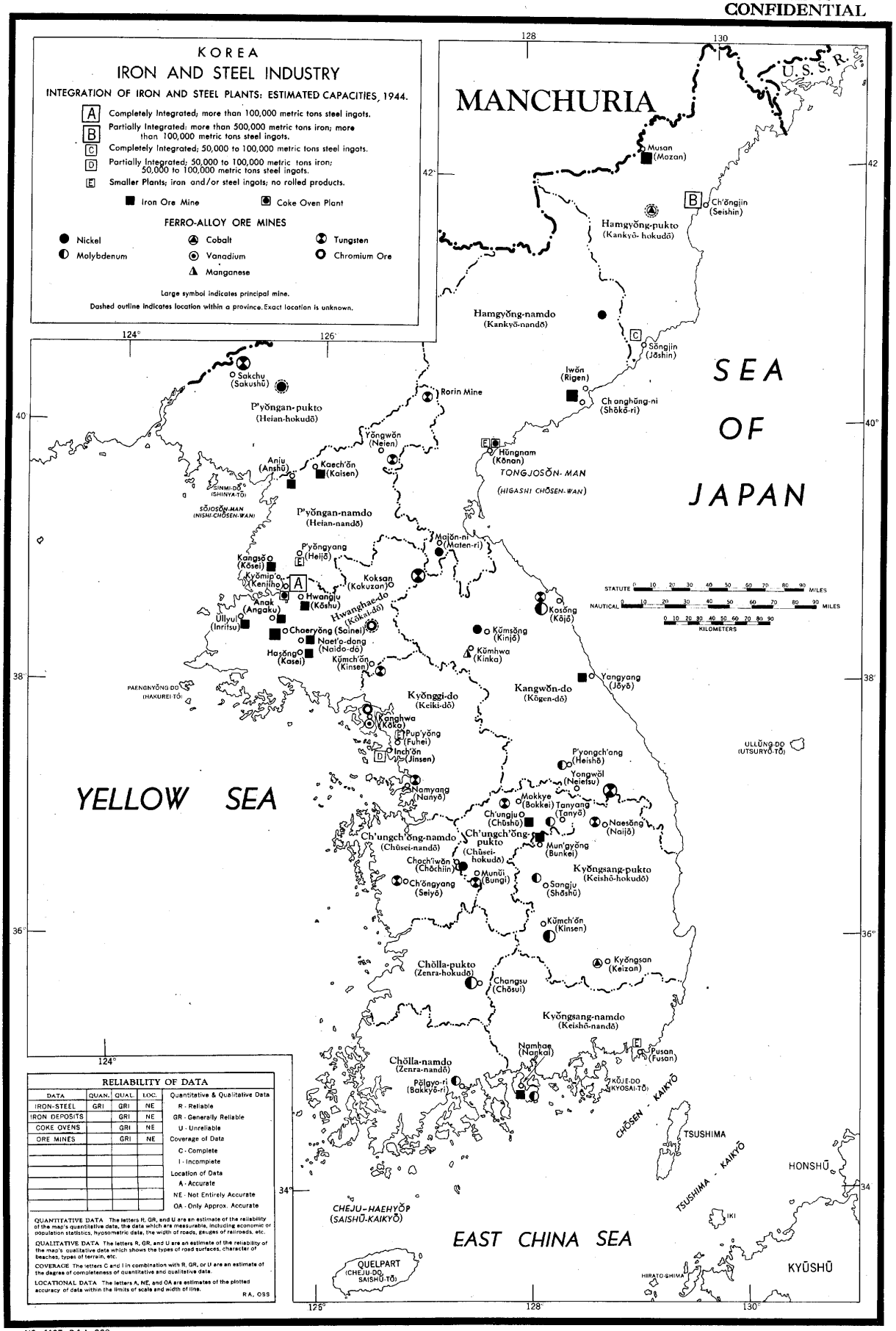
8 FEBRUARY 1945



RELIABILITY OF DATA

DATA	QUAN.	QUAL.	LOC.
IRON-STEEL	GRI	GRI	NE
IRON DEPOSITS		GRI	NE
COKE OVENS		GRI	NE
ORE MINES		GRI	NE

Quantitative & Qualitative Data
R - Reliable
GR - Generally Reliable
U - Unreliable
Coverage of Data
C - Complete
I - Incomplete
Location of Data
A - Accurate
NE - Not Entirely Accurate
OA - Only Approx. Accurate

QUANTITATIVE DATA The letters R, GR, and U are an estimate of the reliability of the map's quantitative data, the data which are measurable, including economic or population statistics, hypsometric data, the width of roads, gauges of railroads, etc.

