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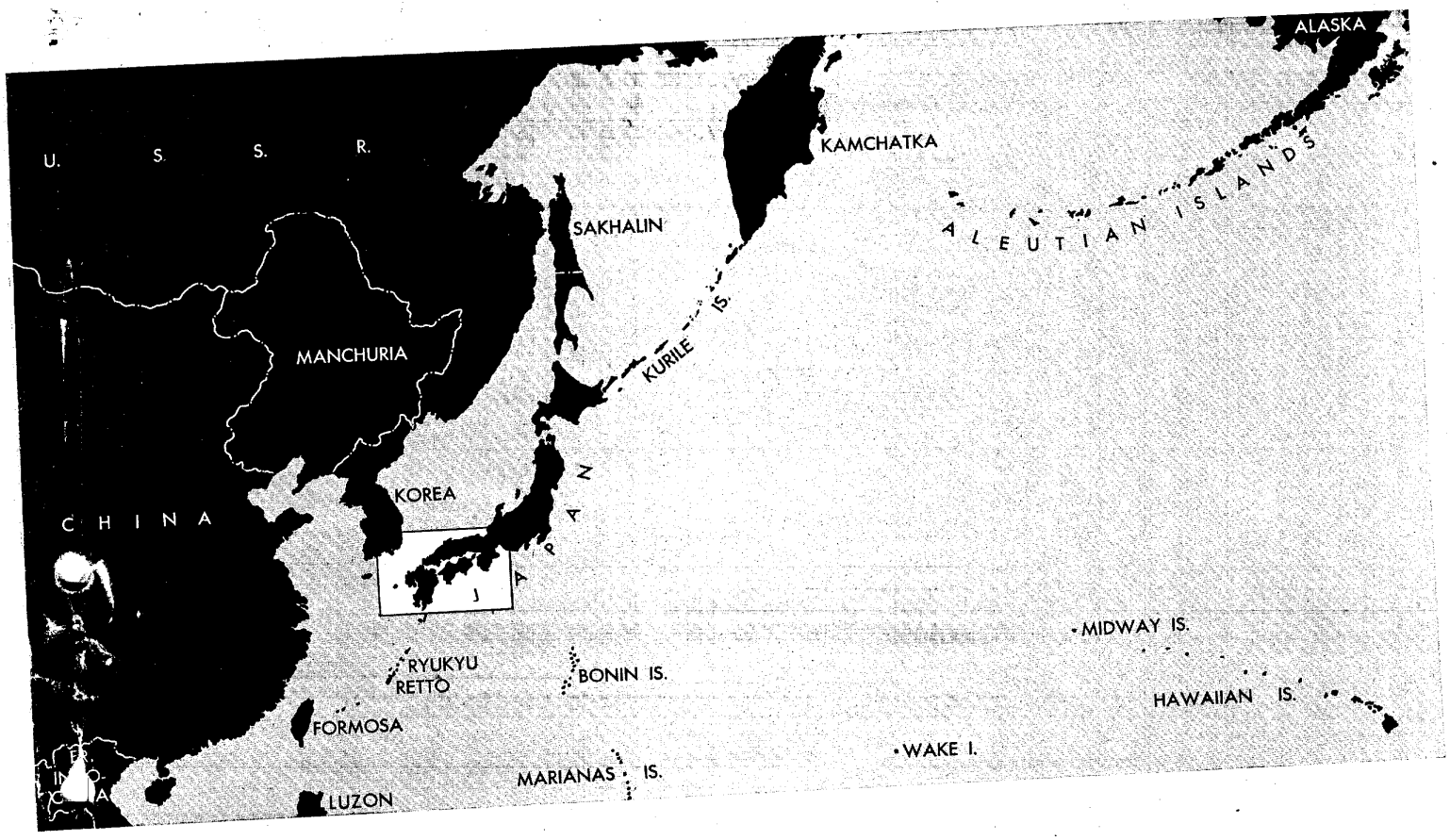
CHAPTER IX



JOINT ARMY-NAVY INTELLIGENCE STUDY

OF

SOUTHWEST JAPAN:

Kyūshū, Shikoku, and Southwestern Honshū

RESOURCES AND TRADE

AUGUST 1944

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RESOURCES AND TRADE

90. *Economic Regions of Southwest Japan*

The Southwest Japan area covered in this study includes 37% of the land area of Japan and 50% of its 75,000,000 population. It grows roughly 45% of the food produced in Japan (about ⅜ of the food consumed), and its factory workers number approximately 55% of the country's total.

Southwest Japan's 25 prefectures are grouped administratively into 5 regions: the islands of Kyūshū and Shikoku, and 3 divisions of southwestern Honshū: Chūgoku-chihō (the "Middle Country"), Kinki-chihō (the "Home Provinces"), and Tōkaidō (the "Eastern Road").*

Each of these regions, except Shikoku, includes industrial districts of great importance, located either along the main seaway which leads from the Asiatic mainland to the economic heart of Japan at the eastern end of the Inland Sea, or, in the case of Nagoya, on the land route from the great center of Ōsaka-Kōbe to Tōkyō and Yokohama.

There are important agricultural areas in each administrative region, mostly in small valleys or plains that are wide near the coast and taper off inland toward the mountains. Away from the coasts there are scattered, discontinuous areas of cultivation in basins and valleys, notably in the Kyōto and Biwa-ko lowland. (TABLE IX - 1 and FIGURES IX - 51, IX - 53, and IX - 58).

The Ōsaka-Kōbe district is a center for the processing and fabrication of steel and other metals as well as for almost every other kind of manufacturing. The Nagoya district is of the highest importance in aircraft and machinery. The north Kyūshū district is the great coal mining area of Southwest Japan, where imported iron ore is converted into pig iron and steel. Yamaguchi and Hiroshima prefectures, at the western end of the Inland Sea, are becoming increasingly important in the production of chemicals and ordnance.

A. Kyūshū.

The island of Kyūshū is divided into primarily industrial and primarily agricultural areas, lying to the west and east, respectively, of a line from Ōmuta to the Inland Sea coast below Moji.

(1) Southern and eastern Kyūshū.

This region, including the prefectures of Kagoshima, Miyazaki, Ōita, and Kumamoto, is the least densely populated and the least industrialized of Southwest Japan. Nitrogen chemicals are produced at Nobeoka on the eastern coast and at Minamata on the Yatsushiro-wan, using hydroelectric power. Tsurusaki in Ōita prefecture makes dye intermediates from coal tar by-products brought from further west, and there are 3 cement plants in Ōita prefecture. A copper and lead smelter and a copper refinery are at Saganoseki in Ōita prefecture, on the outer sea route from the south into Japan.

The region is mountainous and has large timber resources. It is a large charcoal producer. Silk culture and reeling are of some importance, particularly in Kumamoto prefecture.

Southern and eastern Kyūshū are more nearly self-sufficient in food supplies than other parts of Japan. Sweet potatoes are an important crop in the south. They are grown in such quantities that some surplus rice can be exported. Parts of Kumamoto and Ōita prefectures lying farthest to the north and west supply food to the northern industrial district.

The low industrial importance of this region is illustrated by its decline in population between 1935 and 1940. Outward migration at a rate well above 1% a year was not quite balanced by the natural increase in population.

(2) Northern Kyūshū.

The 3 prefectures of Fukuoka, Saga, and Nagasaki contain almost all of Southwest Japan's coal fields, Japan's greatest pig iron and steel district, and important shipyards. Nagasaki has fisheries, and Saga and southern Fukuoka have fields of rice and other grains, but in the aggregate there is a substantial deficiency in food production. With growth in the steel and other industries, population rose 10% from 1935 to 1940, when there were 5,200,000 persons in this region of 4,500 square miles.

The coal fields of Ōmuta, of northern Fukuoka prefecture, and of Nagasaki and Saga prefectures, all produce bituminous coal of a poor coking quality. They account for ⅔ of Japanese production, and supply about ⅔ of the coal consumption of

*Tōkaidō also includes the prefecture of Shizuoka lying farther to the east.

TABLE IX - 1.
RELATIVE ECONOMIC IMPORTANCE OF THE REGIONS OF SOUTHWEST JAPAN.
(As measured by percentages of food production, population, and employment in manufacturing and mining, various dates 1930-1940)

	Kyūshū		*Shikoku*	*Southwestern Honshū*						*Total*
				CHŪGOKU-CHIHŌ		KINKI-CHIHŌ		TŌKAIDŌ (IN PART)		
PERCENTAGES OF ALL JAPAN	SOUTH & EAST	NORTH-WEST		INLAND SEA	JAPAN SEA	ŌSAKA-HYŌGO	REST	AICHI	MIE-GIFU	SOUTHWEST JAPAN
Land Area	8.0	3.0	4.9	5.6	2.6	2.7	4.5	1.3	4.3	36.9
Food Production, 1935-1937-1939 avg.	10.0	6.6	4.7	5.9	1.8	3.7	4.2	2.7	3.2	42.9
Population 1940	6.5	7.1	4.6	6.1	1.7	11.0	5.4	4.3	3.4	50.0
Persons in All Manufacturing 1930 [1]	4.4	6.2	4.3	5.7	1.3	15.2	6.9	6.2	3.7	54.1
Factory Workers 1938	2.3	5.2	2.9	5.5	0.8	21.1	5.3	9.3	3.4	55.8
Persons in Mining 1930	3.1	48.3	3.1	6.2	0.4	1.7	1.0	0.9	0.9	65.6

[1] Including household workshops with fewer than 5 workers.

Southwest Japan; the balance is provided mainly by imports from the continent. These imports include high-grade coking coal necessary for the operation of Japan's blast furnaces.

The chemical industry of Fukuoka prefecture is closely associated with coal and coke production. Synthetic ammonia, nitric acid, calcium carbide, calcium cyanamide, dye intermediates, and synthetic oil are all produced in quantities which range from roughly 7% (synthetic oil) to 15% or more of the totals available to Japan.

Fukuoka's coke oven capacity is nearly ½ of all Japan's and ⅕ of the total in Japan, Korea, and Manchuria. Most of the coke is used locally, chiefly in the blast furnaces at Yawata.

The iron and steel industry of northern Kyūshū is believed to be consuming a large part of the iron ore imported into Southwest Japan. Processing is carried through the rolling mill stage at Yawata. Steel-using industries are much less concentrated in Kyūshū than elsewhere. There are important shipyards and engine works at Sasebo and Nagasaki, a large arsenal at Kokura, and a major machine tool plant at Karatsu (Saga-ken).

There is some primary processing of imported bauxite and zinc concentrates at Yawata and Ōmuta, respectively. Cement is produced at Moji and Yawata.

B. Shikoku.

The island of Shikoku lies apart from the main currents both of external commerce and of inter-island trade in heavy industrial commodities. Because urban centers are few its population density is low in comparison with that of most other regions, but the number of farms per square mile is exceptionally high in its agricultural districts. Shikoku is closely balanced as to food supply.

Of the 4 prefectures of Shikoku—Kōchi, Tokushima, Kagawa, and Ehime—all but the last have declined in population in recent years. Manufacturing has been chiefly of consumer goods, including cotton yarn and rayon, and is concentrated along the inner coasts of the island, particularly in Ehime. Ehime is of some importance for its deposits of copper-bearing iron pyrites, from which sulphuric acid as well as metal is obtained. The Niihama district has smelters and chemical plants. Kagawa has extensive evaporation beds for the production of salt, a deficit item in Japan.

C. Chūgoku-chihō.

This adminstrative region, consisting of the 5 westernmost prefectures of Honshū, is naturally divided into an area partly industrial and partly agricultural facing the Inland Sea, and an area primarily agricultural facing the Japan Sea.

(1) Inland Sea sub-region.

Yamaguchi, Hiroshima and Okayama prefectures form an economic region whose common denominator is easy access to Japan's internal sea lane. Although the 3 prefectures together present a balanced cross-section of the Japanese economy, they differ individually in character. Yamaguchi is most highly specialized in chemicals, Hiroshima in steel and steel-using industries, and Okayama is the largest agricultural producer. The region as a whole has a moderately large deficit in food production.

Ube, in Yamaguchi-ken (prefecture), produces nitrogen chemicals, synthetic oil, and cement. The Ube coal fields are of lignite, and far smaller than those of Kyūshū. One of the largest magnesium plants under Japanese control is also located at Ube. At Tokuyama and neighboring places there are a naval station, steel rolling mills, oil refineries, and some synthetic oil plants. Iwakuni, bordering Hiroshima-ken, is a rayon center.

Kure, in Hiroshima-ken, has a naval base, shipyard, and arsenal, with its own furnaces for making steel. Near Hiroshima city there are important machine tool and other machinery plants. Hiroshima-ken has several rayon plants, but these are not believed to be operating at present.

Hiroshima-ken has extensive timber stands. Both Yamaguchi-ken and Okayama-ken are leading producers of salt, and Okayama of brick.

(2) Japan Sea sub-region.

The prefectures of Shimane and Tottori are in some general respects similar to the island of Shikoku. That is, they are primarily agricultural, but produce no significant food surpluses; there are no cities with population over 100,000, and the total population has declined slightly in recent years. Manufacturing is chiefly of consumer goods.

A moderately large well-integrated iron and steel plant is believed to be in operation in Shimane-ken. In the same vicinity there is a railroad car building plant. Shimane-ken and Tottori-ken have a fair share of Japan's very scanty reserves of ferro-alloys.

D. Kinki-chihō.

The "Home Provinces", once facing toward the old capital of Kyōto, have long had their economic focus in Ōsaka and Kōbe, the 2 great cities and ports. For statistical purposes the prefectures of Ōsaka and Hyōgo must be treated together in order to show the concentration of industry in and between these 2 cities, but a still truer picture would include the prefectures of Kyōto, Shiga, Nara, and Wakayama, as well as the greater part of Hyōgo. These 5 prefectures all have cities that are satellites to Ōsaka and Kōbe; they extend back to the outer coasts or to mountain ranges at the northeast and southeast

(1) Ōsaka-fu and Hyōgo-ken.

These 2 prefectures, with 11% of Japan's population (1940), had 21% of the country's factory workers in 1938. Though the textile industries, which employed ⅓ of all factory workers in 1938, have contracted greatly, it is possible that there is still greater concentration of manufacturing activity in and around Ōsaka and Kōbe today than in 1938. The population of the 2 prefectures increased by nearly 800,000, or 11%, between 1935 and 1940. Almost every branch of modern and old-style industry, except rayon, is strongly represented.

Ōsaka-fu and Hyōgo-ken prefectures have about ⅗ of the steel making capacity of Japan proper, with a higher proportion for alloy steel; about ⅓ of the copper refining capacity; 2 of the largest shipbuilding establishments in Japan at Kōbe; perhaps ⅓ of the machine tool production; and important plants in the manufacture of gears, anti-friction bearings, and electrical equipment (including wire and cable, heavy generators and turbines, small motors and generators, communications equip-

ment, and incandescent lamps). The 2 prefectures possess about ⅙ of the sulfuric acid capacity of Japan. An army arsenal at Ōsaka makes guns and there also appear to be brass mills and shell-making plants at Ōsaka. There are major aluminum rolling mills in Ōsaka, and the operations of the second largest aircraft manufacturer in Japan are centered in Ōsaka.

Ōsaka has been a center of wood-using industries. Many small yards building wooden ships are located there and at Kōbe.

Ōsaka-fu's 700 square miles are fairly flat, and this small land area produces substantial quantities of rice, vegetables and fruits. In the aggregate, however, the 2 prefectures of Ōsaka and Hyōgo have a very large deficit of food production, little helped by neighboring areas.

(2) The remainder of Kinki-chihō.

Only those parts of the region contiguous to Ōsaka are of importance in manufacturing. The single exception is Maizuru on the Japan Sea, with its naval base engaged in destroyer and light cruiser construction. The textile industries formerly employed as many as 55% of the factory workers.

Kyōto and Wakayama have fairly large food production deficits, although Wakayama is a major fruit growing district.

E. The Nagoya region.

The economic structure of the Nagoya region is in some ways similar to that of Kinki-chihō, though on an over-all scale only about ½ as large. Mie-ken and Gifu-ken are the satellite areas for Nagoya, and in them, as in the satellite areas of Kinki-chihō, small-scale manufacturing is highly developed.

Textiles were relatively more important before the war in the Nagoya region than in the Ōsaka district and its surrounding territory. Forty per cent of the factory workers of Aichi-ken and 60% in both Mie-ken and Gifu-ken were in textile factories. This region lies on the edge of Japan's principal silk district, centered northeast of Nagoya.

The manufacture of textiles has been displaced by manufacture of aircraft and components, machine tools, and other branches of the machinery and allied industries, including trucks, tanks, and railroad locomotives. Japan's principal aircraft manufacturer is located in Aichi prefecture, with an estimated ¼ of all Japanese production. Very important anti-friction bearing plants are located in Mie-ken. Machine tool production is probably as large as in the Ōsaka region. The steel-making capacity of the Nagoya region is relatively small, and is chiefly devoted to alloy steel. There is little or no smelting or refining of metal other than steel.

Aichi's pottery and glass industries were based on clay and silica sand deposits in Gifu and Aichi prefectures. Gifu is a fairly important timber producing prefecture, and has the largest lead and zinc mine of Japan.

The food production deficit of the Nagoya region is very large, but the region is closer to self-sufficiency than Kinki-chihō.

91. *Food Resources*

A. Present food position.

Shortages of manpower, draftpower, and fertilizer have resulted in a slight decline in agricultural production as compared to the high level reached in the late 1930's. Two extremely poor rice crops in 1940 and 1941 were followed by a normal crop in 1942. The 1943 rice crop, to be consumed in 1944, was reported to be 20,200,000,000 pounds, about 5% below the high level reached in the late 1930's and only slightly below the average of 1935, 1937, and 1939 which is used as a statistical base in this study.

To cover the food requirements of a growing population, the government has resorted to 4 principal measures: (1) an increase in the imports of rice, soybeans, beans, etc.; (2) a reduction in the amount of food diverted to non-food uses, such as sake; (3) a reduction in rice polishing; and (4) rationing. Rice delivery quotas were imposed on producers, and the quantities collected were distributed through rations differentiated according to age, sex, and degree of physical activity. Imports are now necessary from areas outside the Japanese Empire in order to maintain the total food supply of Japan proper at the level of prewar consumption. The per capita food supply of the civilian population, however, is less than in the late 1930's because of an increase in population, and per capita needs are higher because of longer working hours.

If all imports, including those from Korea, Manchuria, and Formosa were cut off, the total supply would now be only 80% of prewar total consumption.

B. General characteristics of agriculture.

Despite the rapid industrialization of Japan in recent years, agriculture remains the basic industry of the Japanese economy. About 40% of the population is rural and approximately the same proportion of the labor force is engaged in farm work. Obtaining a sufficiency of foodstuffs has always been an acute problem for Japan, and the war has further aggravated the situation.

(1) Land use.

The acreage of available land is small in relation to the growing population of Japan. In 1939, Japan had a cultivated area of 14,896,000 acres or 15.8% of the total land area of the islands. Even with vigorous government efforts to enlarge the cultivated area, there has been practically no expansion in the past 2 decades. In view of the practical difficulties of land reclamation in Japan, caused especially by the hilly and mountainous character of so much of the country (FIGURE IX - 1), the prospects are poor for much expansion of cultivated area in the future.

Southwest Japan has 5,758,000 acres, or 38.6% of Japan's cultivated land area, and 50% of Japan's population. Kyūshū has 13.7% of the total cultivated land area in Southwest Japan; Shikoku, 4.4%; the 5 Chūgoku-chihō prefectures at the western end of Honshū, 7.7%; the 6 prefectures of Kinki-chihō, 6.8%; and Aichi, Mie, and Gifu, 6.0%. The largest agricultural prefecture in terms of acreage is Kagoshima in southern Kyūshū. Further details on cultivated and other areas in Southwest Japan will be found in Topics 24A, 24B, and TABLE II - 1 of CHAPTER II.

(2) Size of farms.

Farm units in Japan are very small, averaging only 2.7 acres. In Southwest Japan the farm units are even smaller,

FIGURE IX - 1. *Miyazaki Prefecture.*
Tōkaidō, date unknown. Terraced fields, dry crops in foreground, rice plots above and at right. Note unfenced land, typical in agricultural districts.

generally averaging 2 acres in size. In 1939, for Japan as a whole, 34% of all farm households cultivated less than 1.2 acres each; 33% cultivated from 1.2 and 2.4 acres; 24% from 2.4 to 4.8 acres, and only 9% cultivated more than 4.9 acres. Most of the cultivated land is worked by tenants. Absentee ownership is very common.

(3) *Manpower, fertilizer, and machinery.*

The productivity of Japanese farms has depended largely on the abundance of labor. In 1930, 14,130,000 workers, 48% of the total labor force, were engaged in farming. It is estimated that by 1944 the number will have declined nearly 5% to about 13.5 million. Because of the rapid growth of war industries and the over-all expansion of employment, however, the decline in the proportion of farm labor to all labor was larger, the proportion being about 41% now as against 48% in 1930. Furthermore, during the war years, the sex and age composition of the farm labor force has undergone drastic changes. Farms are operated today to a large extent by women, children, and older people.

Per capita productive power in terms of monetary value is relatively greater in large-scale than in small-scale farming, but the small-scale farms predominate. Mechanization of farm operation is relatively slight in Japan.

Fertilizer is next in importance to labor as a production factor in Japan's agriculture. Compared with countries where an extensive system of agriculture is used, Japan requires large amounts of fertilizer for her highly intensive system. Farm expenditures for fertilizer represent about 10% of gross agricultural income. Japanese farmers fully utilize local fertlizers such as night-soil, compost, green manure, wood ashes, and commercially traded fertilizers such as bean cake and fish fertilizer. Chemical fertilizers, however, are extremely important and the existing high levels of yield are largely dependent on them. Assuming no increase in the use of manure, night-soil, and similar products, it has been estimated that total agricultural production would drop by 20% if nitrogen-bearing chemical fertilizers were completely eliminated. Japan has been experiencing some fertilizer shortage since 1941, because military demands for nitrogen compounds compete with those of agriculture (Topic 95, B, (1)).