QUALITATIVE DATA The letters R, GR, and U are an estimate of the reliability of the map's qualitative data which shows the types of road surfaces, character of beaches, types of terrain, etc.

COVERAGE The letters C and I in combination with R, GR, or U are an estimate of the degree of completeness of quantitative and qualitative data.

LOCATIONAL DATA The letters A, NE, and OA are estimates of the plotted accuracy of data within the limits of scale and width of line.

R & A, OSS

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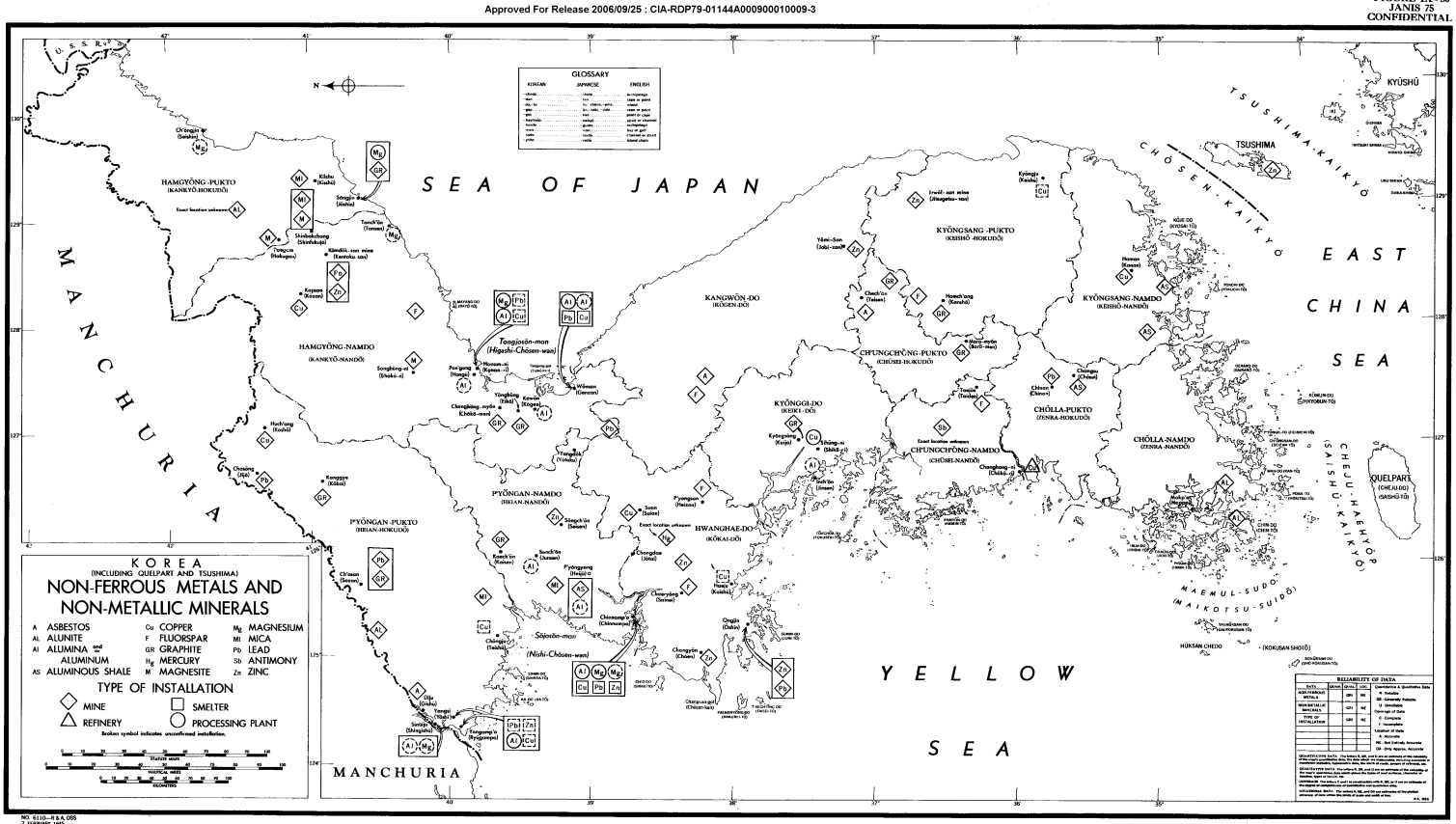
28 FEBRUARY 1945



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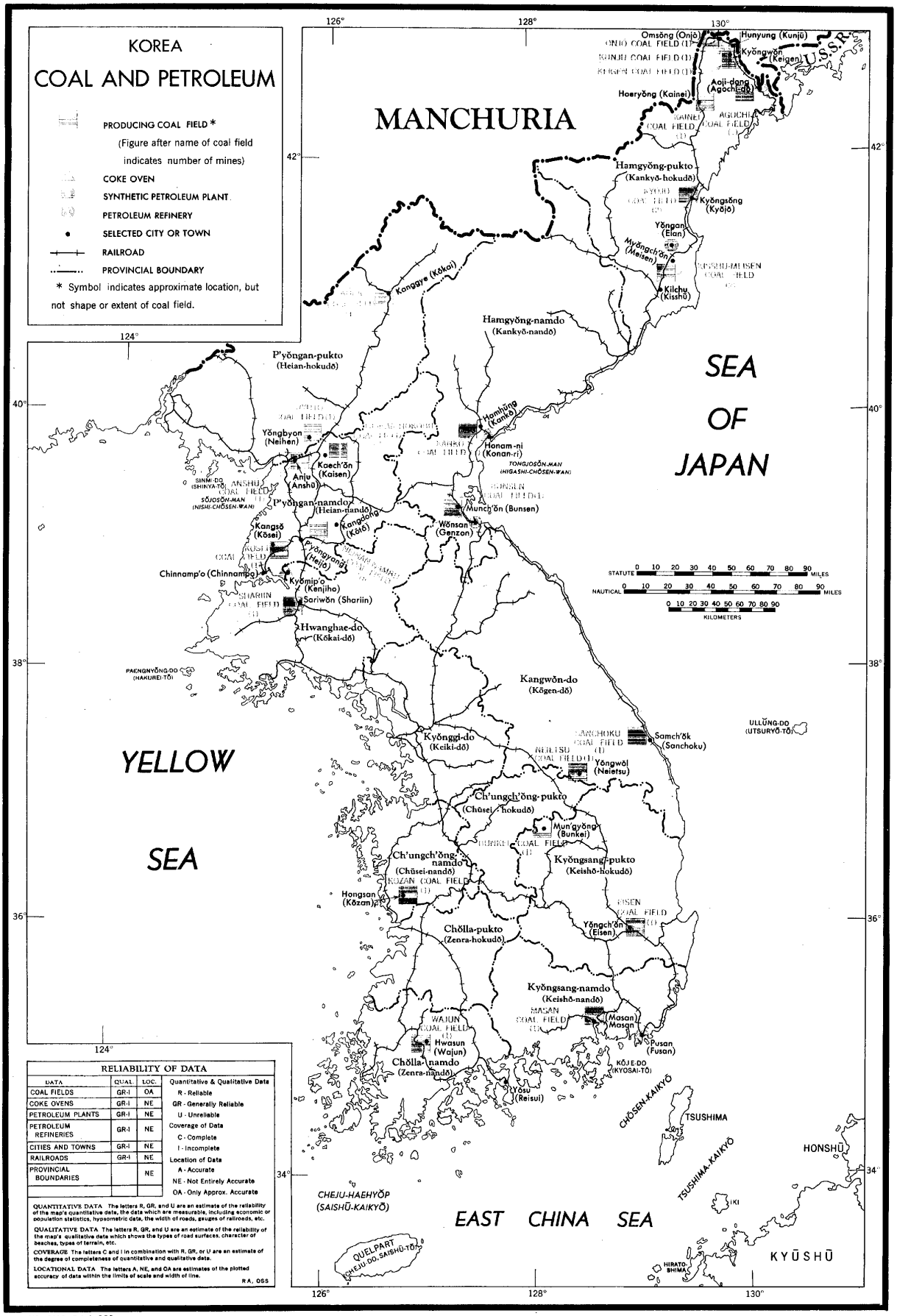
7 FEBRUARY 1945