(4) *Crop specialization in Southwest Japan.*

Generally speaking, the distribution of principal crops is quite homogeneous throughout Japan proper (TABLE IX - 2). Largely because of climatic diversity, however, Southwest Japan grows a larger proportion of most crops than would be expected from its 38.7% share of the cultivated acreage (TABLE IX - 3). Major exceptions are beans and Irish potatoes. The proportion of acreage devoted to rice is greater than in Hokkaidō but somewhat less than in central and northern Honshū. However, per acre yields are high and the quality of the rice produced in Kumamoto, Kagawa, Okayama, Hyōgo, and Ōsaka prefectures is notable. Many kinds of fruit are grown in Southwest Japan. Barley, wheat, vegetables, and mulberry are usual crops in upland fields. The prefectures of Kyūshū and Shikoku facing the ocean are the most nearly tropical parts of Japan. In the southernmost part of Kyūshū, sweet potatoes, tobacco, beans, and winter grains are extensively grown, and this is the only part of Japan proper where sugar cane is of some importance. Kōchi is the only prefecture where a second rice crop is grown regularly.

TABLE IX - 2.
JAPAN AND SOUTHWEST JAPAN.
Estimated production of all foodstuffs, crop year 1943, available for 1943-44 consumption.
(in million pounds)

	JAPAN	SOUTHWEST JAPAN	KYŪSHŪ	SHIKOKU	CHŪGOKU-CHIHŌ	KINKI-CHIHŌ	AICHI-KEN, MIE-KEN AND GIFU-KEN
Rice	20,276*	9,408	3,000	892	1,886	2,088	1,540
Wheat	2,454*	1,304	545	155	238	199	167
Barley	1,294*	294	40	4	89	61	100
Naked barley	1,514*	1,424	522	381	247	203	71
Minor grains	529	210	144	21	22	4	15
Soybeans	882	235	126	19	34	34	22
Other beans	632	229	68	34	46	58	22
Sweet potatoes	9,700	4,986	3,327	621	417	204	417
Irish potatoes	4,466*	661	223	58	134	152	94
Vegetables	12,125	5,674	1,734	594	1,006	1,333	1,006
Fruits	2,204	1,190	280	202	200	414	92
Fish	5,070	1,602	770	208	324	182	116
Meat	249	136	224	4	34	58	16
Eggs	454	272	59	30	39	45	97
Milk	264	78	10	3	8	40	14
Dairy products	33	5	0.4	0.1	0.5	3	0.6

*Japanese official figures of 1943 production

TABLE IX - 3.
FOOD PRODUCTION IN SOUTHWEST JAPAN
(Average - 1935, 1937, 1939)

	PRODUCTION (MILLION LBS.)	PERCENT OF TOTAL JAPAN	SURPLUS (+) OR DEFICIT (−) (MILLION LBS.)[1]
Rice	9,612	46.4	−2,921
Wheat	1,674	53.1	+ 79
Barley	395	22.7	− 475
Naked barley	1,443	94.1	+ 684
Minor grains	238	39.7	− 65
Soybeans	202	26.6	− 758
Other beans	193	36.3	− 291
Sweet potatoes	4,087	51.4	+ 64
Irish potatoes	579	16.4	−1,208
Vegetables[2]	7,046	46.8	− 572
Fruits[3]	1,538	54.0	+ 97
Fish	1,881	31.6	−1,434
Meat	162	54.6	+ 12
Eggs	266	59.9	+ 41
Milk	166	29.5	− 119
Dairy products	10	13.9	− 27

[1] Difference between production (adjusted for non-food uses and waste) and consumption requirements, the latter assumed to be equal to average prewar consumption for Japan.

[2] Cucumber, white cucumber, pumpkin, watermelon, musk melon, eggplant, tomatoes, radishes, turnips, carrots, burdock, taro, lotus roots, green onions, onions, cabbage.

[3] Plums, peaches, loquat, Japanese pears, foreign pears, apples, persimmons, grapes, oranges, other citrus fruits.

C. Food consumption and food balance.

(1) *General characteristics and nutritive value of diet.*

Rice is by far the most important item in the Japanese diet. This does not mean, however, that the Japanese "lives on rice" to the exclusion of other foods. Rice contributes about ½ of his total food energy. Other grains supply 11% of the calories, sweet potatoes and Irish potatoes 8%, sugar 8%, soybeans and other beans 6%, fish 5%, and all other foods 11%. The average prewar diet of the Japanese supplied 2,150 calories per capita per day, 100 to 200 calories short of what nutrition experts consider the minimum required for the maintenance of health. About ⅘ of these calories were obtained from domestic production in 1935, 1937, 1939; ⅕ from imports or by drawing on carry-over stocks. Principal imports are rice, sugar, and soybeans.

Starchy foods are preponderant in the Japanese diet. The average daily per capita intake of carbohydrates is 407 grams (14.4 oz.), most of which is supplied by rice, other cereals, and potatoes. The average protein consumption—62 grams (2.2 oz.) a day, of which 12 are imported—is adequate, though it constitutes only 11% of the diet, compared with 45% for American and European diets. Although rice is not a good source of protein, the large quantities consumed make it the largest source. It is followed by fish, soybeans and beans, and wheat. The Japanese diet is notably deficient in fat; the daily per capita consumption is only 30 grams (1.1 oz.), of which 5 grams are imported. Oils and fish are the most important sources of fat, followed by rice and soybeans. Very small quantities of meat and dairy products are consumed, mainly in the large cities.

Southwest Japan is more deficient in foodstuffs than Japan as a whole. The food resources of the region are sufficient to supply every inhabitant with only about 1,600 calories; about 550 calories, or more than ¼ of total consumption in terms of calories, has to be imported from other regions or from abroad. The region has a greater deficiency in fats (37%) and in proteins (34%) than in carbohydrates (23%).

(2) *Food supply in Southwest Japan.*

If the average prewar consumption pattern for Japan as a whole is taken as a guide,[1] it appears that Southwest Japan should be approximately self-sufficient in grains, except rice, and in sweet potatoes, vegetables, and fruits. There is a major deficit in rice as the area produces only about ⅓ of its per capita requirements. The area also suffers from serious deficits of soybeans, fish, and sugar. To meet these deficits would require bringing in more than 2,200 million pounds of rice, 660 million pounds of soybeans, 220 million pounds of beans, 880 million pounds of sugar, and 880 million pounds of fish per annum.

(3) *Surplus and deficit areas in Southwest Japan.*

Kyūshū as a whole is a food surplus area on a calorie count basis (the basis of calculations of surpluses and deficits is outlined in FIGURE IX - 51 under "Notes for Legend"). The substantial deficit in Fukuoka-ken in industrial northern Kyūshū is partially offset by the large surplus production in Kagoshima-ken in the southwest.

Shikoku comes closest to being self-sufficient in foods, her principal deficits being sugar and soybeans, which all of Japan must import in large quantities.

Chūgoku-chihō is in approximately the same position as Shikoku though its soybean deficit is more serious.

The most serious deficits are, as might be expected, in the urban areas of the central industrial belt. The Kōbe-Ōsaka area must depend on other regions for large proportions of its needs for rice, other grains, soybeans, sweet and Irish potatoes, sugar, and fish. It approximates self-sufficiency only in fruits and vegetables. The Nagoya area is in a similar position, although in general its deficits are less severe.

A general picture of the food position of each prefecture, in which the surpluses and deficits in calories, as measured by average pre-war diets, are expressed in terms of pounds of rice, is given in TABLE IX - 4 and FIGURE IX - 51. Since rice is the staple food and could be used for at least short periods to make up for most of the deficits, this gives some approximation of the feeding problem that would exist in each area if usual import sources were cut off. It does not of course take account of local stocks or of the sharp cuts in food consumption which would be made for brief emergency periods.

D. Food production in Southwest Japan.

(TABLES IX - 2 and IX - 3).

(1) *Rice.*

This basic staple of the Japanese diet is grown in the lowlands and plains of Southwest Japan, wherever irrigation is possible, almost to the exclusion of other crops, but the quantity produced is far from sufficient to cover the requirements of

[1] This is the only possible assumption without making very complicated calculations which would necessarily be of doubtful validity. It should be borne in mind that 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.

TABLE IX - 4.
FOOD PRODUCTION IN SOUTHWEST JAPAN BY REGIONS AND PREFECTURES, SURPLUSES AND DEFICITS
(Average 1935-37-39)

REGION	AGGREGATE CALORIES PRODUCED ANNUALLY[1] (000,000,000)	% OF TOTAL FOR JAPAN	ANNUAL RICE PRODUCTION (1,000,000 LBS.)	% OF TOTAL JAPAN	POPULATION % OF TOTAL JAPAN	ANNUAL SURPLUS (+) OR DEFICIT (−) OF ALL FOODSTUFFS OVER REQUIREMENTS[2] (IN CALORIES BILLIONS)	(IN EQUIVALENT WEIGHT OF BROWN RICE MILLION POUNDS)
Total Southwest Japan	20,839	46.7	9,612	46.4	50.6	−6,748	−4,173
A. Kyūshū	8,127	18.2	3,066	14.8	13.8	+ 581	+ 359
1. Kagoshima-ken	2,156	4.8	414	2.0	2.3	+ 901	+ 558
2. Miyazaki-ken	697	1.6	290	1.4	1.2	+ 40	+ 24
3. Ōita-ken	798	1.8	414	2.0	1.4	− 5	− 3
4. Kumamoto-ken	1,445	3.2	580	2.8	2.0	+ 236	+ 146
5. Fukuoka-ken	761	1.7	746	3.6	4.0	− 745	− 461
6. Saga-ken	946	2.1	435	2.1	1.0	+ 229	+ 141
7. Nagaski-ken	1,323	3.0	186	0.9	1.9	− 75	− 46
B. Shikoku	2,269	5.1	911	4.4	4.8	− 340	− 210
8. Kōchi-ken	435	1.0	207	1.0	1.0	− 117	− 72
9. Tokushima-ken	434	1.0	166	0.8	1.0	− 132	− 82
10. Kagawa-ken	639	1.4	248	1.2	1.1	+ 54	+ 33
11. Ehime-ken	762	1.7	290	1.4	1.7	− 145	− 89
C. Chūgoku-chihō	3,715	8.3	1,926	9.3	8.0	− 648	400
12. Yamaguchi-ken	883	2.0	414	2.0	1.7	− 54	− 33
13. Hiroshima-ken	860	2.0	414	2.0	2.6	− 562	− 348
14. Okayama-ken	1,108	2.5	559	2.7	1.9	+ 62	+ 38
15. Tottori-ken	366	.8	228	1.1	0.7	− 14	− 8
16. Shimane-ken	498	1.1	311	1.5	1.1	− 80	− 49
D. Kinki-chihō	3,837	8.6	2,134	10.3	16.3	−5,066	−3,134
17. Hyōgo-ken	1,234	2.8	642	3.1	4.3	−1,095	− 678
18. Ōsaka-fu	586	1.3	311	1.5	6.4	−2,918	−1,806
19. Wakayama-ken	457	1.0	207	1.0	1.2	− 220	− 136
20. Nara-ken	408	.9	228	1.1	0.9	− 79	− 48
21. Shiga-ken	676	1.5	476	2.3	1.0	+ 119	+ 74
22. Kyōto-fu	477	1.1	269	1.3	2.5	− 873	− 540
E. Tōkaidō*	2,891	6.5	1,574	7.6	7.7	−1,275	− 788
23. Mie-ken	801	1.8	456	2.2	1.7	− 117	− 72
24. Aichi-ken	1,331	3.0	663	3.2	4.2	− 957	− 592
25. Gifu-ken	759	1.7	456	2.2	1.8	− 201	− 124

[1] After deducting waste, seed, feed, and other non-food uses.
[2] Requirements assumed to be equal to average prewar consumption for Japan.
*Without Shizuoka.

this densely populated area. A normal crop in Southwest Japan yields about 9,600,000,000 pounds, or 46.4% of the production of Japan as a whole. Of this, more than 3,000,000,000 pounds are produced in Kyūshū, 1,000,000,000 pounds in Shikoku, about 2,000,000,000 pounds each in the Honshū regions of Chūgoku-chihō and Kinki-chihō, and 1,600,000,000 pounds in Mie, Aichi, and Gifu prefectures.

On the whole, the geographical pattern of rice production coincides with the distribution of the population. Rice surpluses of any consequence are produced only in some of the less populous prefectures of Kyūshū (Saga, Kumamoto, Ōita prefectures) and around Biwa-ko in Shiga-ken. Yields per acre in Southwest Japan are very high and exceed those in northern Japan. Yields are also more dependable than in the north; owing to an equable climate, the year-to-year fluctuations in yields are slight. Rice is heavily fertilized; the consumption of nitrogenous fertilizer per acre is higher than in any other country or for any other crop.

(2) Other grains.

In a normal year, about 1,700,000,000 pounds of wheat, or more than ½ of the Japanese total, are produced in Southwest Japan. Kyūshū accounts for about 700,000,000 pounds; Chūgoku-chihō, 300,000,000; Kinki-chihō, 250,000,000; and Shikoku and the Nagoya region, about 200,000,000 pounds each. The heaviest concentration of acreage is in southern Fukuoka and northern Kumamoto prefectures and in Okayama, Hyōgo, and Kagawa prefectures, along the shores of the Inland Sea. About ½ the wheat is grown on upland, and the other ½ on irrigated land as a second crop following rice. The average yield per crop is relatively high (25 to 30 bushels per acre), and both acreage and yields were increasing before the war.

Closely competing with wheat as an upland crop are barley and naked barley, of which about 1.8 billion pounds per year are grown in the area. In addition, the area normally produces about 240,000,000 pounds of minor grains.

(3) Beans.

Soy and other beans are the principal legumes. Southwest Japan produces about 200,000,000 pounds of soybeans (¼ the total for Japan), more than ½ of which are grown in Kyūshū. The area's share in the Japanese production of other beans exceeds ⅓, and is approximately 200,000,000 pounds.

(4) Sweet potatoes and Irish potatoes.

Southwest Japan produces more than 4,000,000,000 pounds of sweet potatoes (more than ½ the total for Japan). Kyūshū alone accounts for ⅔ of the area's production. Irish potatoes are not extensively grown in the area; less than 600,000,000 of the total Japanese production of 3,500,000,000 pounds, are grown in Southwest Japan.

(5) Fresh vegetables and fruits.

Southwest Japan produces 7,000,000,000 pounds of fresh vegetables, including giant radishes, turnips, taro, watermelons,

eggplants, pumpkins, cabbage, cucumbers, carrots, musk melons, burdock, and lotus roots. Total production of fruits is 1,500,000,000 pounds, or 54% of the total for Japan. Comparatively large surpluses are produced in Wakayama-ken, which accounts for more than 10% of the total Japanese production of fruits, and in Ehime-ken in Shikoku. Mandarin oranges, persimmons, apples, pears, and plums are the principal fruits grown.

(6) *Livestock products.*

Livestock raising plays a minor role in Japanese agriculture. Southwest Japan produces only about 160,000,000 pounds of meat, or about 4 pounds per capita per annum. Ōsaka and Yamaguchi are the leading prefectures. Egg production in the area totals 266,000,000 pounds (60% of Japan's total) of which Aichi prefecture supplies nearly 30%. Milk production in Southwest Japan is only 166,000,000 pounds (about 4 pints per head per annum). Hyōgo, Ōsaka, and Aichi prefectures are the leading producers, owing to the proximity of the large urban markets of Kōbe, Ōsaka, and Nagoya. The area's total production of processed dairy products does not exceed 10,000,000 pounds, or 1/7 of the output of Japan as a whole. Hyōgo prefecture accounts for almost ½ the dairy production of Southwest Japan.

(7) *Tea.*

Japan ranks fifth in the world as a producer and exporter of tea. The area under tea cultivation was about 99,000 acres, or less than 1% of the total cultivated area in 1939.

E. Fishing industry.

Japan, before the war, was the world's foremost fishing nation. About 1½ million people were engaged in the industry. Livestock and poultry are relatively scarce, and the fishing industry must provide not only an important share of protein in the diet, but also much of the fertilizer, animal oils, fats, and skins. In prewar years, the annual fish catch of Japan proper was about 6,000,000,000 pounds (FIGURE IX - 2).

The most important fish is *iwashi* or sardine. The *iwashi* fisheries handle anchovy and round herring as well. Only a small fraction of the annual haul is taken by the canning industry, the major part being salted and dried. Three-quarters of the total fish oil value in 1938 was sardine oil. Sardine accounts for ⅔ of the annual production of fish-meal, used as fertilizers and animal feeds as well as human food. Other important sea foods are mackerel, bonito, tuna, *buri, tai,* and oysters. The Inland Sea, especially the coast of Hiroshima prefecture, and Ariake-wan in Kyūshū, are the outstanding oyster breeding regions in Southwest Japan.

FIGURE IX - 2. *Hyōgo Prefecture.*
Awaji Island, date unknown. Fishing with large nets on floats from shore. Sampan fishing craft in background.

Of Japan's 355,000 fishing vessels in 1939, 283,000 were without engines. Of those with engines, only 123 were steam-propelled; the remaining 71,516 were powered by internal combustion motors—diesels, semi-diesels, small oil and gasoline power units (FIGURE IX - 3). Only a few sailing vessels are engaged in deep-sea fishing off the Japanese coast or in the more remote fishing grounds.

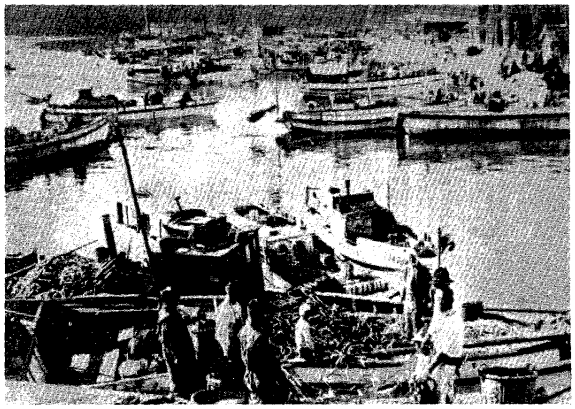

FIGURE IX - 3. *Wakayama Prefecture.*
Katsuura, 1931. Small powered fishing craft in harbor.

About ⅗ of the fishing vessels in 1939 were *isaribune,* flat-bottomed boats propelled by a scull or sails, operating within 20 or 30 miles of the shore.

Roughly 32% of the total Japanese catch was accounted for by the southwestern prefectures. The relationship between coastal fishing and deep-sea fishing in Southwest Japan (as in the country as a whole) was about 7 to 3. About ½ of the 1,500,000 persons engaged in the Japanese fishing industry in 1939 lived in the southwest. Within the area, Nagasaki-ken had by far the largest coastal catch before the war—8% of the total for Japan. Yamaguchi was the leading prefecture in the deep-sea fishing industry.

Fishing in Honshū, Kyūshū, and Shikoku is almost equally divided between coastal and deep-sea fishing. Coastal fishing is carried on in a multitude of tiny villages near good fishing areas, with little regard for quality of boat havens. Deep-sea fishing, on the other hand, is based at a few leading fishing ports with true harbor facilities. A small commercial port for deep-sea fishing in Japan resembles the older Mediterranean harbors more than it does any North American port; it is characterized by permanent stone quays, long sea-walls, and neatness of construction.

The most important fishing ports in Southwest Japan are Shimonoseki and Nagasaki. Nagoya, Ōsaka and Kōbe are im-

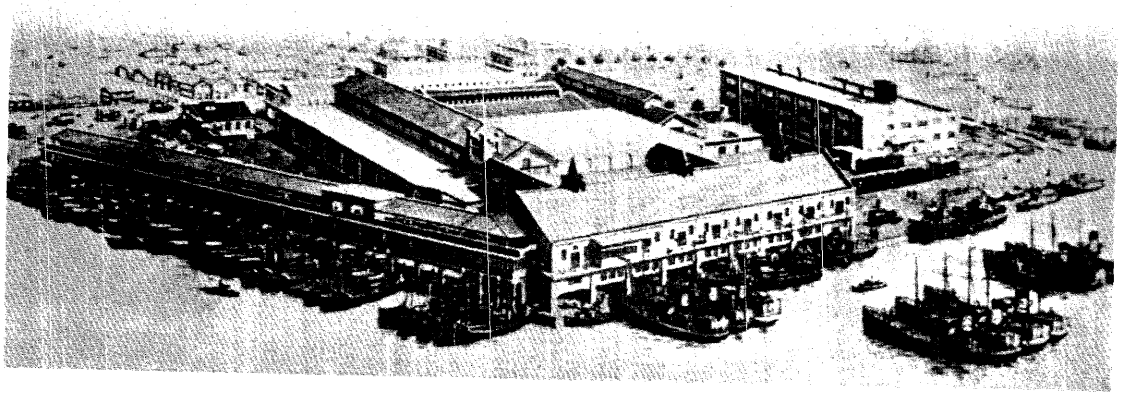

FIGURE IX - 4. *Fukuoka Prefecture.*
Tobata, date unknown. Fishing port, looking E.

portant as destinations for aquatic products and as transshipment points rather than as fishing ports.

Other important fishing ports are Katsuura (Wakayama-ken); Hiroshima (Hiroshima-ken); Takamatsu (Kagawa-ken); Muroto (Kōchi-ken); Kōchi (Kōchi-ken); Tobata (Fukuoka-ken, FIGURE IX - 4); Hakata (Fukuoka-ken); Kagoshima (Kagoshima-ken); Moji (Fukuoka-ken); Miyazaki (Miyazaki-ken); and Aburatsu (Miyazaki-ken).

F. Food products industry.

The food products industry occupies an important place in the Japanese economy. The industry accounted for 9% of the *yen* value of total factory output in 1938, and ranked fifth in importance out of 10 major industrial groups, after metals, chemicals, textiles, and machinery. With 1 exception, the various food products industries serve domestic needs. That exception is canning. Bottled or canned foods, particularly fish, vegetables, and fruits, were Japan's third largest export items in years prior to the war.

Liquor manufacture (including beer), accounted for over 32% of the *yen* value of total food industry output in 1938. In order of their importance the other industries are: milling, sweetmeats, sugar, canning and bottling, marine products (salt, seaweed, agar, etc.), dairy products, ice manufacture, starch, flour, sauces, soft drinks, and vinegar.

In 1938, 14,855 of the 25,743 Japanese food products factories were located in Southwest Japan. They accounted for almost 49% of the output—about equivalent to the proportion of the population living in this area.

The food products industries are in general distributed in proportion to population with the largest concentrations in the large industrial areas. The Kōbe-Ōsaka district is the most important; over 3,500 factories in this district produced 19% of the total Japanese output in 1938. Next in order of importance are the northern Kyūshū industrial area in Fukuoka prefecture and the district around Nagoya. However, in these areas processed food manufacture was overshadowed by other industries and it was in the rural areas, particularly on Kyūshū, that it played a leading role in the community. For example, in 1938 it accounted for over ⅓ of the total industrial output of Kagoshima prefecture.

(1) *Liquor industry.*

The largest of the food products industries, liquor manufacture accounted for ⅓ of Japan's processed food output in 1938. Southwest Japan produced nearly ⅔ of Japan's liquor supply in that year, most of it coming from the 5 leading industrial areas.

(2) *Canning and bottling industry.*

Although the canning industry accounted for less than 6% of the total value of the food products industry output in 1938, it had an important position in Japan's foreign trade, ranking third among prewar exports, after silk and cotton textiles. Japan's canning industry was the world's sixth largest. Prior to the war, Japan led the world in exports of canned marine products.

Southwest Japan is of moderate importance in the canning industry, accounting for only 37% of the value of total production. The industry is centered in Hiroshima; Kyōto, Nagasaki and Ōsaka prefectures are lesser centers.

The canning industry, by 1940, had encountered several wartime bottlenecks, which have probably become worse since that time. A shortage of boxes, wire, and other wrapping materials was evident in 1940. Deficient supplies of coal, steady rises in the prices of vegetables, fruits, fish, and dairy products also had an adverse effect on the industry; irregularity and lack of coordination in transportation added further complications.

(3) *Wheat flour.*

The westernization of Japan in years prior to 1930 largely accounts for the increased demand for wheat flour. Home production did not rise sufficiently to meet this increased demand and resulted in greater imports. By 1938, government efforts had succeeded in bringing wheat production up to almost 50,000,000 bushels and in reducing imports to 2,200,000 bushels.

According to *yen* value of production, milling ranks second among the various food products industries. In 1938 it accounted for 13.4% of the value of the total output of food products. Of the 241 privately owned flour mills operating in Japan proper in 1938, 125 were located in Southwest Japan. These factories accounted for over 44% of the value of wheat

flour production for that year. In Southwest Japan, the industry was centered in 3 prefectures: Aichi, with an output valued at almost 12% of total Japan's; Hyōgo, with 11.6%; and Fukuoka, with over 8%.

(4) *Sugar refining.*

The raising of sugar cane has remained insignificant in Japan proper, except for Okinawa and Kagoshima prefectures; most of the Empire's sugar cane has been grown in Formosa. Sugar refining was expanding in Japan before the war, but a sugar shortage has developed since 1941 because greater quantities are being converted into alcohol.

In 1938, sugar refining accounted for about 10% of the value of total food industry output. About 40% of this was produced in Southwest Japan. The industry was centered in 3 prefectures: Fukuoka, with almost 17% of the total for Japan proper; Hyōgo, with 14%; and Ōsaka, with 7.5%. In early 1944, however, a reliable source reported that all sugar refineries in Japan proper had been shut down and that Formosan mills were handling the entire cane crop.

(5) *Sweetmeats.*

The sweetmeats industry ranks third in output value accounting for 10% of the total *yen* value of the food industry in 1928. The output of this industry, including confectioneries, sweet bread, and *mizuame* (wheat gluten), was valued at about 179 million yen. Over 46% of this was produced by Southwest Japan's 1,172 plants. The industry was concentrated near its markets in the large population centers.

(6) *Other.*

Sauces, meat and dairy products, salt, seaweed and agar, ice, soft drinks, and other minor products account for the remaining ¼ of Japan's food products industry.

92. *Water Supply*

A. Natural availability.

(1) *Cold water sources.*

(a) *Runoff.* The rainfall of Southwest Japan is plentiful. However, the steep slopes result in rapid runoff and flash floods often follow heavy rains in the mountains (FIGURE IX - 52). Hence, unless adequate storage facilities are available, local shortages may occur in times of drought.

(b) *Relative importance of water sources.* Rivers supply most of the municipal waterworks, but wells are also important contributors. The ground water table is high, varying from 5 to 20 feet below the surface in plains areas, and is a large and easily accessible water source. Wells supply 30% of the homes in Ōsaka-ken and 53% of those in Kyōto-ken. Wells and irrigation storage ponds are the principal sources of supply in rural areas. Springs are numerous along the margins of lowlands but not in the lowlands themselves. Certain cold springs, notably the Tansan Spring near Kōbe, produce excellent table water which, in normal times, is exported to many parts of the world. Some localities, such as the city of Kyōto, rely on lakes for their water. Collected rain water and melted snow are small potential sources of supply.

(c) *Quality of water.* In general, the waters of the area are unsafe for drinking without treatment. The water at railway stations should be avoided. Water in which tea is steeped is not necessarily safe, because the water is not customarily brought to a boil. Even bottled waters are unreliable.

(2) *Hot water sources.*

(a) *Abundance.* Hot springs are scattered throughout Southwest Japan (FIGURE IX - 52), and some have flows so large that sizable streams and ponds are formed at the source. Some are in river beds, others on lake bottoms, and still others in caves. The most popular hot spring areas in Southwest Japan are Dōgoyuno on the island of Shikoku, and Beppu and Unzen on Kyūshū. At Beppu alone, there are over 1,000 baths, and natural hot water is so abundant that it is provided at the station for washing, and is piped to many private houses, to every school, to the police station, and to the prison.

(b) *Therapeutic qualities.* The hot springs of the region are beneficial to a great many diseases and ailments. For example, those at Misasa in Tottori-ken are rated high for the treatment of neuralgia and rheumatism. Spring waters are used primarily for bathing, but some are taken internally. There are a number of large bottling plants in the area.

(c) *Chemistry.* Every known chemical element of the hot springs of the world is found in the waters of this region. Simple thermal and salt springs predominate, but alkaline and carbonate varieties are numerous. A number are radioactive, and those at Misasa are the second most active in the world.

B. Developed sources.

(1) *Abundance of waterworks.*

Most of the cities with a population of 10,000 or more have modern waterworks (FIGURE IX - 52). Available information indicates that there are about 350 waterworks in the region, of which about 225 are in southern Honshū, 75 in Kyūshū, and 50 in Shikoku. The per capita supply averages between 20 and 25 gallons per day. This average is low compared to that of American cities, as the Japanese are more frugal with their supplies.

(2) *Quality of waterworks.*

Waterworks of recent construction compare favorably with those in the U. S. Except in the largest cities, however, the water itself is probably inferior. This is suggested by the recommended use of filter equipment in the home, and by the higher incidence of intestinal disease in smaller cities and towns than in rural districts. The typhoid epidemic of 1931 in Nagasaki was attributed to pollution of the municipal water supply. Instances of pollution are not surprising, because some cities are forced to draw water from rivers at points fairly close to sewage outlets of other cities. The intake for Ōsaka, for example, is only 20 miles downstream from the sewage outlet for Kyōto The danger in Ōsaka, however, is considerably lessened by treating the sewage before it is discharged into the river.

(3) *Municipal water sources.*

As indicated above, most of the water supply systems derive their water from rivers. Others rely on drilled wells, springs, or lakes. In all cases, dug wells contribute to the supply. The brackish character of the ground water in the vicinity of some cities, such as Kōbe, has forced them to depend on distant sources for their entire supply.

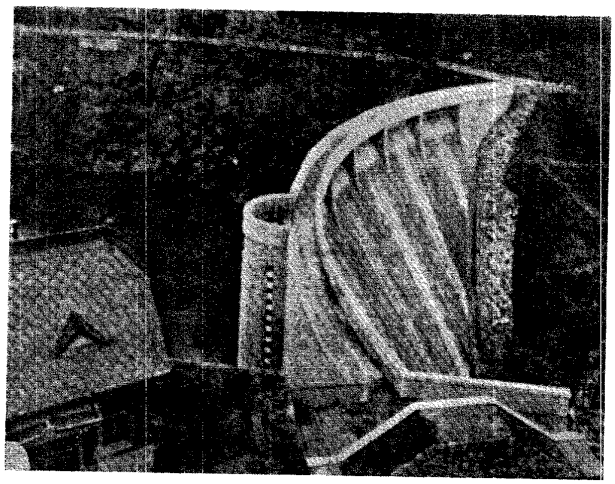

FIGURE IX - 5. *Hyōgo Prefecture.*
Himeji, 1931. Dam and reservoir of Himeji water supply system.

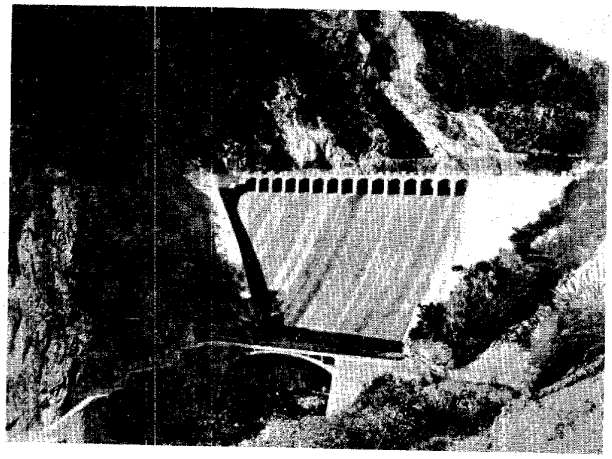

FIGURE IX - 6. *Hyōgo Prefecture.*
Sengari Dam of Kōbe water supply system, 1927. One of the 3 dams in Kōbe's water system. The reservoir behind the dam is 3 miles long.

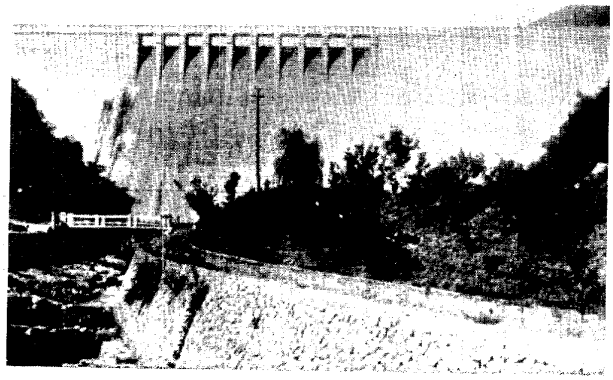

FIGURE IX - 7. *Nagasaki Prefecture.*
Kogakura Dam of Nagasaki water supply system, date unknown.

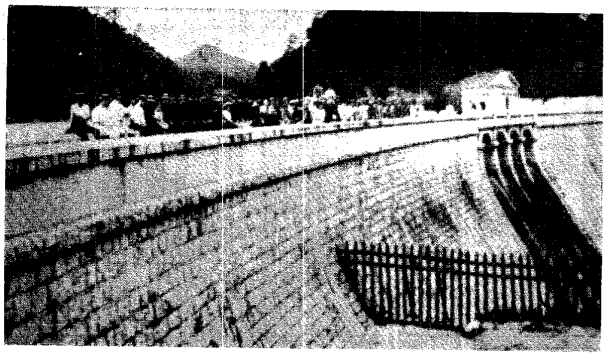

FIGURE IX - 8. *Hyōgo Prefecture.*
Karasuwara Dam of Kōbe water supply system, date unknown. An example of a cut-stone dam and one of the 3 dams in Kōbe's water system.

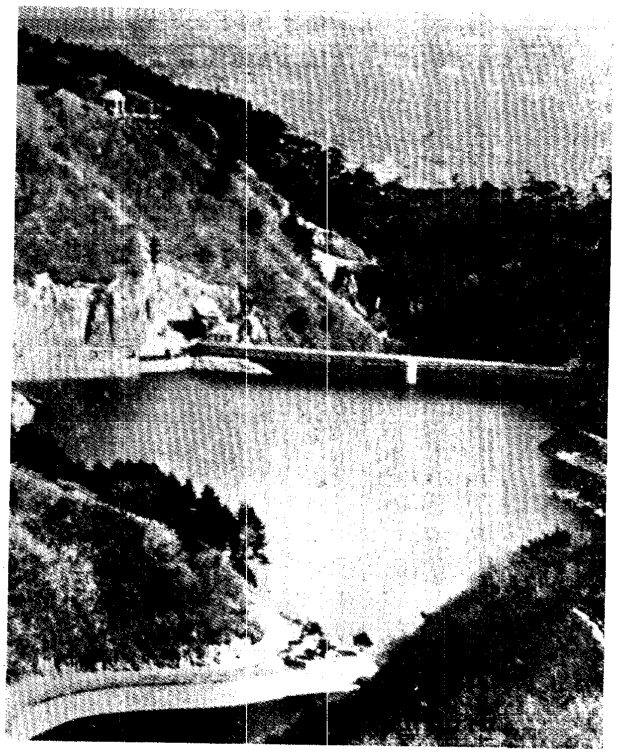

FIGURE IX - 9. *Hyōgo Prefecture.*
Nunobiki Reservoir, before 1938. One of the 3 dams in Kōbe's water system. City of Kōbe in background.

(4) ***Dams.***

Modern dams, built to withstand earthquake shocks, impound many rivers. The dams are of concrete, cut stone, or earth (FIGURES IX - 5 to IX - 8). The ratio of breadth to height is greater than in American dams, 0.85 as compared to 0.69.

(5) ***Reservoirs.***

The reservoirs are generally small, because of the steep and narrow valleys in which the dams are located (FIGURE IX - 9). Hence, water shortages sometimes occur in times of drought even in principal cities, and water has to be rationed. At such times fire hazards are great. The water pressure in many cities is quite high because of the location of the reservoirs in the mountains.

(6) Intakes.

River waters are extracted by several methods. Ōsaka pumps its water directly from a river. Other cities employ either simple underwater or novel subterranean intakes. The latter consist of either a single long pipe or gallery, or a network of these beneath the river bed. The Ube intake, for example, consists of a perforated reinforced concrete pipe of triangular cross-section, about 2 feet deep and 450 feet long. This pipe, buried 6 to 7 feet beneath the river bed, is blanketed with sand so that the water is filtered on its way into the pipe. There are 4 manholes for observation and for removal of sand. Other cities employing such subterranean intakes are Wakayama and Kōchi.

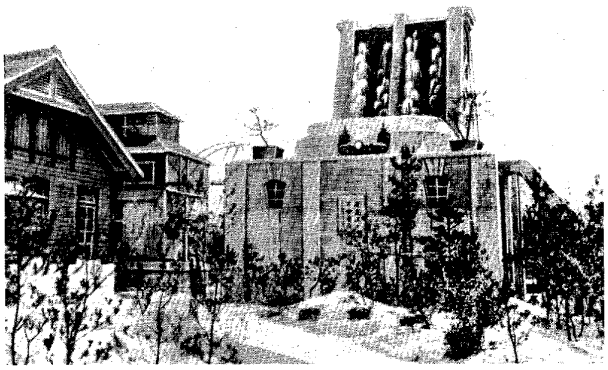

FIGURE IX - 10. *Saga Prefecture.*
Saga, 1927. Water storage tower and aeration plant. Steel and concrete tower 43 feet high.

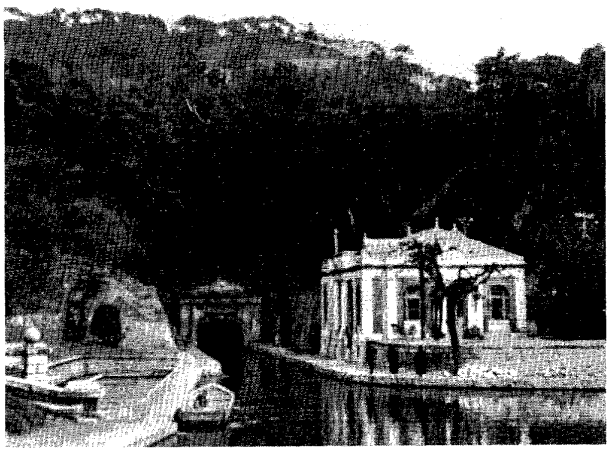

FIGURE IX - 11. *Kyōto Prefecture.*
Between Biwa-ko and Kyōto, date unknown. Section of one of the 2 tunnels conducting water to Kyōto.

(7) Drilled wells.

Drilled wells are second in importance to rivers as sources of municipal water supplies. Saga, for example, is supplied by 3 deep wells, with pumps, small storage ponds, and rapid filtering machines at each well. A view of Saga's concrete water storage tower appears in FIGURE IX - 10. Some cities have flowing wells at which pumping is unnecessary.

(8) Dug wells.

Dug wells contribute to the supply of all cities. Wakayama, which derives the greater part of its supply from a river, has more than 34,000 such wells.

(9) Lakes.

A small number of localities use lake water. The most noteworthy example is the city of Kyōto which gets its water from Biwa-ko by way of 2 large canals about 7 miles long. The canals are tunneled through intervening mountains (FIGURE IX - 11).

(10) Purification systems.

The purification systems of Southwest Japan are also up-to-date (FIGURES IX - 12, IX - 14, IX - 15 and IX - 17). Some of the installations are laid out in circular plan in order to conserve space. Plants which employ alum as a coagulant have mixing basins. Both the mixing basins and the settling basins are of the baffle-chamber type, in which parallel partitions or baffles force the water into circuitous paths. Both slow and rapid sand filters are used (FIGURE IX - 16). Unlike the American type, however, many of the Japanese filters are exposed and susceptible to additional bacterial contamination (FIGURES IX - 13 and IX - 14). Chlorination and aeration are not so widely used in Japan as in the U. S. FIGURE IX - 15 shows one of the few aeration ponds in this region. In some plants the water is sterilized by ozonization.

(11) Table of waterworks.

The available information on 54 of the 73 waterwork systems mapped in FIGURE IX - 52 is summarized in TABLE IX - 5. The cities are arranged alphabetically under their prefectures, the prefectures of Kyūshū being considered first, those of Shikoku next, and those of Honshū last. Much of the information is no later than 1927 and should be evaluated accordingly. Aerial photographic interpretation data as of June 1944 are included in the Remarks column.

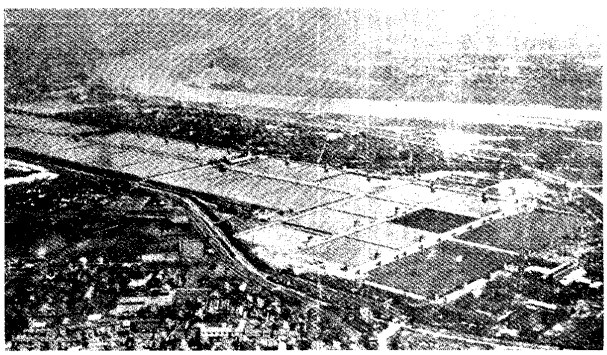

FIGURE IX - 12. *Ōsaka Prefecture.*
Ōsaka, 1936. Kunijima water purification plant of Ōsaka's system.

FIGURE IX - 13. *Ōita Prefecture.*
Ōita, 1936. Water purification plant

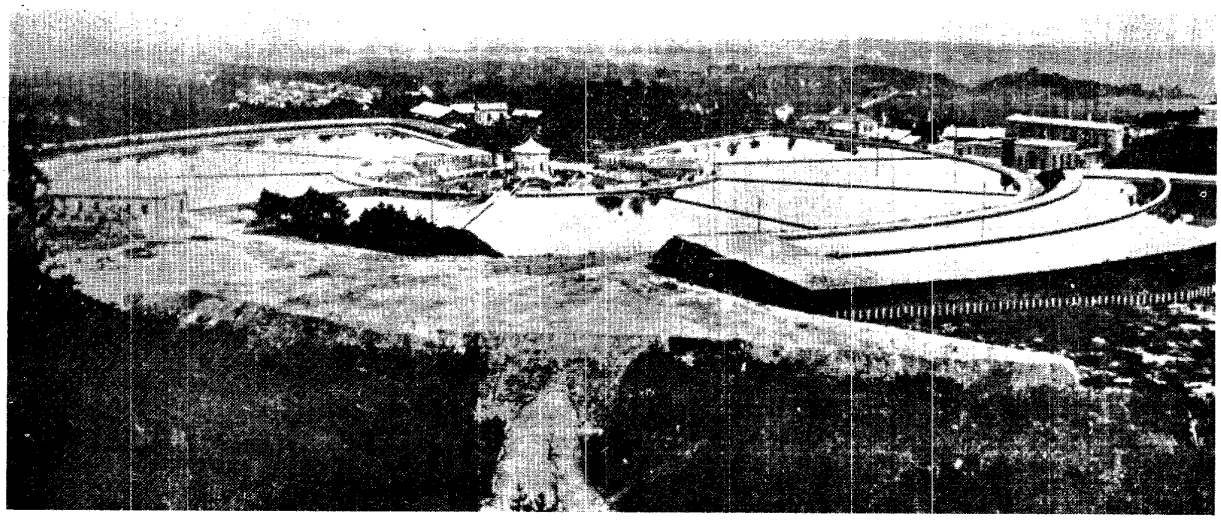

FIGURE IX - 14. *Hyōgo Prefecture.*
Kōbe, before 1930. Filtration plant of Kōbe's system at Uegahara. Eight slow sand ponds, 8 rapid sand filters, and 2 arcuate settling ponds.

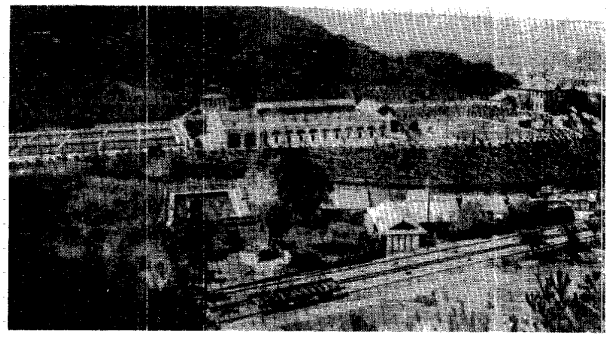

FIGURE IX - 15. *Kyōto Prefecture.*
Kyōto, 1920. Water purification plant at Kwacho Hill supplied with water from Biwa-ko. The mixing or settling basins at left are of the baffle-chamber type.

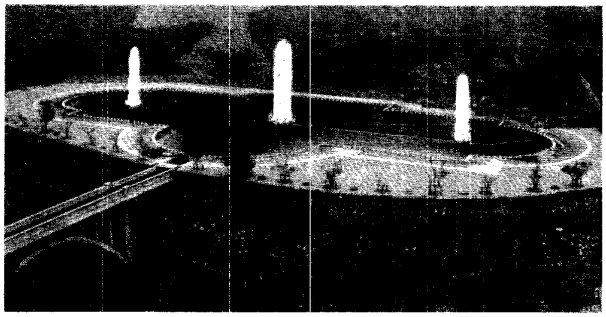

FIGURE IX - 17. *Fukuoka Prefecture.*
Yawata, date unknown. Aeration pond about 4 miles south of Yawata. In addition to the 3 large fountains, there are 300 small jets around the margin of the pond.