RELIABILITY OF DATA			
DATA	QUAL.	LOC.	Quantitative & Qualitative Data
COAL FIELDS	GR-I	OA	R - Reliable
COKE OVENS	GR-I	NE	GR - Generally Reliable
PETROLEUM PLANTS	GR-I	NE	U - Unreliable
PETROLEUM REFINERIES	GR-I	NE	Coverage of Data C - Complete I - Incomplete
CITIES AND TOWNS	GR-I	NE	
RAILROADS	GR-I	NE	Location of Data A - Accurate
PROVINCIAL BOUNDARIES		NE	NE - Not Entirely Accurate
			OA - Only Approx. Accurate

QUANTITATIVE DATA The letters R, GR, and U are an estimate of the reliability of the map's quantitative data, the data which are measurable, including economic or population statistics, hypsometric data, the width of roads, gauges of railroads, etc.

QUALITATIVE DATA The letters R, GR, and U are an estimate of the reliability of the map's qualitative data which shows the types of road surfaces, character of beaches, types of terrain, etc.

COVERAGE The letters C and I in combination with R, GR, or U are an estimate of the degree of completeness of quantitative and qualitative data.

LOCATIONAL DATA The letters A, NE, and OA are estimates of the plotted accuracy of data within the limits of scale and width of line.