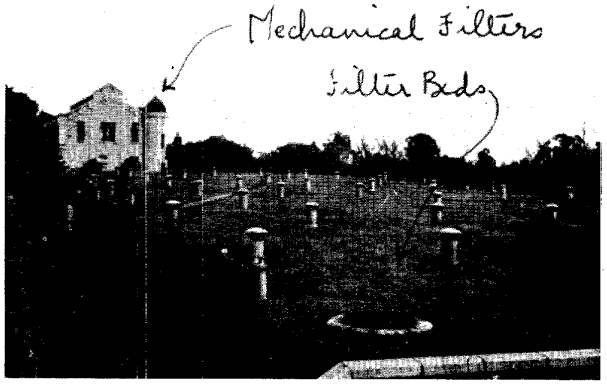

FIGURE IX - 16. *Hyōgo Prefecture.*
Kōbe, date unknown. Okuhirano waterworks of Kōbe's system. Building houses mechanical filters; slow sand filters in foreground under cover. The protruding pipes are ventilators.

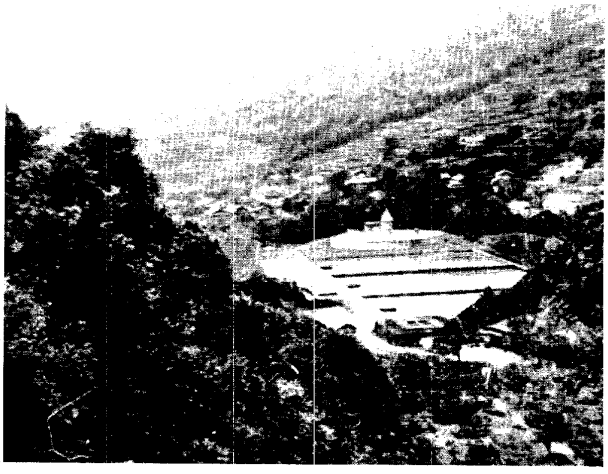

FIGURE IX - 18. *Nagasaki Prefecture.*
Near Nishiyama, date unknown. Part of Nagasaki's water purification system.

TABLE IX - 5.
WATERWORKS OF SOUTHWEST JAPAN*

CITY (PREFECTURE) ISLAND	DATE OF INFORMATION	POPULATION SERVED	PER CAP. (GPD)	SOURCE	SOURCE INSTALLATIONS H: HEIGHT L: LENGTH T: THICKNESS (TOP - BOT)	PURIFICATION FACILITIES	CLEAR WATER RESERVOIRS	REMARKS**
Fukuoka Fukuoka-ken Kyūshū	1927	320,000	26	Muromi-gawa	Dam H: 102′, L: 416′ T: 13′ - 87′	2 storage reservoirs, total cap. 81,697 cu. ft., 4 filter ponds.	2 reservoirs, total capacity 207,500 cu. ft.	System has high head. 32,366 dug wells. Well water brackish.
Kokura Fukuoka-ken Kyūshū	1927 (see remarks)	60,000	27	Kiyotaki-gawa and Hata-gawa	2 dams (1) cap. 22,095 cu. ft. (2) H: 85′, L: 370′ T: 18′ - 429′	4 slow sand filter ponds	2 reservoirs, total capacity 136,792 cu. ft.	Intake tower 71.4′ high near one dam. 9,240 dug wells. Kokura (including Tobata) 1. Dam: 500′ Reservoir: 1000′ x 4900′. Five miles SW of Kokura. 2. Dam: 250′. Reservoir: 350′ x 800′. Two miles W of Kokura. 3. Three reservoirs, SE side of Kokura: Dams: 250′, 300′ and 400′. Reservoirs, 300′ x 600′, 400′ x 1200′, and 550′ x 2500′. 4. Six basins, 1 mile W of Tobata. a. One: 150′ x 225′ b. One: 75′ x 100′ c. Four: 85′ x 85′
Kurume Fukuoka-ken Kyūshū	1927	100,000	30	Chigo River		3 settling ponds total capacity 405,075 cu. ft. 4 filtering ponds	2 reservoirs total capacity 155,088 cu. ft.	
Moji Fukuoka-ken Kyūshū	1927	80,000	22	Kuro-gawa	Dam H: 96′, L: 405′	2 storage areas: (1) 26,925 cu. ft. (2) 3,373,372 cu. ft. 5 slow sand filters.	2 reservoirs, total capacity 235,224 cu. ft.	19,040 hydrants, 4,895 dug wells. Additional system for Takachi district, cap. 1,906 cu. ft.
Ōmuta Fukuoka-ken Kyūshū	1927	61,000	30	Deep wells (1) 473′ (2) 283′ (3) 460′	Circular bricked wells, strainer pipe at bottom.	Kandy type English filtering machines	Reservoir, cap. 136,864 cu. ft.	Very good water. 750 dug wells.
Wakamatsu Fukuoka-ken Kyūshū	1927	50,000	30	River	Dam H: 70′, L: 475′ T: 50′.	Coagulation pond, cap. 596,400 cu. ft. 7 filter ponds	2 reservoirs, total capacity 146,200 cu. ft.	Large complex systems. Max. supply 294,600 cu. ft., 39,280 cu. ft. not filtered. Undersea forwarding pipe often troublesome.
Yawata Fukuoka-ken Kyūshū	1927 (see remarks)			Onga-kawa	Dam. Kawachi cap. 220,840,000 cu. ft.	2 coagulation ponds (one for Yawata city). 4 reservoir ponds, one for sea water, for emergency use. Aeration pond.	Reservoirs, total capacity 168,150 cu. ft.	System belonging to steel plant also supplies city. Factory water also reclaimed. Ozonization 12,883 dug wells. Yawata (incl. Kurosaki) 1. Reservoir (850′ x 2600′) and 3 settling basins (two, 120′ x 120′, one 85′ x 110′) on south side Yawata. 2. Otani Reservoir, 550′ x 600′, with 3 settling basins (one, 60′ x 145′, two 60′ x 120′), on south side Yawata. 3. Reservoir, 375′ x 500′. South side of Yawata. 4. Four reservoirs, 300′ x 550′ to 850′ x 2000′, with 2 settling basins 100′ x 175′. SW of Kurosaki. 25 smaller reservoirs in same area.
Kagoshima Kagoshima-ken Kyūshū	1927	100,000	22	5 flowing wells	Intake well, 23.7 ft. square 6.9 ft. deep		2 reservoirs, total cap. 187,162 cu. ft.	
Kasanohara Kagoshima-ken Kyūshū	1927	8,500	10	Takakawa (River)		Filter pond near dam		
Miyanojō Kagoshima-ken Kyūshū	1927	3,000	22	Drilled well			Distribution pond near well.	Very clear, cold water.

*All large numbers rounded off.
**In some cases, public hydrants are probably only spigots.
Bracketed data under "Remarks" is from a late Photo Intelligence report and may or may not refer to installations listed in the table proper.

TABLE IX - 5. (*Continued*)

CITY (PREFECTURE) ISLAND	DATE OF INFORMATION	POPULATION SERVED	PER CAP. (GPD)	SOURCE	SOURCE INSTALLATIONS H: HEIGHT L: LENGTH T: THICKNESS (TOP - BOT)	PURIFICATION FACILITIES	CLEAR WATER RESERVOIRS	REMARKS**
Kumamoto, Kumamoto-ken Kyūshū	1927	200,000	30	2 flowing wells	Concrete structures		2 reservoirs, total cap. 264,680 cu. ft.	2,357 fire hydrants. 10,428 dug wells.
Ushibuka Kumamoto-ken Kyūshū	1927	6,000	22	Runoff		Settling pond	Reservoir	39 public hydrants. 26 fire hydrants.
Aburatsu Miyazaki-ken Kyūshū	1927			Drilled well				
Kannoura Nagasaki-ken Kyūshū	1927	2,500	22	Ushigome River				
Nagasaki Nagasaki-ken Kyūshū	1938	200,000	20	Nakajima-gawa and Shikao Rivers, and wells.	4 Dams (1) H: 55', L: 407', T: 20' (Top). cap. 12,396,300 cu. ft. (2) H: 74', L: 378', T: 10' (Top) cap. 7,802,287. (3) H: 104' cap. 51,853,977 cu. ft. (4) H: 134', L: 445', T: 10' (Top), cap. 66,287,046 cu. ft.	9 slow sand filter ponds	2 reservoirs, one circular, total cap. 245,438 cu. ft. 2 other reservoirs, one for irrigation, capacities unknown.	System designed for popul. of 269,000. Typhoid epidemic 1931, attributed to polluted water. 870 wells.
Sasebo Nagasaki-ken Kyūshū	1927 (see remarks)	120,000	30	Ono-gawa and Aiuta Rivers	Naval Base System.	5 filter ponds	(1) Naval Base Reservoir, cap. 1,840 cu. ft. (2) Reservoir, cap. 58,576 cu. ft.	252 public hydrants. 268 fire hydrants. 2,100 dug wells. Photo Intelligence, 1944: 3 reservoirs NE of Sasebo, all impounded by dams. (1) Dam: 1000' long. Reservoir: 800' x 1200'. (2) Dam: 500'. Reservoir: 450' x 950'. (3) Dam: 500'. Reservoir: 500' x 1000'.
Takeshiki Nagasaki-ken Kyūshū	1927	506(?)	30	Takeshiki Naval waterworks.				14 public hydrants. 8 fire hydrants. 10 private hydrants.
Tomie Nagasaki-ken Kyūshū	1927	7,000	30	Stream at Saramoyama				
Beppu Oita-ken Kyūshū	1943							Water obtained from Oita-ken plant, which is *not* source of water for Oita city.
Oita Oita-ken Kyūshū	1927	100,000	20	Oita-gawa	Concrete pipe intake	4 filter ponds and other installations	2 reservoirs, total cap. 112,572 cu. ft.	Fire hydrants spaced at intervals of 328'.
Hamasaki Saga-ken Kyūshū	1944			Wells			Better homes have small water tanks.	Adequate supply.
Saga Saga-ken Kyūshū	1927			3 deep wells	Pumps, filtering machines.	3 rapid filtering machines. Water aerated.	3 reservoirs, one at each well. Total capacity 14,730 cu. ft.	43' high storage tank 2 distribution pumps. 25 fire pumps.
Takeo Saga-ken Kyūshū	1927	5,000	22	Well				
Nagahama Ehime-ken Shikoku	1927	5,000	22	Stream near Kitanada	Dam H: 49'	3 filter ponds	Concrete reservoir, cap. 6,210 cu. ft.	
Tadotsu, Ehime-ken Shikoku	1927	2,850	20	Drilled well			Wooden reservoir tank, 25' high, cap. 7,940 cu. ft.	Privately owned system.
Uwajima, Ehime-ken Shikoku	1927	45,000	20	Suga River	Stone dam. H: 6', L: 48', T: 6' (Top)	Coagulation treatment 2 settling ponds, total cap. 50,515 cu. ft. 8 rapid sand filters.	2 reservoirs, total capacity 66,235 cu. ft.	Gov't owned forest surrounding intake basin. Clear, pure water.

** In some cases, public hydrants are probably only spigots.

TABLE IX - 5. (*Continued*)

CITY (PREFECTURE) ISLAND	DATE OF INFORMATION	POPULATION SERVED	PER CAP. (GPD)	SOURCE	SOURCE INSTALLATIONS H: HEIGHT L: LENGTH T: THICKNESS (TOP - BOT)	PURIFICATION FACILITIES	CLEAR WATER RESERVOIRS	REMARKS**
Takamatsu, Kagawa-ken Shikoku	1927	34,000	30	Koto River and 3 drilled wells	Intake dam H: 6', L: 477', T: 5'. Mechanical filters.	3 filter ponds. 3 mechanical filters at wells.	2 reservoirs, total capacity 74,132 cu. ft.	Infiltration pipe beneath river bed.
Kōchi, Kōchi-ken Shikoku	1927	80,000	30	Kagami-gawa	Dam Long infiltration pipe.	3 filter ponds	2 reservoirs, total capacity 78,060 cu. ft.	Infiltration pipe, beneath river bed. Very good water. 1,759 public hydrants. 210 fire hydrants
Tokushima, Tokushima-ken Shikoku	1927	80,000	30	Yoshino-gawa	Buried intake pipe and 6 intake wells.	2 filter ponds located in filled area, covered with 1' of soil.	2 reservoirs, supply 138,680 cu. ft. of water to 80,000 people in 11 hours.	476 fire hydrants.
Nagoya, Aichi-ken Honshū	1938	470,049	45	Kiso-gawa	Intake 17 mi. N of Nagoya. Reservoir 1 mi. below intake. Hexagonal intake tower in reservoir.	Large settling reservoir near Torii-matsu. 10 modern slow sand filters at Nagoya.	2 reservoirs, total capacity 623,700 cu. ft. Small water tower.	Ample supply, good water. 37,432 hydrants. 2,705 fire hydrants.
Toyohashi Aichi-ken Honshū	1942							Daily supply 35,500 gals. per day.
Hiroshima (city) Hiroshima-ken Honshū	1927	250,000	30	Ōta-gawa 1.8 mi. north of city	Elliptical intake tower	3 settling basins, total cap. 16,000,000 gal. 7 slow sand filters.	5 reservoirs total cap. 384,000 cu. ft.	33,008 hydrants. 2,671 fire hydrants.
Hiroshima Military waterworks Hiroshima-ken Honshū	1927	160,000	22	Ōta-gawa	2 stone intake structures	2 concrete settling ponds, total cap. 158,386 cu. ft. 5 concrete filtering ponds.	3 reservoirs total cap. 49,765 cu. ft.	285 public hydrants. 684 fire hydrants.
Kure (city) Hiroshima-ken Honshū	1927	150,000	22	Nika River	Dam Siphon and tunnels at Yakeyama	Small settling pond. 4 filter ponds (Washomachi Valley)	2 reservoirs total cap. 183,024 cu. ft.	
Kure Military waterworks Hiroshima-ken Honshū	1927			Nika River	Intake same as Kure city (above)	Water purified (no details)		Supply for military reservation and barracks.
Himeji Hyōgo-ken Honshū	1937				Dam, high concrete arch structure.			Capacity of system 3,100,000 gallons per day.
Kōbe Hyōgo-ken Honshū	1935		42	River	3 dams: (1) Nunobiki, H: 100', cap. 2,700,000 cu. ft. (2) Karasuhara cap. 51,700,000 cu. ft. (3) Sengari, H: 120', cap. 213,000,000 cu. ft.	3 filter plants: (1) Kitano: slow filter (2) Okuhirano: slow and rapid filter (3) Kamigahara: Circular plan, arcuate settling reservoir, 8 slow and 8 rapid filters.	5 reservoirs total cap. approx. 5,200,000 cu. ft.	Hydroelectric stations tied in with water supply source in Rokkō-zan. Adequate fire protection.
Nishinomiya Hyōgo-ken Honshū	1927	60,000	30	Muko-gawa	Intake filter pipe	2 settling ponds, total cap. 271,660 cu. ft. 2 filtering ponds	2 reservoirs total cap. 264,640 cu. ft. Daily supply for 60,000 popul.	3,788 hydrants.
Toyooka Hyōgo-ken Honshū	1927	15,000	22	Drilled wells	Small pumping pond, cap. 720 cu. ft.		2 reservoirs, total cap. 16,533 cu. ft.	Abundant good water.
Kyōto Kyōto-fu Honshū	1938	765,000	30	Biwa-ko	2 tunnels lead water to city.	Covered coagulation basin, cap. 1,500,000 gals. 2 filtering plants (1) 20 rapid filters (2) 5 slow sand filter ponds	2 reservoirs (1) Cap. 300,000 cu. ft. (2) Cap. unknown	One of largest mechanical filtering plants in Japan.
Kurashiki Okayama-ken Honshū	1927	25,000	30	5 drilled wells	Mortar-lined wells		Reservoir, cap. 2,300 cu. ft.	65 public hydrants. 86 fire hydrants.

** In some cases, public hydrants are probably only spigots.

TABLE IX - 5. (*Continued*)

CITY (PREFECTURE) ISLAND	DATE OF INFORMATION	POPULATION SERVED	PER CAP. (GPD)	SOURCE	SOURCE INSTALLATIONS H: HEIGHT L: LENGTH T: THICKNESS (TOP - BOT)	PURIFICATION FACILITIES	CLEAR WATER RESERVOIRS	REMARKS**
Okayama Okayama-ken Honshū	1927	180,000	45	Asahi-gawa	Infiltration pipe	4 settling ponds 8 filter ponds, total cap. 430,597 cu. ft.	4 reservoirs cap. of 2: 89,642 cu. ft. Other 2, circular: 67 ft. diam., 13 ft. deep.	City has fire fighting equipment.
Saidaiji Okayama-ken Honshū	1927	10,000	30	Yoshii-gawa	Dam. Infiltration pipe. Collecting well near dam, cap. 5,760 cu. ft.			1,560 hydrants.
Tamashima Okayama-ken Honshū	1927	5,040	22	8 drilled wells	Bamboo pipes inserted in wells for jets.	Settling pond. Filter ponds.		57 hydrants. 76 fire hydrants.
Ōsaka Osaka-fu Honshū	1938	3,300,000	46	Yodo-gawa (Outlet of Biwa-ko	Suction towers at intake, grit chamber and pumps.	Coagulation basin 10 settling basins 24 slow sand filters 13 rapid sand filters Chlorination system 6 sand cleaning beds.	4 reservoirs	Kunijima Filter Plant of Ōsaka one of largest in Japan. Supplies 153 million gals. daily. Park-like area. Good quality water.
Sakai Osaka-fu Honshū	1927	100,000	30	Ōsaka water system and drilled well 933 ft. deep.		Well water jetted to eliminate ammonia. 3 settling ponds. Coagulant added. 6 rapid sand filters.	Reservoir, cap. 59,640 cu. ft.	8,872 hydrants.
Matsue Shimane-ken Honshū	1927	50,000		Imube River		No settling. 4 filter ponds.	Reservoir, cap. 72,089 cu. ft.	10,051 hydrants.
Tottori Tottori-ken Honshū	1927	50,000	24	Fukuro-kawa River	Dam H: 89', L: 338', T: 8' - 64', cap. 18,577,440 cu. ft.	4 filter ponds	2 reservoirs, total cap. 49,100 cu. ft.	6,797 hydrants.
Gobō Wakayama-ken Honshū	1927	600	22	Well			Steel tank, cap. 397 cu. ft.	
Wakayama Wakayama-ken Honshū	1927	150,000	30	Kino-kawa	Infiltration pipe, intake well.	6 filter ponds.	Reservoir, cap. 131,588 cu. ft. 10 hours supply for 150,000 people.	215 hydrants. 34,117 dug wells.
Onoda Yamaguchi-ken Honshū	1938	12,000	25	Kōto-gawa	Gotagase Dam		Water tower 358 yds. below dam.	Gotagase Dam is source of irrigation water for Ube.
Shimonoseki Yamaguchi-ken Honshū	1938 (see remarks)	87,299	30	Junction of 3 streams	Dam. H: 69', L: 279', T: 24' (Top). Circular intake. 2 other smaller dams.	Impounding and settling reservoir, cap. 286 million gals. 3 slow sand filter ponds.	2 reservoirs.	15,066 hydrants. 3,870 dug wells. Well water bad. Photo Intelligence, 1944: (1) Reservoir, approx. 100 x 500, N side of town. (2) Two reservoirs 75 x 250, W side of town. (3) Filtration plant near center of town: 3 beds: 85' x 100'. 1 bed: 175' x 250'. 1 bed: 120' in diameter. (4) Filtration plant near center of town: 2 beds: 100' x 130'.
Ube Yamaguchi-ken Honshū	1927	70,000	33	Kotō-gawa	Infiltration pipe in river bed below Gotagase Dam.	Settling pond, cap. 111,000 cu. ft. 3 filter ponds.	Reservoir top of Kaitate-yama covered with soil. Cap. 50,000 cu. ft.	Former well supply brackish, uncertain, and polluted. 138 fire hydrants.
Yanai Yamaguchi-ken Honshū	1927	2,000	16	Drilled wells and streams				

** In some cases, public hydrants are probably only spigots.

93. *Construction Materials*

Lumber is a relatively more important construction material in Japan than in the western world. Primarily brick residential areas are scarce, as are reinforced concrete industrial buildings. Most large industrial plants built in the last decade are of modern reinforced concrete construction, but most older factories are of brick and wood construction. Most commercial establishments are of wood-frame construction, often with brick facings; while most residences are of wood, generally with paper ceilings and partitions, and often with tile roofs.

Southwest Japan has about ⅓ the total Japanese timber reserves of 49,000,000 acres but turned out in 1939 a little over ½ the cut timber. Its supply of temperate-zone conifers—the best construction lumber in Japan—is quite limited. Of the other principal construction materials, Southwest Japan was responsible in 1938 for ⅔ of cement, largely Portland; 80% of the brick; 72% of the tile; and 45% of structural steel production by value.

Timber stands are widely scattered. Brick and tile production are more concentrated near satisfactory clays; cement production is centered near coal, limestone, or blast furnace slag. Structural steel capacity is even more centralized in the two great steel centers of this area, the Yawata-Tobata and the Ōsaka-Kōbe industrial districts.

Kyūshū is well supplied with construction materials. Although not as well-developed as in other areas of Japan, the timber stands of southeastern Kyūshū are large (1,300,000 acres in Miyazaki-ken). Fukuoka and Oita prefectures in northern Kyūshū are centers of cement production (29% of Japan's production, 1937), and Fukuoka of brick (18% of all Japan, 1938) and structural steel production. Shikoku has no important construction material activity.

The westernmost part of Honshū is important for cement plants (Yamaguchi-ken), lumber (Hiroshima-ken has reserves of 1,000,000 acres), and brick (Okayama-ken).

The central industrial belt has a varied construction material industry with substantial lumber resources north of Nagoya in Gifu prefecture; very important tile centers around Nagoya producing in 1938 over 30% of total Japanese output; and structural steel production (30% of Japan's total) and brick production (12%) in the Ōsaka district. Although there are a number of cement plants in this region, cement is not an important part of its industrial output.

Okayama-ken produced in 1938 almost 30% of Japan's bricks.

TABLES IX - 6 and IX - 7 list the most important structural steel and cement producers in Southwest Japan. Cement plants and some of the brick plants in this area are located in FIGURE IX - 56, and the steel mills in FIGURE IX - 54. Sawmills are too small and too numerous to list, but the number in each prefecture in 1938 is shown in FIGURE IX - 53.

TABLE IX - 6.
MAJOR STRUCTURAL STEEL PRODUCERS, SOUTHWEST JAPAN, 1944

PREFECTURE AND LOCATION	COMPANY
Kyūshū	
Fukuoka-ken	
Kokura	Kokura Seiko KK
Yawata	Nippon Seitetsu KK
Wakamatsu	Tokai Kogyo KK
Southwest Honshū	
Hyōgo-ken	
Amagasaki	Amagasaki Seikosho KK
Amagasaki	Nichia Seiko KK
Amagasaki	Sumitomo Kinzoku Kogyo KK
Kōbe	Kōbe Seikosho KK
Ōsaka-fu	
Ōsaka	Nakayama Seikosho KK
Ōsaka	Nippon Seitetsu KK

TABLE IX - 7.
MAJOR CEMENT PLANTS IN SOUTHWEST JAPAN, 1938

PREFECTURE AND LOCATION	COMPANY	ANNUAL CAPACITY (METRIC TONS)
Kyūshū		
Ōita-ken		
Tsukumi-machi	Onoda Cement KK	245,000
Saeki-machi	Asano Cement KK	345,000
Fukuoka-ken		
Moji	Asano Cement KK	740,000
Kawara-machi, Tagawa-gun	Asano Cement KK	385,000
Kokura	Toyo Cement KK	360,000
Moji	Hokoku Cement KK	400,000
Kumamoto-ken		
Yatsushiro	Asano Cement KK	290,000
Shikoku		
Kōchi-ken		
Kōchi	Asano Cement KK	480,000
Southwest Honshū		
Yamaguchi-ken		
Onoda-machi	Onoda Cement KK (FIGURE IX - 19)	315,000
Ube	Ube Cement KK	1,100,000
Ōsaka-fu		
Ōsaka	Ōsaka Yogyo Cement KK	1,800,000
Ōsaka	Asano Cement KK (FIGURE IX - 20)	420,000
Ōsaka	Onoda Cement KK	290,000
Aichi-ken		
Higashi, Fujiwara-mura	Onoda Cement KK	340,000

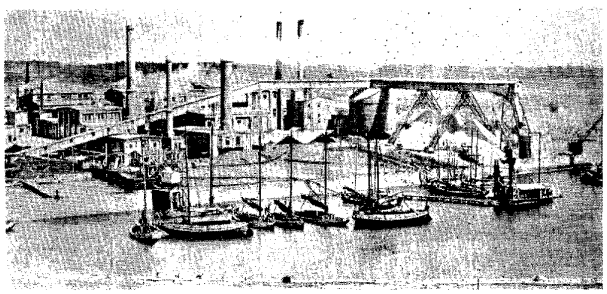

FIGURE IX - 19. *Yamaguchi Prefecture.*
Onoda, date unknown. Onoda Cement K. K. plant. One of a half-dozen plants owned by one of the 2 largest cement companies in Japan.

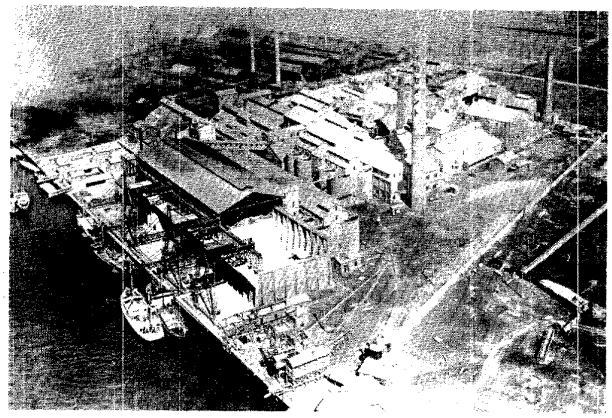

FIGURE IX - 20. *Ōsaka Prefecture.*
Ōsaka, date unknown. Airview of plant of Asano Cement K. K., one of the largest cement plants in Japan.

94. *Industrial Raw Materials and Primary Processing*

A. Minerals.

(1) *Iron-bearing ores.*

Difficulties in obtaining adequate supplies of iron ore have prevented blast furnaces and steel mills in Japan proper from operating at full capacity and thus have constituted a major obstacle to rapid growth of Japan's war economy. Exploitation of iron-bearing ores within the islands meets only a small part of the country's needs, imports of ore and pig representing over 80% of the current supply of iron. Deposits of magnetite, the usual source of iron, are scarce in Japan and iron pyrites are an important additional domestic source of iron. Magnetite was not mined in Southwest Japan in 1935, though small deposits are known to exist in Okayama-ken (Koshino Field), in Hyōgo-ken (Karawada Field) and in Nara-ken (Doroyawa Field). However, this area is the source of nearly ¼ of the Japanese supply of pyrites, important to both the iron and the chemical industries (Topic 95, A, B).

Two mines responsible in 1935 for 45% of Japanese iron pyrite production are of importance in view of Japan's short iron ore position and her dependence on imports. They are the Yanahara mine in Okayama-ken in Honshū, and the Besshi mine near Niihama in Ehime-ken in Shikoku. TABLE IX - 8 gives production of iron pyrites by prefectures in Southwest Japan. Many of the deposits contain some copper. Besshi is of some importance in this respect (Topic 94, A, (3)). Yields of iron vary widely, with 40% as an upper limit.

TABLE IX - 8.
IRON PYRITES PRODUCTION IN SOUTHWEST JAPAN, 1935

ISLAND AND PREFECTURE	PRODUCTION (IN METRIC TONS)	% OF TOTAL JAPAN
Kyūshū		
Miyazaki	48,763	3.53
Kagoshima	17,773	2.57
Honshū		
Okayama	426,603	30.90
Nara	820	.06
Shiga	1,468	.10
Wakayama	46,326	3.35
Shikoku		
Tokushima	29,110	2.11
Ehime	247,369	17.93
Kōchi	61,183	4.43
	879,415	64.98

Japan has extensive deposits of an iron-bearing sand in several prefectures of southwestern Honshū, but nothing is known about her success in using them to relieve the shortage of domestic ore (FIGURE IX - 54). A rotary kiln process of producing *luppe* (lump iron) from iron sands is said to have been developed.

(2) *Ferro-alloys.*

Generally speaking, Japan proper has a deficiency of ferro-alloy ores. It is believed, however, that substitutions, proximity to other sources, and accumulated stock piles have prevented the deficiencies from becoming a serious problem. Southwest Japan has an important share of the ferro-alloy ores found in Japan proper. Refineries and domestic sources of these ores are located in FIGURE IX - 54.

(*a*) *Manganese.* Japan probably produced about 3,500 metric tons of manganese in 1943, or about 1/3 of her requirements. Manganese content of ores ranges from 40% to 60%. Japanese mines have been small and rapidly depleted. It is believed that Southwest Japan is an important producing area for Japan proper, with deposits and mining in Kagoshima-ken and Ōita-ken on Kyūshū; in Kōchi-ken on Shikoku; and in Kyōto-ken and Gifu-ken on Honshū.

(*b*) *Tungsten.* Annual domestic production of tungsten in Japan proper is no more than a few hundred tons against annual requirements of about 5,000 tons. Requirements are met from an accumulated stock pile; by imports from Korea, and smuggling out of Free China; and perhaps by the substitution of molybdenum on a limited scale. Domestic mines are small producers, and most of them are found in Southwest Japan. The larger producers are believed to be at Kiwada (Yamaguchi-ken), Sasagaya (Shimane-ken), and the Otani mine, Kameoka-machi, Minami Kuwada-gun (Kyōto-fu). There is some evidence that deposits have been discovered near Yamada-mura, Akaiwa-gun and Kawabe-mura, Kibi-gun (Okayama-ken).

(*c*) *Chromium ore.* Chrome, which may be substituted for manganese in the production of alloy steel, is produced only in small quantities in Japan proper. The chief source of supply in recent years has been the Philippine Islands. Japanese chrome ores average about 40% metal content, and the major producing areas are in Southwest Japan. Mines which were comparatively large producers in the past, and which may still be important, are the Hinokami mine, the Hirose mine (probably at Ukeno-mure, Yazu-gun) and the Wakamatsu mine, all in Tottori-ken in western Honshū. The Wakamatsu mine is probably the largest producer. Other workings are the Kyūragi mine (Saga-ken), the Akashi mine (Ehime-ken), and the Kōmori mine (Kyōto-fu).

(*d*) *Nickel.* Japan proper is estimated to have produced only about 2,400 metric tons of nickel in 1943, which is about ¼ of the requirements. Domestic deposits and refineries located in Southwest Japan are listed in TABLE IX - 9.

Smelting and refining capacity is large compared to domestic

mine capacity, in order to process imports. The ore of domestic mines is generally low-grade, and cost of production is high. The domestic deficiency, plus the need for nickel in the production of armor plate, stainless steel, machinery, and other alloys has led to limited success in increasing both mine and refinery output. The 1943 supply available to Japan (estimated 5,000 tons), depended heavily upon the Celebes. Japan had an estimated stockpile of about 3,000 tons at the beginning of 1944, and a minimum annual requirement of perhaps 10,000 tons. In the light of her relatively small domestic production, coupled with the closing off of supplies from the Celebes, she appears to be facing a seriously tight situation in nickel. This possibility may be offset by substitutions and further development of domestic mines.

TABLE IX - 9.
LOCATION OF NICKEL ORES AND REFINING PLANTS, SOUTHWEST JAPAN 1943

DEPOSITS	PROCESSING PLANTS
Kyūshū	
Ōita-ken	
Saganoseki area	Saganoseki*
Shikoku	
Kōchi-ken	
Kōchi	
Ehime-ken	
Besshi	Niihama*
	Shisakashima
Southwest Honshū	
Hiroshima-ken	Takehara
Hyōgo-ken	
Natsume area	Natsume
Ōya-mura, Yabu-gun	Ōya-mura, Yabun-gun*

*Believed to be among the more important plants.

(*e*) *Molybdenum.* Molybdenum production in Japan proper is negligible in relation to estimated requirements of 500 metric tons in 1943, but an ample stockpile and substitution possibilities may prevent any crucial shortage. Korea, Manchuria, and North China can meet irreducible needs. In Southwest Japan deposits (and probably production) are at Yamasa-mura, Nita-gun in Shimane-ken.

(*f*) *Cobalt.* Japan proper is estimated to have contributed about 40% of the 85 metric tons of cobalt required in 1943. The domestic mines could probably meet the most important requirements if necessary. Probably one of the most important mines in Japan proper is at Naganobori-oaza, Ōta-mura, Mine-gun, in Yamaguchi-ken.

(*g*) *Vanadium.* It is believed that there is no domestic deficiency of vanadium. Requirements and production are only a few hundred tons. There are no data available on the location of domestic deposits.

(3) *Non-ferrous metals.*

(*a*) *Light metals.*

1. BAUXITE AND SUBSTITUTES. No appreciable quantities of bauxite, the principal source of alumina, have been found in Japan. Imports from Malaya and Bintan, plus stockpiles, are relied on. Alunite and aluminous shales can be substituted with great difficulty, but they likewise are not found in Japan in any appreciable quantity. They are available, however, in Manchuria, Korea, and North China, and shales have been used for perhaps ⅓ of the total Japanese-controlled alumina production. Nevertheless, the difficulties involved in processing them are such that a failure of bauxite sources might have serious consequences after depletion of stockpiles of bauxite and of aluminum ingot.

2. ALUMINA. Southwest Japan was responsible in 1943 for about ⅙ of the estimated alumina output of more than 250,000 metric tons in Japan and the territories she controlled. One plant at Yawata in northern Kyūshū and 1 at Niihama on the north coast of Shikoku are believed to be operating; several other plants are believed to exist, but it is not clear that they are in operation (FIGURE IX - 27).

3. ALUMINUM INGOTS. Probably well over ⅘ of Japanese controlled aluminum production is destined for aircraft and other direct military and naval materiel produced in Southwest Japan. The area's own production of aluminum is, however, less than 10% of the total Japanese production, estimated at 100,000 to 130,000 tons in 1943. Excess capacity will exist if total production is kept in line with current requirements, which are estimated at about 170,000 metric tons in 1944. The principal aluminum plants in Southwest Japan are listed in TABLE IX - 10.

The electrolytic reduction of aluminum from alumina consumes large quantities of electric power (probably about 25,000 kilowatt hours per ton of aluminum). Any disruption in the flow of electric power of more than a few hours duration would seriously damage aluminum production facilities.

TABLE IX - 10.
ALUMINUM CAPACITY AND PRODUCTION, PRINCIPAL PLANTS, SOUTHWEST JAPAN, ESTIMATED 1943
(in Metric Tons)

PREFECTURE AND LOCATION	COMPANY	CAPACITY	PRODUCTION
Shikoku			
Ehime-ken			
Niihama	Sumitomo Aruminium KK	10,000	10,000*
Kinki-chihō			
Ōsaka-fu			
Ōsaka	Osaka Yogyo Cement KK	2,000	**
Tōkaidō			
Gifu-ken			
Ōgaki	Toyo Aruminium KK	8,000	**

* Operates in conjunction with alumina plant.
**Not believed in production in 1943.

4. ALUMINUM ROLLING MILLS. Aluminum rolling mills, particularly those producing sheet required for aircraft, are believed to be concentrated heavily in Southwest Japan. Rolling mill capacity as known in 1941 (TABLE IX - 11) would be inadequate to meet current demands, and the subsequent expansion probably has been barely sufficient to meet the need. The difficulty of rapidly replacing rolling mills, the importance of rolling mill products in war implements—especially aircraft, the press of production against capacity, all render aluminum rolling mills a potentially severe bottleneck. Southwest Japan had about 75% of total Japanese-controlled rolling mill capacity in 1941, and about ⅔ of this was in the Ōsaka area (FIGURE IX - 27).

TABLE IX - 11.
CAPACITY OF ALUMINUM ROLLING MILLS, SOUTHWEST JAPAN, ESTIMATED 1941

PREFECTURE AND LOCATION	COMPANY	CAPACITY (000,000 LB.)
Yamaguchi-ken		
Shimonoseki	Kōbe Seikosho KK	
Ōsaka-fu		
Ōsaka	Nippon Aruminium KK	20

TABLE IX - 11 (*Continued*)

PREFECTURE AND LOCATION	COMPANY	CAPACITY (000,000 LB.)
Ōsaka	Ōsaka Zoheisho KK	
Ōsaka	Sumitomo Kinzoku KK	35*
Mie-ken		
Kuwana	Sumitomo Kinzoku KK	25

*Output of several small plants included in this estimate.

5. MAGNESIUM. The Japanese are estimated to have obtained about 13,200 metric tons of magnesium in 1943, of which 7,200 tons (54%) were produced in the islands and the remainder in Manchuria and Korea. It is thought that 5,000 metric tons, or about 70% of the total production of Japan proper, were produced at Ube (Yamaguchi-ken) in southwestern Honshū. There is substantial surplus capacity. Total Empire capacity may range to about 20,000 metric tons, with a probable capacity in Japan proper of 9,400 tons, but the Ube plant with its 5,000-ton capacity remains a very important producer (FIGURE IX - 27).

The Ube plant is owned by Riken Kinzoku KK. It is believed that the production method here is essentially the electrolysis of salt bitterns concentrated in sea gardens. Electric power requirements are believed to be very high, approximately 50,000 kilowatt hours per ton of magnesium metal.

(b) Other non-ferrous metals.

1. COPPER. Japan proper depends heavily upon imported ores for an adequate copper supply, although it is estimated that the accumulated stockpile is close to 150,000 metric tons metal content. In general there is substantial idle smelting and refining capacity.

Southwest Japan is a center of copper refining, producing nearly ⅔ of the output of Japanese-controlled territory; mining and smelting operations are of lesser importance. Shikoku, not generally of much industrial importance, has fairly large copper smelting and refining plants, particularly near the Besshi mines (FIGURE IX - 21), as well as a number of other non-ferrous metal installations along the northern coast. The position of Southwest Japan in copper mining, smelting, and refining is shown in TABLE IX - 12. Available information on brass mills and other primary fabricators of copper and its alloys is meager but suggests that there is considerable concentration in the Ōsaka industrial district.

Important copper mines, smelters, and refineries are listed in TABLES IX - 13, IX - 14, and IX - 15, respectively, and are located on FIGURE IX - 55. Ores are generally of poor grade and require concentration.

TABLE IX - 12.

COPPER MINING, SMELTING, AND REFINING, ESTIMATED 1943

(in Metric Tons)

	MINING	SMELTING	REFINING
Empire capacity, (recovered metal)		161,000	152,000
Empire production	133,000	133,000	133,000
Japan Proper capacity		136,000	142,000
Japan Proper production	80,000	94,000	123,000
Southwest Japan capacity		66,000	90,000
Southwest Japan production	34,000	44,000	83,000

TABLE IX - 13.

COPPER MINING INSTALLATIONS, SOUTHWEST JAPAN, 1943

PREFECTURE AND LOCATION	COMPANY	ESTIMATED PRODUCTION (METRIC TONS OF RECOVERED COPPER)
Shikoku		
Ehime-ken		
Besshiyama-mura	Sumitomo Honsha KK	13,000
Southwest Honshū		
Hyōgo-ken		
Ikuno-machi	Mitsubishi Kogyo KK	10,000
Various		
Sundry smaller mines		11,000
Total Southwest Japan		34,000

The Besshi and associated mines apparently send concentrates to Shisaka-shima, off the coast of Shikoku, for smelting to blister copper, which is then electrolytically refined at Niihama. The Ikuno mines (FIGURE IX - 22) are believed to send base matte to Nao-shima (Kagawa-ken) where blister copper is produced and sent to Ōsaka for refining.

TABLE IX - 14.

MAJOR COPPER SMELTING INSTALLATIONS, SOUTHWEST JAPAN, 1943

PREFECTURE AND LOCATION	COMPANY	CAPACITY	ESTIMATED PRODUCTION (METRIC TONS OF RECOVERED COPPER)
Kyūshū			
Ōita-ken			
Saganoseki-machi	Nippon Kogyo KK	22,000	15,000
Shikoku			
Kagawa-ken			
Naoshima-mura	Mitsubishi Kogyo KK	12,000	10,000
Shisaka-shima (Miya-kubo-mura)	Sumitomo Honsha KK	20,000	13,000
Southwest Honshū			
Hiroshima-ken			
Chigiri-shima	Showa Kogyo KK	10,000	5,000
Various			
Small smelters		1,900	1,000
Total Southwest Japan		65,900	44,000

TABLE IX - 15.

MAJOR COPPER REFINERIES, SOUTHWEST JAPAN, 1943

PREFECTURE AND LOCATION	COMPANY	CAPACITY	ESTIMATED PRODUCTION (METRIC TONS)
Kyūshū			
Ōita-ken			
Saganoseki-machi	Nippon Kogyo KK	30,000	29,000
Shikoku			
Ehime-ken			
Niihama	Sumitomo Kogyo KK	25,000	20,000
Southwest Honshū			
Hiroshima-ken			
Takehara-machi	Showa Kogyo KK	10,000	10,000
Ōsaka-fu			
Ōsaka	Mitsubishi Kogyo KK	25,000	24,000
Total Southwest Japan		90,000	83,000

2. LEAD. Japan depends heavily upon stockpiles and imports for lead supplies. Of an estimated 40,000 tons production in Japan, Korea, and Manchuria in 1943, only 13,000 tons of mine production (recoverable lead) and 18,000 tons refined lead are attributed to Japan proper. Southwest Japan had an estimated 5,750 metric ton mine production (recoverable lead) and 14,750 tons refined lead, the major share for Japan proper but not for the Empire. Lead ores are generally of low-grade. The important Kamioka mine in Gifu-ken is 1 of the 2 mines that dominate lead production in Japan proper. This mine lies just beyond the borders of the map, FIGURE IX - 55. TABLE IX - 16 lists Southwest Japan's lead production in 1943.

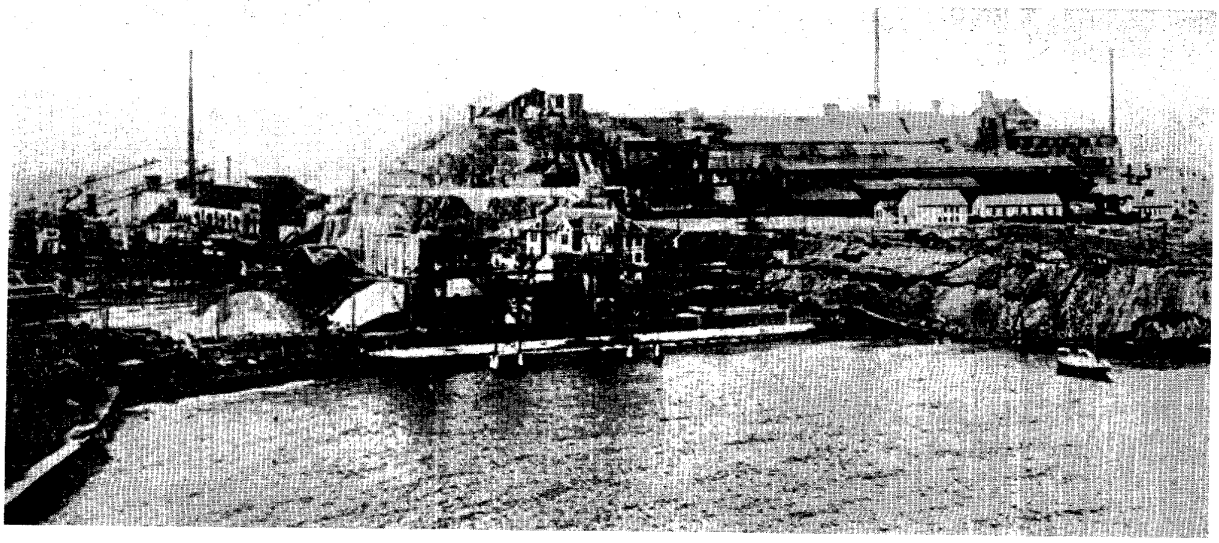

FIGURE IX - 21. *Ehime Prefecture.*
Shisakajima Island, date unknown. Shisakajima copper smelter of the Sumimoto Honsha K. K. One of the 2 largest copper smelters in Japan; handles concentrates from the Besshi mine.