R A, OSS

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21 FEBRUARY 1945

FIGURE IX - 52
JANIS 75
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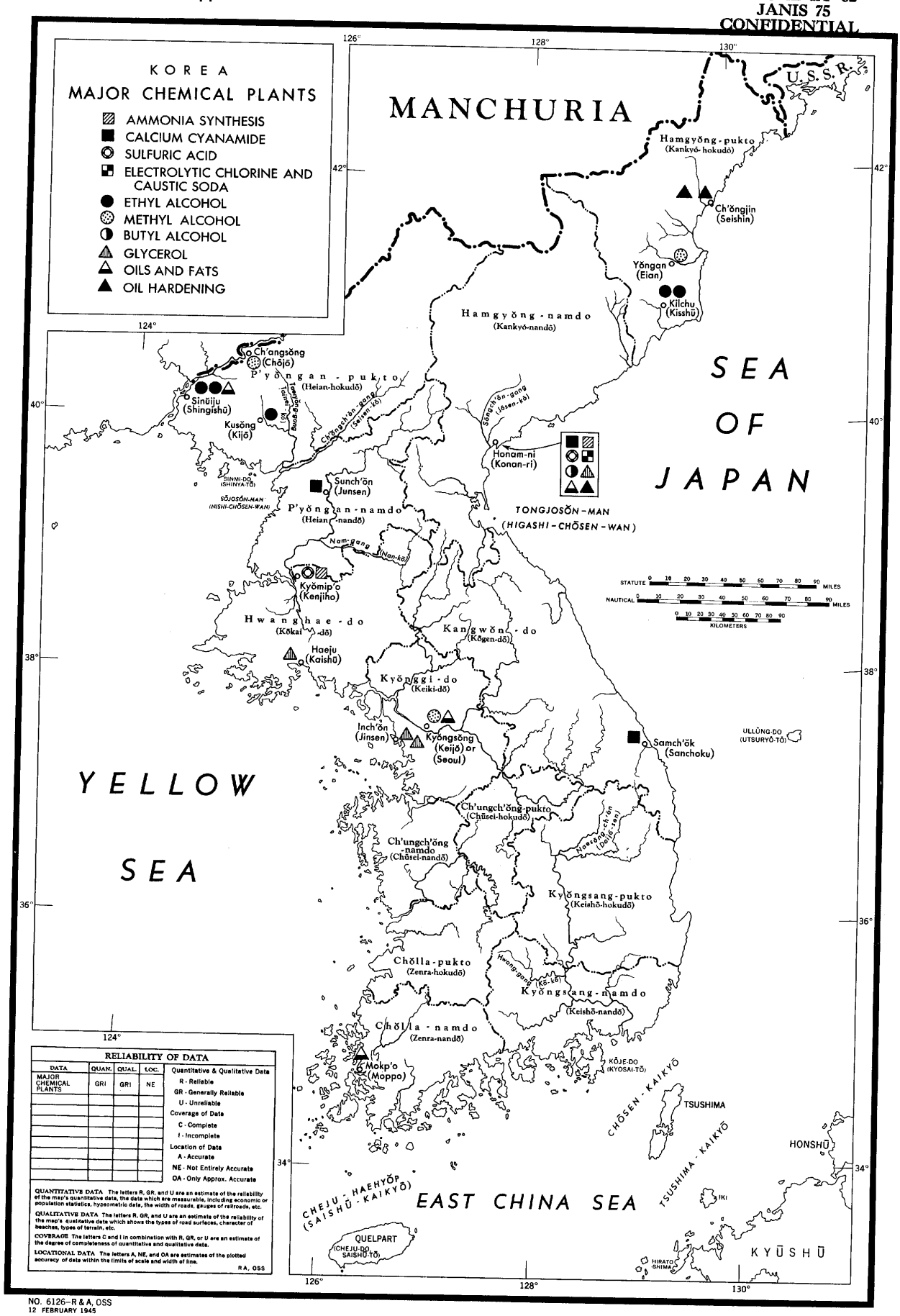