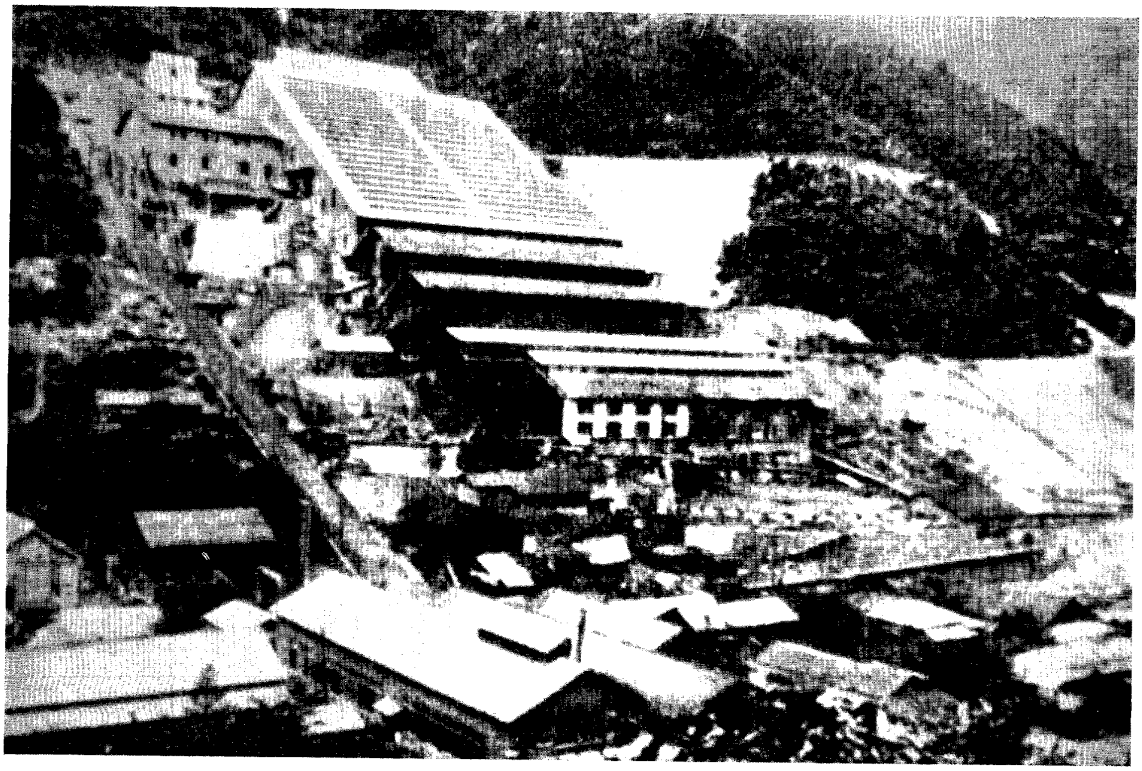

FIGURE IX - 22. *Hyōgo Prefecture.*
Ikuno, date unknown. Copper concentrating plant of Mitsubishi Kogyo K. K. Connected with Ikuno mines, second in copper production in Japan.

TABLE IX - 16.
LEAD PRODUCTION, SOUTHWEST JAPAN, ESTIMATED 1943

PREFECTURE AND LOCATION	COMPANY	MINE PRODUCTION (METRIC TONS OF RECOVERABLE LEAD)	REFINING PRODUCTION
Kyūshū			
Ōita-ken			
Saganoseki-machi	Nippon Kogyo KK		8,500
Southwest Honshū			
Hyōgo-ken			
Ikuno-machi	Mitsubishi Kogyo KK	100	
Gifu-ken			
Funatsu-machi (Kamioka)	Mitsui Kozan KK	5,400	6,000
Various			
Smaller mines and refineries		5,750	250
Total Southwest Japan		11,250	14,750

3. ZINC. Japan proper in 1943 mined about ½ the 50,000 metric tons of zinc available to Japan at home and in Korea and Manchuria. It is believed that Japan proper possesses a little over ½ the 64,000 metric tons of capacity for the smelter and refinery production of low-grade zinc, and possessed all the Empire's capacity for the production of high-grade zinc, necessary for brass cartridge cases and other important military uses. All of the low-grade zinc capacity in Japan proper is believed to be located in Southwest Japan, but only about 30% of the estimated 49,000 metric tons of capacity for the production of high-grade zinc is found there. Only about ½ the high-grade zinc facilities were used in 1943. Nearly ⅔ of the output is estimated to have come from Southwest Japan; most of it came from the plant at Fukuoka in northern Kyūshū (FIGURE IX - 55).

Southwest Japan contains the most important zinc mines in Japan proper, the Kamioka mines in Gifu-ken, covering some 8,500 acres and producing about 15% of the 1943 production in the Empire. All domestic zinc-bearing ores contain only low percentages of this metal. TABLE IX - 17 lists Southwest Japan's zinc production in 1943.

TABLE IX - 17.
ZINC PRODUCTION, SOUTHWEST JAPAN, 1943 (ESTIMATED)
(in Metric Tons)

PREFECTURE AND LOCATION	COMPANY	MINE PRODUCTION	LOW-GRADE ZINC SMELTING AND REFINING	HIGH-GRADE ZINC SMELTING AND REFINING
Kyūshū				
Fukuoka-ken				
Ōmuta (Miike)	Mitsui Kozan KK		10,000	6,000
Shikoku				
Kagawa-ken				
Naoshima-mura	Kyoritsu Kogyo KK			2,000
Southwest Honshū				
Yamaguchi-ken				
Shimonoseki	Mitsui Kozan KK		3,000	
Okayama-ken				
Hibi-machi, Kojima-gun	Showa Kogyo KK			1,500
Hyōgo-ken				
Ikuno-machi	Mitsubishi Kogyo KK	2,000		
Gifu-ken				
Funatsu-machi (Kamioka)	Mitsui Kozan KK	9,600		
Various				
Smaller mines		600		
Total Southwest Japan		12,200	13,000	9,500

4. TIN. The very few tin deposits in Japan proper produce ores of poor quality. Against an estimated requirement of 15,000 metric tons in 1943, domestic production was probably 2,000 tons. Malaya and other outer zone areas produce ample amounts to remedy domestic deficiencies and it is believed that stockpiles are large.

Southwest Japan is relatively the most productive area for tin in Japan proper, but only a few mines are of importance. The Akenobe mine in Hyōgo-ken is believed to be the most important (1763 metric tons production, 1940). The Ikuno mines in Hyōgo-ken produce some tin; these and other small producers are located on FIGURE IX - 55.

Tin mining is probably carried on by surface operations such as sluicing, panning, dredging, placer mining, and by lode mining.

Available sources indicate that Ōsaka-ken is an important center of tin smelting and refining in Japan. Some smelting and refining may also be found in Fukuoka, Hiroshima, Hyōgo, and Aichi prefectures. Electrolysis is the usual method for the refining process. Tin-plate and tin-sheet production were formerly concentrated in Southwest Japan (91% by volume in 1938), with Fukuoka-ken in northern Kyūshū alone producing about 60% (by volume) of the total output of Japan proper.

5. MERCURY. Domestic production of mercury is a major Japanese deficiency but it is believed that stockpiles are large. Mines in Japan proper are few and small. Estimated production in 1943 was 100 tons, with probably most of the output coming from Nara-ken (FIGURE IX - 55).

6. ANTIMONY. Estimated domestic production of 700 metric tons is probably about ¼ of Japan's needs. It is believed that Japan relies heavily upon China to meet needs. Unless new deposits have been developed, Southwest Japan has the chief antimony deposits, at Ichinokawa (Ehime-ken) and Nakase (Hyōgo-ken) (FIGURE IX - 55).

7. PLATINUM. Greatly increased war requirements for platinum have been met either through stockpiles or imports. Southwest Japan has none of the negligible production in Japan proper.

(4) *Non-metallic minerals and products.*

Japan has deficiencies in most non-metallic minerals, with the principal exception of sulfur. Reliance is placed upon imports or stockpiles or both in almost all cases. In some instances deposits are negligible; in most others the deposits are inadequate to meet the need. Of the deposits which do exist, Southwest Japan has important proportions.

(*a*) *Asbestos.* Virtually the only asbestos deposits in Japan are in Nagasaki and Wakayama prefectures, and these deposits are of low grade. Annual production of about 1,200 metric tons is only about 6% of needs, but stockpiles accumulated by import appear ample for several years. There are claims that satisfactory substitutes have been derived from rock wool and pulp material.

Southwest Japan produces about ⅔ of Japan's asbestos products, with Ōsaka-ken alone having about ½ of Japan's total output. Other producers are in Hyōgo, Nara, and Aichi prefectures (FIGURE IX - 56).

(*b*) *Abrasives.* In 1938 Southwest Japan contributed about 60% of Japanese production of abrasives. Kyōto and

Hiroshima prefectures were leading producers with 32% and 22%, respectively, of the output (by value) (FIGURE IX - 56). Carborundum (made from silicon and coke) and aluminum oxide grains are the most important artificial abrasives. These are also important refractories, used for furnace linings and metal-melting pots. No data are available on Japanese requirements.

(*c*) *Glass.* In 1938, Southwest Japan produced about 70% (by value) of Japan's glass production. Ōsaka, Fukuoka, Hyōgo, Aichi, and Mie prefectures were centers of production (FIGURE IX - 56).

Silica sand resources, of poor grade generally, are located chiefly in Aichi, Nara and Gifu prefectures, and also along the Inland Sea. Import sources have been Korea and Indochina. Feldspar sources are in Kyūshū, but there are also deposits in northeast Honshū and in Korea.

(*d*) *Graphite.* Japan proper has minor deposits of graphite in Gifu and Kyōto prefectures. Crystalline graphite of crucible grade, important in steel manufacturing, has been imported largely from Ceylon and Madagascar, and stockpiled. Amorphous graphite (and crystalline graphite not of crucible grade), used for foundry facings, self-lubricating bearings, motor and generator brushes, and lubricants, is imported from Korea. While the geographical distribution of processing and consumption cannot be ascertained, a large part of both probably occurs in Southwest Japan as nearly all graphite processors were located there in 1939, and much of the consumption would occur logically in the industrial centers of Southwest Japan.

(*e*) *Sulfur.* Minor deposits are in Ōita, Miyazaki, and Kagoshima prefectures, all in Kyūshū. An important sulfur source in Southwest Japan is iron pyrites (Topic 94, A, (1)).

(*f*) *Salt.* Japan's production of salt (about 630,000 metric tons in 1939) is almost completely concentrated in Southwest Japan. Production starts with evaporation of sea water and is centered on the coasts of the Inland Sea, chiefly in Kagawa, Hyōgo, Yamaguchi, and Okayama prefectures (FIGURES IX - 23). Food consumption of salt is somewhat in excess of domestic production. Imports are obtained from China, Manchuria, and Formosa. Industrial salt requirements are estimated at about 1,000,000 metric tons annually, of which about ½ is consumed in caustic soda used in making synthetic fiber (Topic 95, B and K).

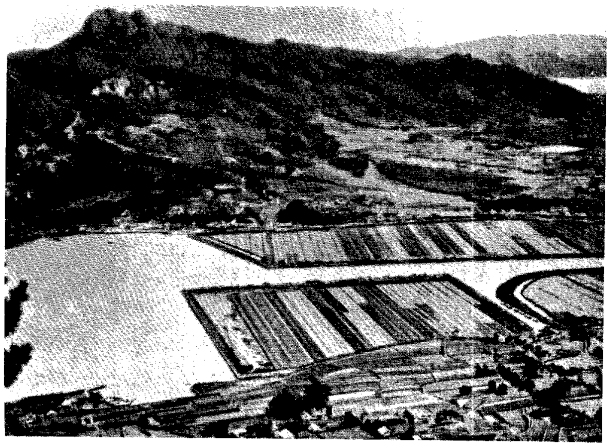

FIGURE IX - 23. *Kagawa Prefecture.*
Yashima, date unknown, looking E. Airview of salt-beds.
Mt. Goken in background.

(*g*) *Others.* The main Japanese Islands are believed to have negligible mica, quartz, magnesite, or phosphate deposits. The nearest source of phosphates is in the Ryūkyū-rettō.

B. Fuel.

With the growth of war industry and particularly the expansion of steel, coke, and electric power output, Japanese coal requirements have increased substantially. The Japanese have found it impossible to expand coal production at an adequate rate, and a chronic deficiency of coal has been one of the most important factors limiting expansion of industrial production. Consequently, the coal mines of northern Kyūshū are of strategic importance to Japanese industry.

(*1*) *Coal.*

Although Southwest Japan produced ⅔ of the total Japanese coal output in 1937 and ⅓ the combined output of the areas under Japanese control, the area's requirements for electric power, coke ovens, steel mills, railroads, ship bunkers, etc., are now so large that it is clearly a coal deficit area. Current output of around 32,000,000 metric tons (mostly non-coking bituminous coal) must be supplemented by 10,000,000 to 15,000,000 metric tons of imported coal coming largely from North China, Karafuto, and Korea, including 2,000,000 to 3,000,000 tons of high-grade coking coal.

Within the area, coal mining is highly concentrated. All the important fields are in northern Kyūshū except for several black lignite mines in the western tip of Honshū (Yamaguchi-ken). The central industrial belt of Ōsaka-Kōbe and Nagoya must rely on imports and surplus shipped through the Inland Sea from Kyūshū.

(*a*) *Production.* Only 6 of the coal fields shown in FIGURE IX - 57 have major producing mines. The Chikuhō field, occupying an area of about 290 square miles adjacent to and overlapping the industrial district of northern Kyūshū, was officially estimated in 1932 to contain 20% of Japan's coal reserves, but the percentage of proved reserves is undoubtedly far higher. The Karatsu field, whose mines are connected by railroad with the northern Kyūshū industrial district and with Karatsu, ships much coal from the latter port. The Miike field extends from Fukuoka-ken into Kumamoto-ken but practically all its mines are in the former, close to the city of Ōmuta. Production of the major mines in these and other fields in 1937 is shown in TABLE IX - 18. Mines producing more than 400,000 tons a year accounted for only about 60% of the entire coal output of Southwest Japan in that year. A large proportion of the balance of production came from smaller mines in Fukuoka-ken.

Manpower shortages and difficulties in obtaining equipment and iron or steel for gallery supports have impeded expansion of output. Production in Kyūshū has increased far less than in Hokkaidō. Korean male workers in large numbers and women have been used as miners. With increasing mechanization the annual output per worker in Japanese mines rose from 147 short tons in 1926 to 224 short tons in 1932. While some mechanization has occurred since 1932, this may be compared

with about 1,400 short tons per worker in the United States in 1943, and 400 short tons per worker in Great Britain in 1938. Japanese coal mines are generally equipped with electrically driven pumps, blowers, hoists, rail lines, conveyors, and loading and unloading machinery.

(*b*) *Consumption.* Southwest Japan's coal consumption is currently estimated at an annual rate of at least 45,000,000 metric tons, or about 70% of total requirements in the Japanese Islands. About ¼ of this is for public utility and private industrial steam power plants, a far higher proportion than in the rest of Japan. Other major users of coal are coke ovens, iron and steel plants, railroads, ship bunkers, chemicals, synthetic petroleum, rayon, and cement plants.

Imports of coal into Southwest Japan to meet its estimated annual deficiency of 10,000,000 to 15,000,000 metric tons are likely to come, in descending order of importance, from China, Karafuto, Korea, and Manchuria.

(*c*) *Coal for coke.* Coke ovens in Southwest Japan may be operating at less than capacity as indicated in Topic 94, B, (2), (b). Coal requirements for 3,300,000 to 4,000,000 metric tons of furnace-grade coke now produced in this area are 5,500,000 to 6,700,000 metric tons. Japanese coal does not produce a strong coke, but it may be mixed with high-grade coking coals in proportions ranging as high as two-thirds. The import requirements of this area for high-grade coking coal from China or Manchuria range between 1,800,000 to 3,300,000 metric tons.

(*2*) *Coke.*

Coke is not only an essential fuel for the smelting of iron in blast furnaces but is used as a raw material in the manufacture of synthetic oil. Of the coke by-products, tar and light oils are raw materials for synthetic oil and numerous important war chemicals respectively, and coke oven gas is used as fuel in iron and steel plants and in other ways (Topic 95, B (3), and Topic 95, A).

Coke production in the Japanese-controlled territory is highly concentrated. Six plants, of which 3 are in Japan, 2 in Manchuria, and 1 in Korea, are responsible for ⅗ of total capacity. Coke ovens are considered highly vulnerable to air attack.

Capacity of by-product coke ovens in Southwest Japan has been estimated at a little over 4,000,000 metric tons of furnace-grade coke. This is 70% of all Japan's capacity and ⅓ of the total in Japan, Korea, and Manchuria. Operating at an average of 85 to 90% of estimated capacity, the coke ovens of Southwest Japan can provide 2,500,000 metric tons of coke for blast furnaces in the area, perhaps 800,000 tons for use in synthetic oil production, and smaller amounts for nonferrous metal smelting, synthetic ammonia production, and production of calcium carbide. Larger production will be required only if synthetic oil production has been greatly increased or if partial substitution of coal for coke in making water gas is found impracticable. There is no deficit of coke production in central and northern Honshū which would call for capacity operations in the southwest and shipments out of the area. Production of coke in Japan is dependent on imports of coking coal from the continent (Topic 94, B, (1)).

(*a*) *Capacity.* Southwest Japan's coke ovens are in 11 plants (FIGURES IX - 54 and IX - 57). There is a heavy concentration of capacity at Yawata-Tobata (Kyūshū) and lesser concentration at Hiro-mura (Hyōgo-ken) and in the Ōsaka-Kōbe district (TABLE IX - 19).

(*b*) *Production and consumption.* Japan's coke oven capacity in the islands and on the continent is hardly adequate to meet both the needs of her blast furnaces operating at anything like full capacity and the growing requirements of the synthetic oil industry. However, blast furnace operations are limited by shortage of iron ore (Topic 95, A). Under current conditions it is likely that some excess coking capacity exists. No actual estimate of coke requirements in Southwest Japan is possible, particularly because of possible coal substitution for the coke used in production of synthetic petroleum or ammonia. Moreover, present estimates of synthetic oil production are based on scanty information (Topic 94, B, (3)).

The greatest excess of capacity over probable requirements in the vicinity occurs at Yawata-Tobata. Coke produced here is used in the important blast furnaces of the district, and it supplies the requirements of synthetic oil plants and blast furnaces at Ube (Yamaguchi-ken) and elsewhere in the Chūgoku-chihō region of southwest Honshū. Coke production in the Ōsaka-Kōbe district is probably sufficient for local synthetic oil and blast furnace requirements, since pig iron production is likely to be low. If a deficit exists, it may be met from Hiro-mura. Coke produced at Ōmuta (Fukuoka-ken) is used locally, mainly for synthetic oil, and that at Niihama (Ehime-ken) for nonferrous metal smelting and synthetic ammonia production. Only a small part of the potential production at Nagoya (Aichi-ken) is required locally.

TABLE IX - 18.

COAL FIELDS AND PRODUCTION OF PRINCIPAL COAL MINES IN SOUTHWEST JAPAN, 1937

(Mines with production over 400,000 metric tons)

PREFECTURE AND FIELD	MINE	PRODUCTION (IN THOUSAND METRIC TONS)	REMARKS (APPLYING TO FIELDS)
Kyūshū			
Kumamoto-ken			
Amakusa			Anthracite. No production information.
Kumamoto-ken and Fukuoka-ken			
Miike	Miike	2,876	Bituminous with poor coking quality. Fixed carbon content 48.2%, volatile matter 41.7%, B.t.u. 13,427. Mines wet, some under the sea.

TABLE IX - 18 (*Continued*).

PREFECTURE AND FIELD	MINE	PRODUCTION (IN THOUSAND METRIC TONS)	REMARKS (APPLYING TO FIELDS)
Fukuoka-ken			
Chikuhō	Onoura	1,685	Chiefly bituminous with poor coking properties. Fixed carbon content 45.7%, volatile matter 42.9%, B. T. U. 12,965. Field also contains many small mines. Thickness of seams, of which there may be as many as 16 to a basin, ranges from 2.0 to 4.9 feet. Deposits cover 288 square miles along Onga-kawa and its tributaries. Mines usually very deep and some are wet. Often mixed with good coking coals for coke manufacture, particularly Futase mine. Much bunkering coal comes from Namazuta mine.
	Mitsui-Tagawa	1,534	
	Futase	1,024	
	Namazuta	772	
	Nakatsura	710	
	Mitsui-yamano	790	
	Iizuka	679	
	Hokuku	538	
	Hojo	535	
	Takomatsu	804	
	Kido	445	
	Kaizun-Shinbaru	598	
	Tsunawaka	432	
Total 13 mines		10,546	
Nagasaki-ken and Saga-ken			
Karatsu	Kishima	799	Bituminous with poor coking properties. Fixed carbon content 46.2%, volatile matter 42.7%, B.t.u. 12,662.
Nagasaki-ken			
Sasebo			Bituminous of fair quality, though non-coking.
Nagasaki-ken			
Sakito	Sakito	1,071	Bituminous of non-coking variety. Used by Japanese government railways and for bunkering.
Nagasaki-ken			
Matsushima			
Nagasaki-ken			
Takashima		598	Bituminous of good grade to mix for coke. Fixed carbon content 55.8%, volatile matter 40.9%, B.t.u. 13,000 (estimate). Mining on 3 islands, much of it beneath the sea.
Southwest Honshū			
Yamaguchi-ken			
Ube	Okinoyama	1,073	Black lignite of inferior quality. Fixed carbon content 35%, volatile matter 42%, B.t.u. 9,000. Actively mined. Some under sea. Numerous small mines.
	Higashimisome	839	
Total 2 mines		1,912	
Yamaguchi-ken (adjacent to Ube Field)			
Ōmine			Semi-anthracite. Fixed carbon content 64.7%, Volatile matter 8.6%, B.t.u. unknown. Not extensively mined because of powdered quality and high sulfur and ash content.
Wakayama-ken and Mie-ken			Reported deposits. Small-scale mining of powdered anthracite at Kumano mine.
Aichi-ken			
Nobi			Lignite of inferior quality reported mined for local porcelain factories. Also at Ono, small-scale mining of powdered anthracite of high sulfur and ash content.
Total Southwest Japan (19 large mines)		17,802	
Total Southwest Japan (all mines) estimated		30,000	
Total Japan proper, estimated		45,000	

TABLE IX - 19.

BY-PRODUCT COKE-OVEN PLANTS, SOUTHWEST JAPAN, 1944 (ESTIMATE)

PREFECTURE AND LOCATION	COMPANY	ESTIMATED CAPACITY FOR PRODUCTION OF FURNACE-GRADE COKE (IN THOUSANDS OF METRIC TONS)	PERCENT OF TOTAL IN JAPAN
Kyūshū			
Fukuoka-ken			
Ōmuta	Mitsui Kozan KK	360	6.3
Yawata-Tobata	Nippon Seitetsu KK	1906	33.2
Yawata-Tobata	Nippon Kasei Kogyo KK	366	6.3
Shikoku			
Ehime-ken			
Niihama	Sumitomo Kagaku Kogyo KK	106	1.9

TABLE IX - 19. (*Continued*).

PREFECTURE AND LOCATION	COMPANY	ESTIMATED CAPACITY FOR PRODUCTION OF FURNACE-GRADE COKE (IN THOUSANDS OF METRIC TONS)	PERCENT OF TOTAL IN JAPAN
Southwest Honshū			
Hiroshima-ken			
Kure	Hiroshima Gasu Denki KK	40	0.7
Hyōgo-ken			
Hiro-mura	Nippon Seitetsu KK	623	10.8
Kōbe	Kōbe Gasu KK	100	1.7
Ōsaka-fu			
Ōsaka	Ōsaka Gasu KK	132	2.3
Ōsaka	Ōsaka Gasu KK	105	1.9
Ōsaka	Nakayama Seikosho KK	179	3.1
Aichi-ken			
Nagoya	Toho Gasu KK	126	2.2
	Total Southwest Japan	4,043	70.4

(3) ***Petroleum.***

Japan is very heavily dependent upon stockpiles and production in the East Indies for her petroleum supplies. Production in 1944 in Japan, Karafuto, Korea, and Manchuria is forecast at a total of about 22,000,000 barrels of all oil products, including 10,000,000 barrels of fuel oil (¼ of current requirements); a little over 1,000,000 barrels each of lubricating oil and aviation gasoline (both of low quality and respectively 40% and 25% of requirements); and nearly 10,000,000 barrels of gasoline (more than double the estimated requirements).

Synthetic production may account for about 12,000,000 barrels of this total.* Southwest Japan is assigned between ¼ and ⅓ of the synthetic production. This area has no oil wells.

(*a*) *Stocks and storage.* Stocks built up before the war were partially depleted while East Indies production was being restored. Fuel oil stocks available to Japan are believed to be stabilized now between 25,000,000 and 30,000,000 barrels, or 7 to 9 months' consumption requirements. Lubricating oil stocks are probably still shrinking and are well below 1 year's requirements. Aviation gasoline stocks in Japan and nearby territories are estimated at about 1½ years' requirements. A large surplus of motor gasoline is apparently being accumulated in the process of satisfying other needs.

Location of major storage depots in Southwest Japan is unknown. Substantial above-ground tankage will probably be found at naval bases at Sasebo, Tokuyama, Kure, and Maizuru, and at the refineries listed in TABLE IX - 20 and shown in FIGURE IX - 57.

(*b*) *Refineries.* It is not known to what extent Japanese refinery capacity may have been transferred to the East Indies, or its location altered within Japan. Based on prewar data, modified by scanty recent information, Southwest Japan would have 37% of the 25,000,000-barrel annual crude refining capacity of Japan proper and 30% of the total in Japan, Korea, and Manchuria. These figures exclude distillation capacity which may occur at synthetic oil and coke-oven plants. Plants are listed in TABLE IX - 20, with their capacities, and prewar locations are shown on FIGURE IX - 57. A great deal of this capacity is now idle, since crude oil produced in the East Indies is largely processed there to save shipping (FIGURE IX - 24).

(*c*) *Synthetic petroleum.* Expansion of synthetic oil production in Japan has been held back by difficulties in obtaining equipment and technical assistance from abroad. Little or no reliable information is available after 1941. Japan is believed to have had at that time 1 Fischer-Tropsch plant in operation as well as 5 small plants hydrogenating coal and low-temperature tar. There was also some straight distillation of tar from low-temperature carbonization of coal. Estimates, based on Japanese plans and reported achievement up to 1941, credit Japan, Korea, and Manchuria with a 1944 output from these 3 sources of about 12,000,000 barrels of petroleum products, of which less than 3,000,000 barrels is assigned to Southwest Japan. Details are given in TABLE IX - 21, and locations are shown on FIGURE IX - 57.

* This figure excludes Manchurian shale oil; about 1,500,000 barrels of fuel oil presumed to be obtained from straight distillation of coke-oven tar; and coke-oven benzene which might be available as a gasoline substitute.

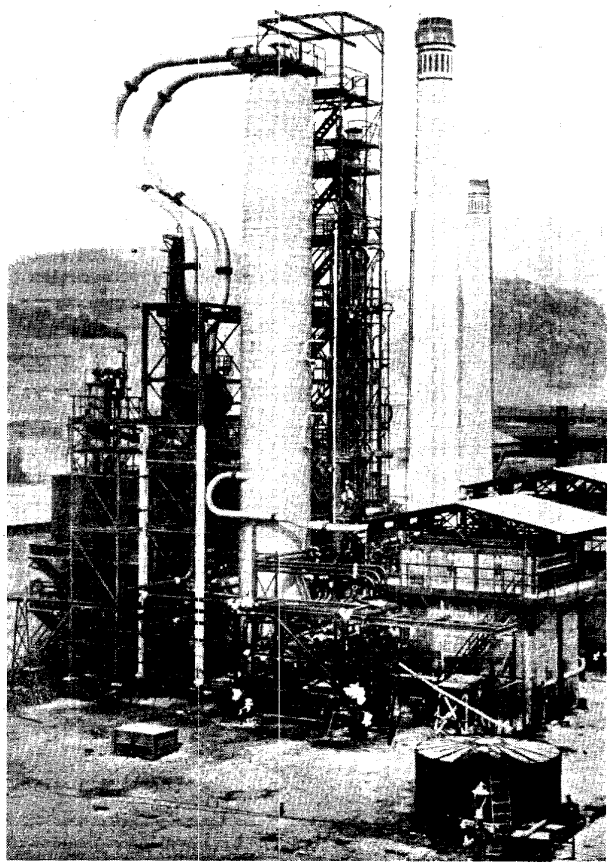

FIGURE IX - 24. *Yamaguchi Prefecture.*
Kudamatsu, near Tokuyama, 1931. Refinery unit of Nippon Sekiyu K. K. Believed to be of 3 distillation units, each with daily capacity of 2,500 barrels.

Coal is the basic raw material for synthetic oil by any of the processes. In the Fischer-Tropsch process it is best utilized in the form of coke. Most hydrogenation plants in Japan are believed to use some coke for hydrogen production, but their major raw materials are coal or lignite, and tar obtained by heating coal at lower temperatures than in ordinary coke ovens. The semi-coke produced along with this tar can be used to substitute in part for coke in the synthetic oil industry and other non-metallurgical uses.

(*d*) *Crude petroleum.* Japan's natural petroleum resources are meager and the Southwest area has none.

(4) ***Charcoal.***

Charcoal is the principal household fuel in Japan. It is also used as a substitute for gasoline and as fuel in metallurgy.

Production and distribution difficulties have arisen because of relative inaccessibility of supplies of suitable wood, transportation problems and labor shortages. About 80% of the charcoal is produced ordinarily by farmers in their spare time. There is considerable evidence that a serious shortage of charcoal has developed or is feared in the near future.

Of the total 1939 domestic production of 2,375,000 metric tons, Southwest Japan contributed about 1,000,000 metric tons or a little over 40%. Production is scattered throughout the

TABLE IX - 20.
CAPACITIES OF CRUDE OIL REFINERIES AND SYNTHETIC OIL PLANTS, SOUTHWEST JAPAN, ESTIMATED 1944
(in thousands of barrels of 42 U. S. gallons)

PREFECTURE AND LOCATION	COMPANY	PRINCIPAL CRUDE OIL REFINERIES ANNUAL CAPACITY FOR CRUDE	PRINCIPAL CRUDE OIL REFINERIES ANNUAL CAPACITY FOR CRACKING	SYNTHETIC OIL PLANTS ANNUAL CAPACITY FOR PRODUCTS FISCHER-TROPSCH	SYNTHETIC OIL PLANTS ANNUAL CAPACITY FOR PRODUCTS HYDROGENATION
Kyūshū					
Fukuoka-ken					
Ōmuta (Miike)	Mitsui Kozan KK			730	
Wakamatsu	Nissan Ekitai Nenryo KK				120
Southwest Honshū					
Yamaguchi-ken					
Shimonoseki (Hiko-shima)	Asahi Sekiyu KK	165			
Ube	Ube Yuka Kogyo KK			510	300
Tokuyama	Navy Ministry	2,640	?		120
	Nippon Seiro KK	400			
	Nippon Sekiyu KK	2,475	660		
Hyōgo-ken					
Amagasaki	Nippon Sekiyu KK	1,650	500		
	Amagasaki Jinzo Sekiyu KK			730	
Ōsaka-fu					
Ōsaka	Maruzen Sekiyu KK	330			
	Showa Sekiyu KK (formerly Niitsu Sekiyu KK)	230			
	Toyo Sekiyu KK	230			
Wakayama-ken					
Shimotsu	Maruzen Sekiyu KK	990			
Aichi-ken					
Nagoya	Toho Kagaku Kogyo KK				150
	Totals, Southwest Japan*	9,110	1,160	1,970	690

*Excluding minor refineries and possible additional synthetic oil plants.

area. The leading charcoal producing prefectures are all non-industrial districts with substantial acreages of timber (TABLE IX - 21 and Topic 93).

TABLE IX - 21.
PRODUCTION OF CHARCOAL
Leading Prefectures, Southwest Japan, 1939

SECTOR	PREFECTURE	PER CENT OF ALL JAPAN
Kyūshū	Kagoshima	3.0
	Miyazaki	2.8
Shikoku	Kōchi	4.0
Southwest Honshū	Shimane	3.0
	Okayama	2.8
	Gifu	3.0

C. Industrial crops.

Industrial crops (with the exception of silk) play a relatively small role in Japan's agricultural economy. Apart from silk, only 750,000 acres (about 4% of the total harvested acreage) were involved in 1939, accounting for less than 4½% of the total value of agricultural output.

(1) *Sericulture.*

Sericulture, basis of the silk industry, holds a position second only to rice in the island's agricultural economy. In 1939, output value was 16% of total agricultural value, and 30% of all farm families were engaged in raising silkworms. During 1935 to 1939, raw silk made up 21% of the value of Japan's exports to countries outside the *yen* bloc. Currently, the production is believed to be less than ⅓ of the 1934-1939 average (Topic 95, K, (4), discussion of silk reeling).

Japan possesses 2 conditions essential to successful sericulture: a warm, humid climate, and a cheap, abundant labor supply; and there is some sericulture in each ken. Southwest Japan had 467,000 acres of mulberry trees, or almost 36% of the total acreage, and accounted for 288,000,000 pounds of cocoons, or over 38% of the 1939 crop. The principal producing region of the area lies on the edge of an even more important area farther north. The agricultural districts around Nagoya, including the prefectures of Aichi, Gifu, and Mie, together produced 13% of the Japanese total. Kumamoto-ken and Kyūshū are also of some importance.

(2) *Other crops.*

(*a*) *Fiber.* In 1939 fiber crops covered 192,034 acres in Japan as a whole. The most extensive areas were in flax, paperbush, paper mulberry, hemp, and rush. No flax and little hemp (primarily in Hiroshima-ken) are grown in Southwest Japan. The bulk of paperbush, paper mulberry, and rush output comes from this area, but none of these is of great industrial importance.

(*b*) *Oilseeds.* In 1939, oilseeds were grown on approximately ⅓ of the total area devoted to industrial crops in Japan as a whole. By far the most important is rapeseed used to produce a fatty oil used in lubrication, lighting, and soap-making. Almost 79% of the land devoted to rapeseed, producing more than 78% of the 1939 crop, is located in Southwest Japan. Fukuoka-ken in northern Kyūshū, with about 21% of the total area and almost 29% of the crop in 1939, is the most important producing area.

(*c*) *Pyrethrum.* Pyrethrum, an important insecticide, was the outstanding industrial crop produced in Japan for export, next to silk. About 7% of the Japanese industrial crop area is devoted to its cultivation. (Hokkaidō has about ¾ the acreage and about ½ the production, 5,400 short tons in 1939.) Southwest Japan contributed almost ½ of the 1939 crop.

(*d*) *Tobacco.* Tobacco is an important crop in Japan with over 14% of the total area devoted in 1939 to industrial crops. In 1939 about ½ the total area devoted to tobacco was located in Southwest Japan, principally in Kagoshima-ken (Kyūshū).

95. *Manufacturing Plants*

Japan has made tremendous strides in the past 10 or 15 years in expanding her modern manufacturing industries (FIGURE IX - 58). It is impossible to say how much remains of the household workshop system, but in 1930 approximately 50% of all workers engaged in manufacturing of any kind were employed in units with less than 5 workers, making such goods as silk and woolen cloth, bamboo products, paper fans and umbrellas, matches, brushes, pottery, enameled iron ware, electric lamps, and food products. Household work was often organized and financed by local wholesale merchants. Half of the remaining manufacturing workers were in factories employing 5 to 30 workers.

The number of factory workers, excluding those in shops with less than 5 workers, increased from 1,800,000 in 1930 to more than 3,200,000 in 1938.* Undoubtedly there has been a very substantial further increase in factory employment since 1938, made possible both by absorption of workers from other employments and by expansion of the total labor force. It is probable that the number of small-scale "manufacturing" workers, though smaller than in 1938, still remains very large. It is not known how substantial a contribution to war production, such as the making of small parts, these handicraft workers may be adding.

What is known of the capacity of Japan's principal modern manufacturing industries, with special emphasis on war industries, has been compiled for this section. Information has been brought up to 1938-1940 in general. Known facts about Japan's supply of raw material and war requirements permit some conclusions to be drawn regarding current output.

A. Iron and steel.

Japan's steel production, in the islands and on the continent, is less than ⅛ as large as that of the United States. Nearly ⅔ of the total passes through Southwest Japan's rolling mills.

(*1*) *Over all capacity and production.*

The Japanese-controlled iron and steel industry depends almost entirely on 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 the Japanese Islands and the mainland. Southwest Japan, with 54% of Japanese-controlled steel-making capacity and 65% of the net capacity of rolling mills, has only 37% of the pig iron capacity. Korea and Manchuria, on the other hand, have much greater capacity to produce pig iron than steel ingot, and more ingot facilities than their rolling mills can handle. The remainder of Japan is well-balanced with about 30% of total capacity at each level (TABLE IX - 22 and FIGURE IX - 54).

* Excluding office workers and employees of government-owned establishments.

TABLE IX - 22.
CAPACITY OF IRON AND STEEL PLANTS IN JAPAN, KOREA AND MANCHURIA BY AREA, ESTIMATED 1944
(in Thousands of Metric Tons)

	Pig Iron*	Per Cent	Steel Ingots	Per Cent	Rolled Products	Per Cent
Southwest Japan	4,978	37	7,315	54	6,419	65
Rest of Honshū	2,422	18	3,327	25	2,456	25
Hokkaidō	1,441	11	844	6	212	2
Korea	1,328	10	620	4.5	185	2
Manchuria	3,198	24	1,411	10.5	635	6
	13,367	100	13,517	100	9,907	100

NOTE: Two-thirds to ¾ of a ton of pig iron is required (together with scrap iron and steel) to produce 1 ton of steel ingots plus an indeterminate amount of iron castings. One ton of steel ingots yields, on the average, in Japan ¾ of a ton of rolled products and steel castings, the ratio varying greatly with different types of products.

* Rated annual capacities, from which a deduction of 15% must ordinarily be made for time lost in relining and repairs.

Under conditions existing in the first half of 1944, the Japanese are not obtaining enough iron ore to utilize, on the average, more than 60% of all their pig iron capacity and 80% of their steel capacity. To save transportation of iron ore and coal, Manchurian and Korean blast furnaces are used as fully as possible. Even so, several million tons of ore must be transported from China, Korea, and the Philippines to Japan. Rough estimates of the maximum 1944 production and consumption of iron and steel at the various stages in Southwest Japan are shown in TABLE IX - 23.

Blast furnaces in this area are not expected to operate at more than 50% of gross annual capacity, on the average, with higher rates of operation in Kyūshū than elsewhere. The iron ore requirements of the area amount to 4,000,000 tons or more a year. Roughly 2,000,000 tons of pig iron must be imported. Coke requirements are discussed in Topic 94, B, (2). A large part of the scrap requirements of steel furnaces in this area comes from associated rolling mills and the remainder from scrap created in the metal-using industries.

(*2*) *Concentrations of capacity and production.*

Southwest Japan's iron and steel industry is highly concentrated in or near the 2 major industrial districts of north Kyūshū and Ōsaka-Kōbe, where there are 5 out of the 10 largest plants in Japan, Korea or Manchuria, as well as 4 other important plants and a number of smaller ones (FIGURE IX - 54). The 9 leading plants have 95% of the pig iron capacity, 82% of the steel capacity, and 76% of the rolled products capacity of Southwest Japan (TABLE IX - 24). Capacities and locations of all plants in the area are shown in TABLE IX - 25.

The giant plant at Yawata (FIGURE IX - 25) is believed to be smelting a major share of the iron ore imported into Southwest Japan. This saves transportation of iron ore, coal and coke through the Inland Sea. After going through steel furnaces and rolling mills, the metal moves on to other consuming centers in the form of bars, rods, wire, tube, sheet, plate, and other intermediate products.

The plant at Hiro-mura, less than 50 miles by water from Ōsaka and Kōbe, is relatively new. It is believed to specialize in the rolling of plate and probably also supplies some steel ingots to the Ōsaka-Kōbe district.

The Ōsaka-Kōbe district (FIGURE IX - 26) is deficient in blast furnace capacity and probably receives a substantial part of the pig iron imported into Southwest Japan. Even the 4

TABLE IX - 23.

IRON AND STEEL PRODUCTION AND REQUIREMENTS, SOUTHWEST JAPAN, ESTIMATED 1944
(in Thousands of Metric Tons)

	CAPACITY*	PRODUCTION	REQUIREMENTS	AVERAGE EXCESS CAPACITY	SURPLUS OR DEFICIT OF PRODUCTION	DESTINATION OR SOURCE OF SURPLUS OR DEFICIT
	(1)	(2)	(3)	(1) - (2)	(2) - (3)	
Pig iron	5,000	2,500	4,500	2,500	—2,000	From Manchuria and Korea
Steel	7,250	6,000	6,500	1,250	— 500	From Manchuria and Korea
Rolled products	6,500	4,750	3,750	1,750	+1,000	To rest of Japan

*In round figures. Capacity for pig iron makes no allowance for shut-downs for relining and repairs.

TABLE IX - 24.

LEADING IRON AND STEEL PLANTS, SOUTHWEST JAPAN
PERCENTAGES OF CAPACITY IN THE AREA,
ESTIMATED, 1944

INDUSTRIAL DISTRICT AND LOCATION	COMPANY	PIG IRON	STEEL INGOTS	ROLLED PRODUCTS
North Kyūshū				
Yawata-Tobata	Nippon Seitetsu KK	50.0	41.0	35.0
Kokura	Kokura Seiko KK	5.4	3.3	6.4
Southwest Honshū				
Hyōgo-ken				
Hiro-mura	Nippon Seitetsu KK	15.0	11.0	8.6
Ōsaka-Kōbe				
Kōbe	Kawasaki Jukogyo KK	5.8	9.2	8.4
	Kobe Seikosho KK	6.0	4.8	3.9
Tōgō-mura	Amagasaki Seiko KK	5.2	1.6	2.8
Ōsaka	Nakayama Seikosho KK	7.4	6.2	7.5
	Nippon Seitetsu KK		2.6	2.6
	Sumitomo Kinzoku Kogyo KK		2.1	1.0
	Total	94.8	81.8	76.3

TABLE IX - 25.

IRON AND STEEL PLANT CAPACITIES,
SOUTHWEST JAPAN, ESTIMATED 1944

PREFECTURE AND LOCATION	COMPANY	CLASS [1]	PIG IRON [2]	STEEL INGOTS	ROLLED PRODUCTS
			(IN THOUSANDS OF METRIC TONS PER YEAR)		
North Kyūshū					
Nagasaki-ken					
Nagasaki	Mitsubishi Jukogyo KK			57**	10
Fukuoka-ken					
Kokura		C			
	Kokura Seiko KK		274	243	410
	Fujikoshi Kozai Kogyo KK			7	
Yawata-Tobata		A			
	Nippon Seitetsu KK		2543	3007**	2250
	Hitachi Seisakusho KK			12	1
Hachiya-machi	Nippon Kogyo KK				28
Wakamatsu	Tokai Kogyo KK				92
Southwest Honshū					
Shimane-ken					
Yasugi-machi		C			
	Hitachi Seisakusho KK		75	100	75
Minari-mura	Teikoku Seitetsu KK		6		
Yamaguchi-ken					
Tokuyama	Tokuyama Toppan KK			10	200
Ube	Hitachi Seisakusho KK			15	
	Ube Tekkosho KK		75		
Kudamatsu-machi	Toyo Kohan KK				100
Hiroshima-ken					
Kure	Kure Arsenal			100	
Kake-machi	Teikoku Seitetsu KK		36		
Nie-machi	Nippon Seikosho KK			2	
Tottori-ken					
Yonago	Nippon Soda KK			2	
Kurosaka-mura	Osaka Tokushu Seiko KK		4		
Hyōgo-ken					
Hiro-mura		B			
	Nippon Seitetsu KK		730	800	500
Shikama	Sanyo Seiko KK			17	12
	Nippon Seitetsu KK			35*	
Takasago-machi	Nippon Seitetsu KK			25*	
Ōgo-mura		C			
	Amagasaki Seiko KK		255	119*	182
Amagasaki		D			
	Daido Seiko KK				49
	Nippon Spindle Seizosho KK			43**	
	Osaka Seiko KK				72
	Sumitomo Kinzoku Kogyo KK			67	57
	Otani Seiko KK			48**	105
Hōjō-machi		D			
	Nichia Seiko KK				
Kōbe		B			
	Kawasaki Jukogyo KK (2 plants)		290	667*	538
	Kobe Seikosho KK		300	350	245
Ōsaka-fu					
Ōsaka		B			
	Nakayama Seikosho KK		365	449	480
	Nippon Seitetsu KK			187	173
	Osaka Seiko KK			94	63
	Sumitomo Kinzoku Kogyo KK			149**	70
	Nippon Sutenresu KK			100	75
	Kokko Seisa Kogyo KK			59*	25
	Sekisan Kinzoku Kogyo KK			2	18
Otsu-machi	Kotobuki Jukogyo KK		15	34	
Suita-machi	Osaka Tokushu Seiko KK			6	4
Toyono-gun	Riken Atsuen KK				10
Nara-ken					
Takada-machi	Teikoku Seitetsu KK				7
Mie-ken					
Yokkaichi	Toho Jukogyo KK			100***	20
Tsu	Toyoda Seiko KK			40	30
Aichi-ken					
Nagoya		D			
	Daido Seiko (Atsuta)			23*	10
	Daido Seiko (Tsukiji)			25*	6
	Daido Seiko (Hoshizaki)			60**	185
	Yatsukari Seitetsu KK			12	
	Toho Seiko KK				
Kariya-machi		D			
	Nippon Spindle Seizosho KK			25*	
	Toyoda Seiko KK		10	100***	80
Koromo-machi	Toyodo Jidosha KK			25*	

* Including electric furnace capacity 20,000 to 39,999 tons
** Including electric furnace capacity 40,000 to 99,999 tons
*** Including electric furnace capacity 100,000 tons or more

1. Based on capacity of all plants in the same city or township, as follows:
A. Full integration, steel ingot capacity greater than 3,000,000 metric tons.
B. Full integration, steel ingot capacity 500,000 to 1,100,000 metric tons.
C. Full integration, steel ingot capacity 100,000 to 500,000 metric tons.
D. Partial integration, steel ingot capacity 50,000 to 200,000, rolling capacity 50,000 to 300,000.
2. Gross annual capacity.