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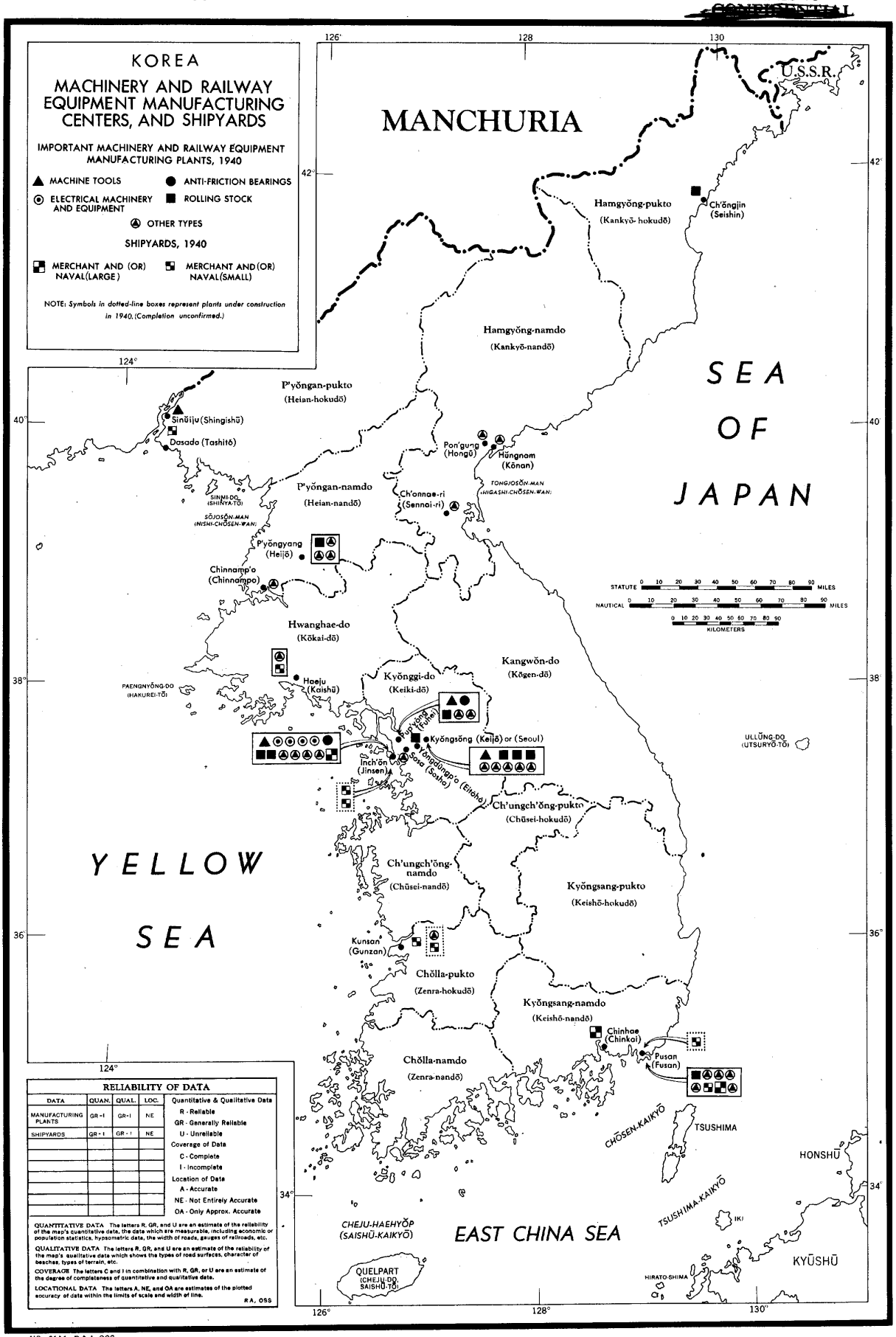
12 FEBRUARY 1945



RELIABILITY OF DATA

DATA	QUAN.	QUAL.	LOC.
MANUFACTURING PLANTS	GR-I	GR-I	NE
SHIPYARDS	GR-I	GR-I	NE

Quantitative & Qualitative Data
R - Reliable
GR - Generally Reliable
U - Unreliable
Coverage of Data
C - Complete
I - Incomplete
Location of Data
A - Accurate
NE - Not Entirely Accurate
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QUANTITATIVE DATA The letters R, GR, and U are an estimate of the reliability of the map's quantitative data, the data which are measurable, including economic or population statistics, hypsometric data, the width of roads, gauges of railroads, etc.

QUALITATIVE DATA The letters R, GR, and U are an estimate of the reliability of the map's qualitative data which shows the types of road surfaces, character of beaches, types of terrain, etc.

COVERAGE The letters C and I in combination with R, GR, or U are an estimate of the degree of completeness of quantitative and qualitative data.

LOCATIONAL DATA The letters A, NE, and OA are estimates of the plotted accuracy of data within the limits of scale and width of line.

R A, OSS

NO. 6111–R & A, OSS
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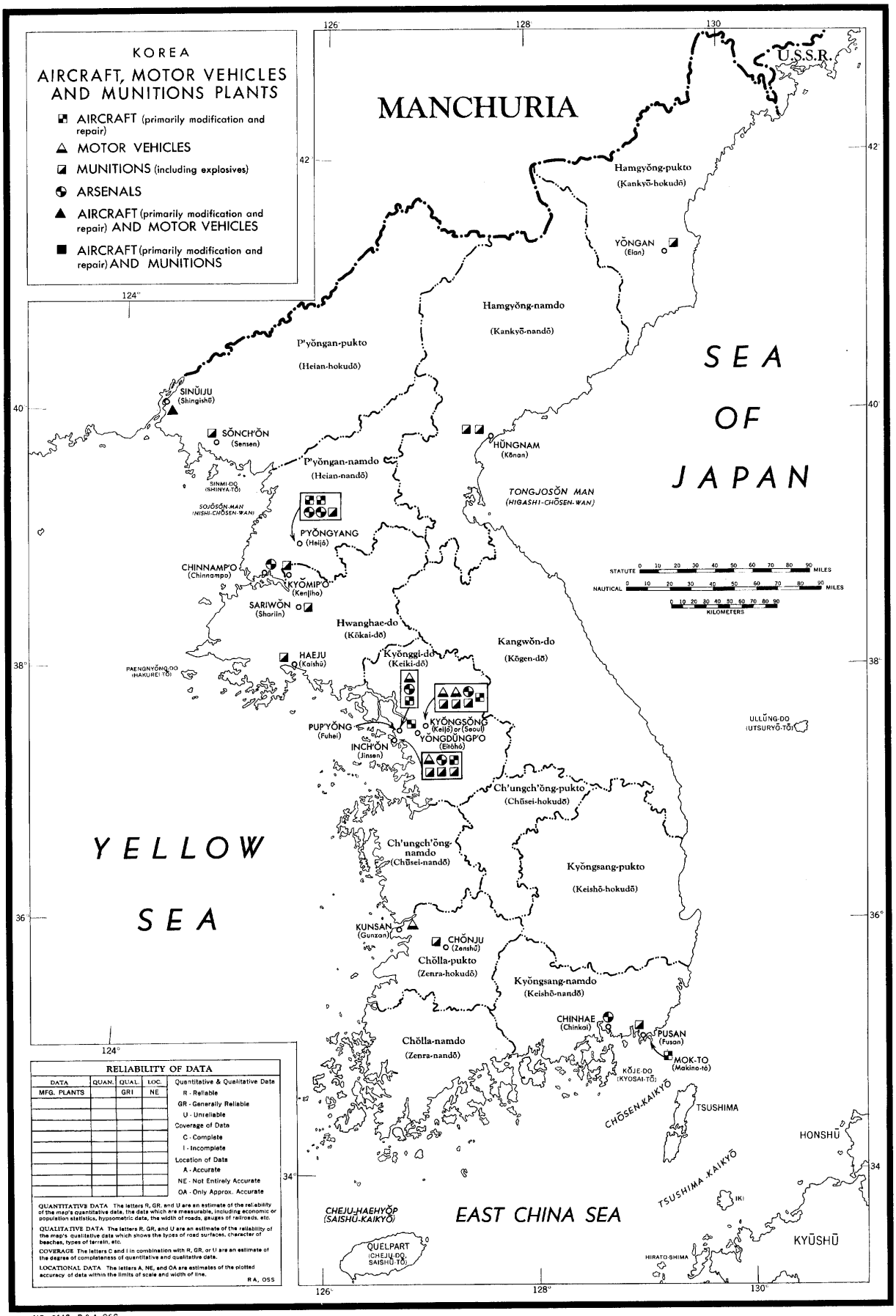
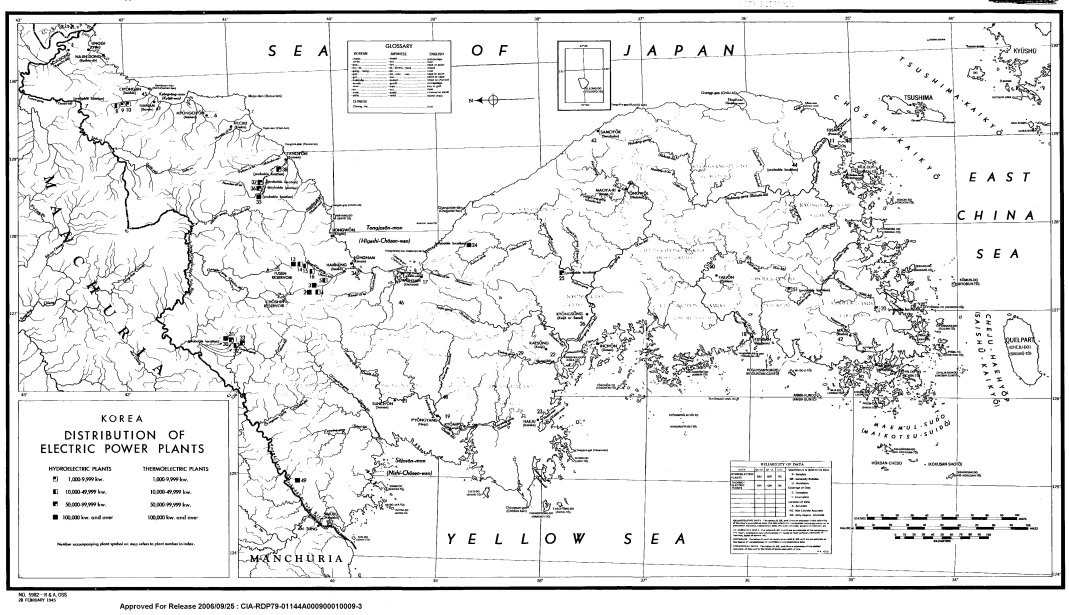


NO. 6112-R & A, OSS
28 FEBRUARY 1945

FIGURE IX - 55
JANIS 75

PLANT NUMBER	PLANT NAME	CAPACITY IN KW.
1	Agochi Steam Plant	5,000
2	Choshinko No. 1 Hydro Plant	144,000
3	Choshinko No. 2 Hydro Plant	120,000
4	Choshinko No. 3 Hydro Plant	46,500*
5	Choshinko No. 4 Hydro Plant	36,450*
6	Eian Steam Plant	6,000
7	Eisui Steam Plant	2,000
8	Funei No. 1 Hydro Plant	13,100*
9	Funei No. 2 Hydro Plant	9,400*
10	Funei No. 3 Hydro Plant	5,100
11	Fusan Factory Steam Plant	3,120
12	Fusan Steam Plant	12,600*
13	Fusenko No. 1 Hydro Plant	129,600
14	Fusenko No. 2 Hydro Plant	41,400
15	Fusenko No. 3 Hydro Plant	18,000
16	Fusenko No. 4 Hydro Plant	12,375
17	Genzan Steam Plant	1,200*
18	Gunzan Steam Plant	3,650*
19	Heijo Steam Plant	18,000
20	Hojoko Hydro Plant	3,100
21	Jonsen Factory Steam Plant	10,000*
22	Koiji Steam Plant	1,100*
23	Kaisha Steam Plant	5,000*
24	Kanko Kasen Hydro Plant	108,000*
25	Kanko Seihei Hydro Plant	59,400*
26	Keiji Ryuzan Steam Plant	11,000
27	Keiji Tojinri Steam Plant	22,500
28	Kenjiho Steam Plant	1,000
29	Kinsen Steam Plant	1,000
30	Kokai No. 1 Hydro Plant	135,000*
31	Kokai No. 2 Hydro Plant	54,000*
32	Kokai No. 3 Hydro Plant	32,400*
33	Kokai No. 4 Hydro Plant	75,000**
34	Konan Steam Plant	13,000
35	Kyosenko No. 1 Hydro Plant	144,000*
36	Kyosenko No. 2 Hydro Plant	72,000*
37	Kyosenko No. 3 Hydro Plant	66,600*
38	Kyosenko No. 4 Hydro Plant	72,000*
39	Moppo Steam Plant	2,250
40	Naietsu Steam Plant	100,000
41	Ranan Steam Plant	2,000
42	Rasiii Steam Plant	2,800
43	Sanchoku Steam Plant	50,000
44	Seido Steam Plant	7,000
45	Seishin Factory Steam Plant	16,000
46	Sennairi Steam Plant	3,600
47	Shingishii Steam Plant	1,400
48	Shokori Factory Steam Plant	10,200
49	Suiho Hydro Plant	630,000***
50	Toiden Steam Plant	4,200
51	Ungan Hydro Plant	5,120

*Estimated Capacity
**Estimated Capacity. It is not known whether this plant has been completed.
***270,000 kw used for Korea.



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