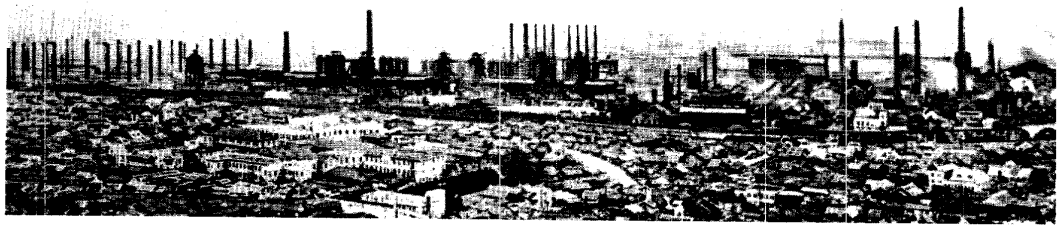

FIGURE IX - 25. *Fukuoka Prefecture.*
Yawata, date unknown, looking N. Yawata steel plant.

largest plants, which have their own blast furnaces, are likely to import pig. In this district, there is a considerable concentration of electric furnaces, used for making alloy steels. A similar concentration occurs in the Nagoya district (FIGURE IX - 27), where there are no important blast furnaces or open-hearth furnaces.

B. Chemicals.

Southwest Japan is responsible for a large proportion of Japan's vital chemical production. In this area is about 55% of the nitrogen fixation capacity of Japan (or 40% of the Japanese Empire and Manchuria) and roughly 75% of the sulfuric acid manufacturing capacity of Japan proper (or about ½ that of the Japanese Empire and Manchuria). Other important production of chemicals is concentrated to much the same extent in Southwest Japan.

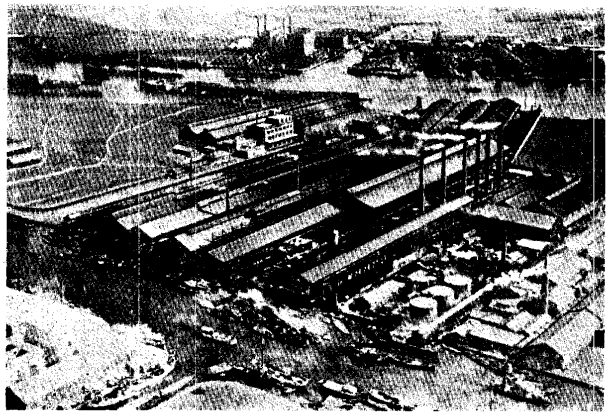

FIGURE IX - 26. *Ōsaka Prefecture.*
Ōsaka, date unknown. Nakayama steel plant.

The chemical industries are heavily dependent upon coal produced in northern Kyūshū and Yamaguchi-ken or imported from the continent, both for fuel and as a raw material. Their products are absorbed by industries in the same area: other chemical industries (as in the use of sulfuric acid for ammonium sulfate), explosives, textiles, paper, glass, and soap. Locations of plants are shown in FIGURE IX - 59.

(1) Nitrogen compounds.

The pool of nitrogen fixation capacity available to Japan at home and in Manchuria and Korea is composed roughly as follows:

Ammonia synthesis	474,000 metric tons of nitrogen content
Calcium cyanamide	131,000 metric tons of nitrogen content
Coke-oven by-product ammonia	40,000 metric tons of nitrogen content
Oil shale by-product ammonia	10,000 metric tons of nitrogen content
Total	655,000 metric tons of nitrogen content

Military and agricultural uses compete for the available supply. The principal military requirement is for the manufacture

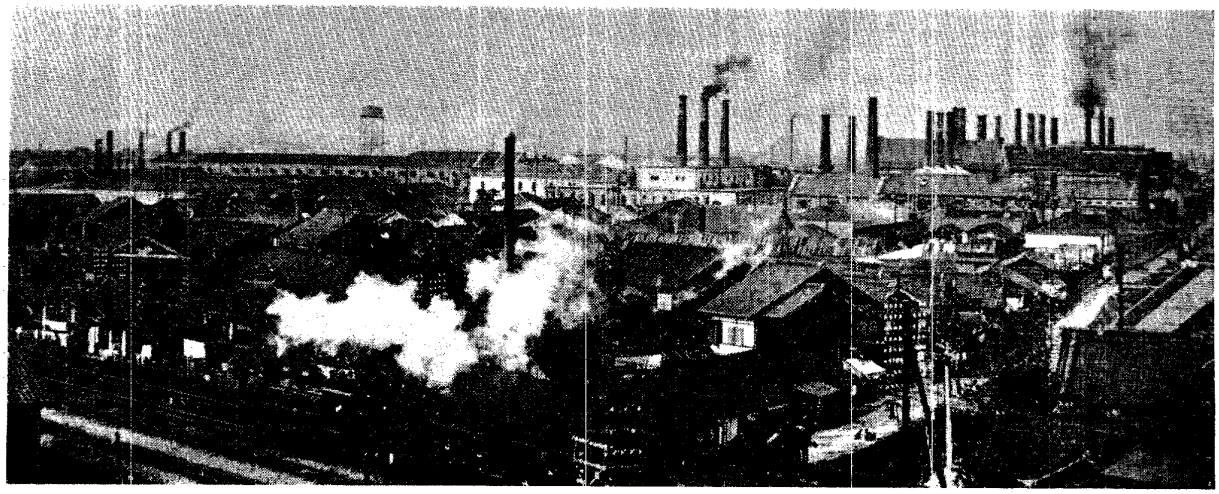

FIGURE IX - 27. *Aichi Prefecture.*
Nagoya, date unknown. Part of industrial section in southern part of city.

of nitric acid, an essential constituent of explosives. The agricultural requirement is for fertilizer, both ammonium sulfate and calcium cyanamide, and is by far the largest single requirement. In 1939, 1,407,049 metric tons of ammonium sulfate, with nitrogen content of about 300,000 tons, were consumed in Japan proper.

(*a*) *Ammonia.* Approximately 60% of the ammonia synthesis industry of Japan proper and 45% of that in the Japanese Empire and Manchuria is in Southwest Japan, much of it near the coal fields. TABLE IX - 26 lists the ammonia plants in the area. They are shown on FIGURE IX - 59. Three of these plants, those at Nobeoka and Minamata in eastern and southern Kyūshū respectively and the one at Nagoya, are known to obtain all or part of the necessary hydrogen through electrolysis of water. The others have used the water gas process, for which coke is the necessary raw material.

TABLE IX - 26.
AMMONIA SYNTHESIS PLANT CAPACITY, SOUTHWEST JAPAN, ESTIMATED 1943

PREFECTURE AND LOCATION	COMPANY	ANNUAL CAPACITY IN METRIC TONS OF NITROGEN*
Kyūshū		
Miyazaki-ken		
Nobeoka	Asahi Bemberg Kenshi KK	12,000
Fukuoka-ken		
Yawata (Kurosaki)	Nippon Kasei KK	17,000
Ōmuta	Toyo Koatsu KK	33,000
Kumamoto-ken		
Minamata-machi	Nippon Chisso Hiryo KK (FIGURE IX - 28)	16,000
Shikoku		
Ehime-ken		
Niihama	Sumitomo Kagaku Kogyo KK (FIGURE IX - 29)	47,000
Southwest Honshū		
Yamaguchi-ken		
Shimonoseki (Hiko-shima)	Gasei Kogyo KK	3,500
Ube	Ube Chisso Kogyo KK	45,000
Hyōgo-ken		
Befu-machi	Taki Seihi KK	10,000
Aichi-ken		
Nagoya	Yahagi Kogyo KK	25,000
	Total Southwest Japan	208,500

* Approximately 10,000 tons of nitrogen is contained in 12,000 tons of ammonia or in 49,000 tons of ammonium sulfate.

(*b*) *Calcium cyanamide.* The calcium cyanamide industry, less dependent on coal and more likely to be located in regions of abundant hydroelectric power, is not so concentrated in Southwest Japan as is the ammonia synthesis industry. One major calcium cyanamide plant is located in Kyūshū, the Ōmuta plant of Denki Kagaku Kogyo KK (estimated 1943 capacity 134,100 metric tons of calcium cyanamide containing 29,500 tons nitrogen). Together with a small plant at Ōgaki (Gifu-ken) this accounts for about 30% of the capacity of Japan proper and about 25% of the capacity of the Japanese Empire and Manchuria.

(*c*) *Nitric acid.* Because nitric acid is commonly manufactured from ammonia, most of the nitric acid plants are adjacent to ammonia plants, as a comparison of TABLES IX - 26 and IX - 27 shows. Nitric acid production figures have not been published for many years.

TABLE IX - 27.
NITRIC ACID PRODUCERS, SOUTHWEST JAPAN, ESTIMATED 1943

PREFECTURE AND LOCATION	COMPANY
Kyūshū	
Kumamoto-ken	
Ōmuta	Mitsui Kozan KK
Minamata-machi	Nippon Chisso Hiryo KK
Shikoku	
Ehime-ken	
Niihama	Sumitomo Kagaku Kogyo KK
Southwest Honshū	
Yamaguchi-ken	
Ube	Ube Chisso Kogyo KK
Ōsaka-fu	Fuku Ryusan KK

(2) *Calcium carbide.*

An intermediate product in making calcium cyanamide is calcium carbide. The calcium carbide capacity of the Japanese Empire and Manchuria is estimated at about 950,000 metric tons annually, but production may be lower. Consumption is roughly estimated at 250,000 tons for generation of acetylene, 100,000 tons for synthesis of other chemicals, and at least 200,000 tons for conversion to calcium cyanamide.

The large amount of electric power required in the manufacture of calcium carbide has caused much capacity to be located in Manchuria, Korea, and north central Japan. Roughly 25% of the capacity of Japan proper and 20% of the capacity of the Japanese Empire and Manchuria are located in Southwest Japan. The calcium carbide installations of this area and their capacities are listed in TABLE IX - 28 and shown on FIGURE IX - 59.

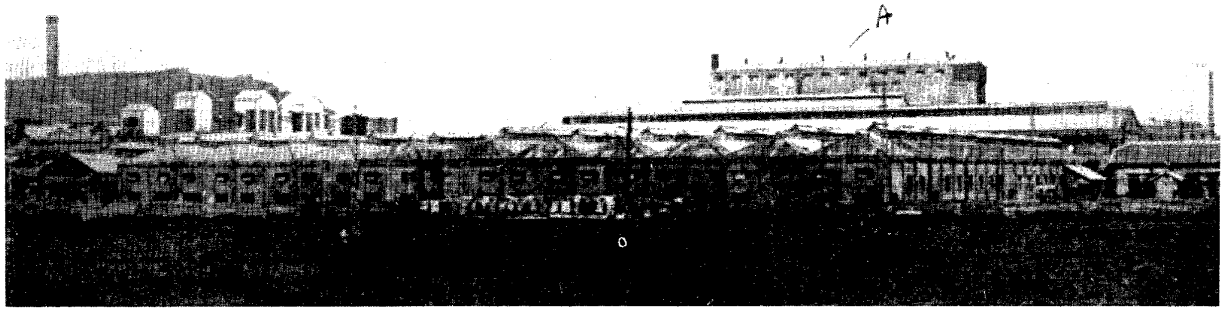

FIGURE IX - 28. *Kumamoto Prefecture.*
Minamata, 1937. Installations of Nippon Chisso Hiryo K. K. Electrolysis plant in foreground; ammonia synthesis plant behind.

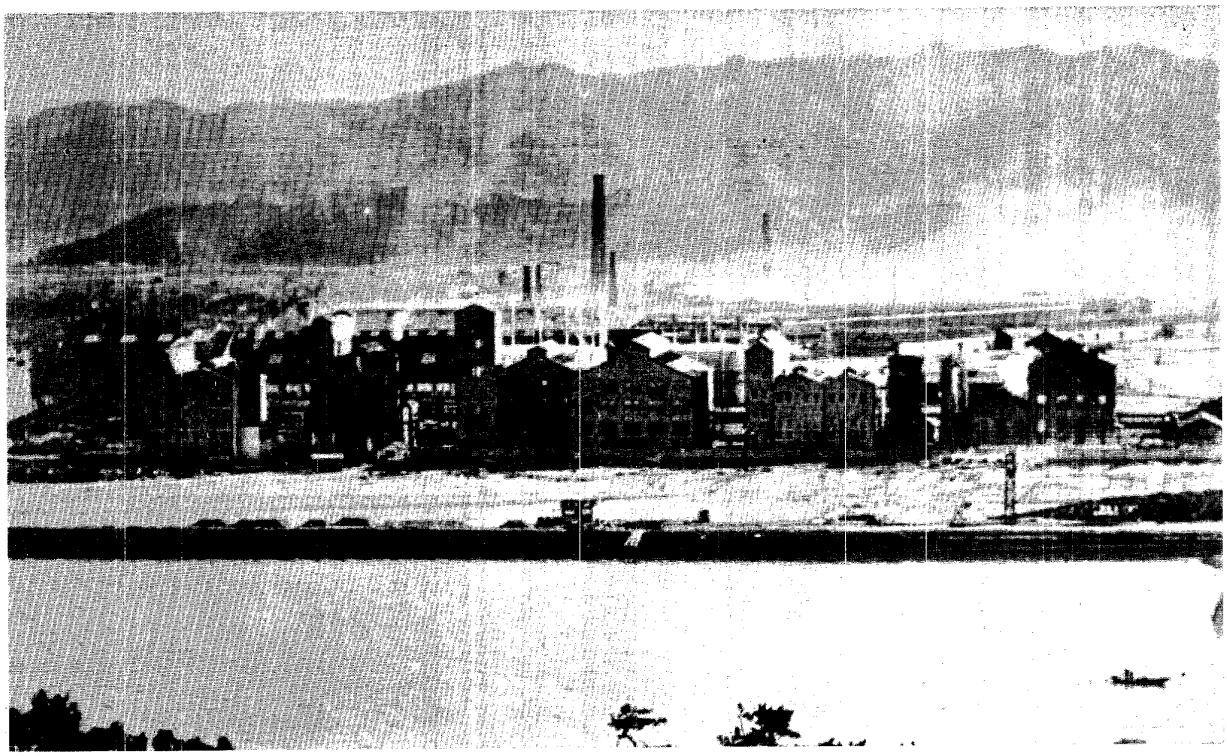

FIGURE IX - 29. *Ehime Prefecture.*
Niihama, probably 1932. Installations of Sumitomo Kagaku Kogyo K. K. Gas plant and ammonia synthesis plant in foreground; sulfuric acid and ammonium sulfate plants behind.

TABLE IX - 28.
CALCIUM CARBIDE CAPACITY, SOUTHWEST JAPAN, ESTIMATED 1943

PREFECTURE AND LOCATION	COMPANY	ANNUAL CAPACITY IN METRIC TONS OF CALCIUM CARBIDE
Kyūshū		
Ōita-ken		
Kawasaki-mura	Kyūshū Denki Kogyo KK	8,800
Fukuoka-ken		
Ōmuta	Denki Kagaku Kogyo KK	136,600
Kumamoto-ken		
Kagami-machi	Nissan Kagaku Kogyo KK	6,000
Minamata-machi	Nippon Chisso Hiryo KK (FIGURE IX - 30)	10,000
Southwest Honshū		
Hyōgo-ken		
Amagasaki	Asahi Kagaku Hiryo KK	?
Gifu-ken		
Ogaki	Ibigawa Denki Kogyo KK	22,000
Ogaki	Denki Kogyosho KK	?
Mino-machi	Denki Kogyosho KK	10,500
Total Southwest Japan		(at least) 193,900

(3) *By-products of coal carbonization.*

Some 70% of the by-product coal carbonization industry of Japan is in Southwest Japan (Topic 94, B, (2)). Facilities for refining the light oil and tar into such products as benzene, phenol, and toluene are likewise highly concentrated. In 1934, the last year for which such figures are available, 91% of Japan's benzene and 58% of her toluene were produced in Fukuoka-ken in northern Kyūshū.

The great importance of benzene, toluene, and phenol lies in their use as a starting point for the manufacture of explosives, war gases, drugs, photographic supplies, and other organic compounds, including dyes. For most of these end uses, the raw materials are first converted to dye intermediates. Production of dye intermediates is highly concentrated in Southwest Japan, all 5 of the large intermediate plants of Japan being located there, 3 of them on Kyūshū.

The 5 plants are: Nippon Soda Kogyo KK at Yawata and Miike Senryo Kogyosho at Ōmuta (Fukuoka-ken); Nippon Senryo Seizo KK at Tsurusaki-machi (Ōita-ken); Teikoku Senryo Seizo KK at Fukuyama (Okayama-ken); and Nippon Senryo Seizo KK at Ōsaka (Ōsaka-fu).

(4) *Sulfuric acid.*

Three-quarters of the sulfuric acid plant capacity of Japan proper is in Southwest Japan, much of it in prefectures bordering on the Inland Sea (FIGURE IX - 59, and TABLE IX - 29). The largest use of sulfuric acid is in the production of fertilizers, especially ammonium sulfate, which is largely manufactured at ammonia plants (Topic 95, B, (1), (a)). Large quantities are also required for explosives manufacturing in northern Kyūshū, along the Honshū shores of the Inland Sea, and in the Ōsaka-Nagoya area (Topic 95, B, (6)). Rayon manufacture, in which Yamaguchi and Hiroshima prefectures are outstanding, also requires sulfuric acid (Topic 95, K). The preeminence of Ehime-ken on Shikoku in production of sulfuric acid is due to its large deposits of pyrites, a raw material (Topic 94, A, (1)).

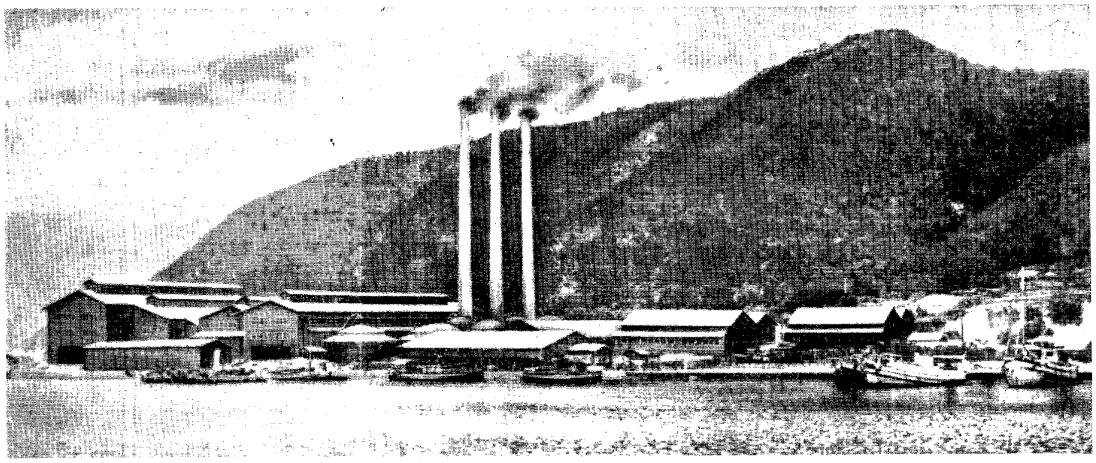

FIGURE IX - 30. *Kumamoto Prefecture.*
Minamata, 1937. Calcium carbide plant of Nippon Chisso Hiryo K. K. One of the smaller producers of calcium carbide in Japan.

TABLE IX - 29.
SULFURIC ACID CAPACITY, SOUTHWEST JAPAN BY PREFECTURES, INCOMPLETE ESTIMATES, 1942

ISLAND AND PREFECTURE	CAPACITY IN METRIC TONS OF 50° BE. ACID	
Kyūshū		
Miyazaki-ken	116,000	
Ōita-ken	1,500	
Fukuoka-ken	350,500	
Subtotal		468,000
Shikoku		
Kagawa-ken	84,000	
Ehime-ken	583,000	
Subtotal		667,000
Southwest Honshū		
Yamaguchi-ken	311,000	
Hiroshima-ken	51,500	
Okayama-ken (FIGURE IX - 31)	140,000	
Subtotal		502,500
Hyōgo-ken	347,000	
Ōsaka-fu	250,500	
Wakayama-ken	10,000	
Shiga-ken	129,000	
Subtotal		736,500
Mie-ken	121,000	
Aichi-ken	279,000	
Subtotal		400,000
Total Southwest Japan		2,774,000

NOTE: These figures are incomplete, as they omit plants for which no data are available. Capacities for companies with more than a single plant are arbitrarily divided among plants in some cases. Acids shipped in concentrations higher than 50° Be. have smaller tonnages than are indicated in the table.

(5) *Chlorine and caustic soda.*

Caustic soda is manufactured by 2 processes, the electrolytic process in which chlorine also is produced, and the Solvay process in which soda ash is an intermediate product. There is probably excess capacity in both of these industries in Southwest Japan. The principal uses of caustic soda are in the rayon, cotton, soap, paper, explosives, and dyestuffs industries. In

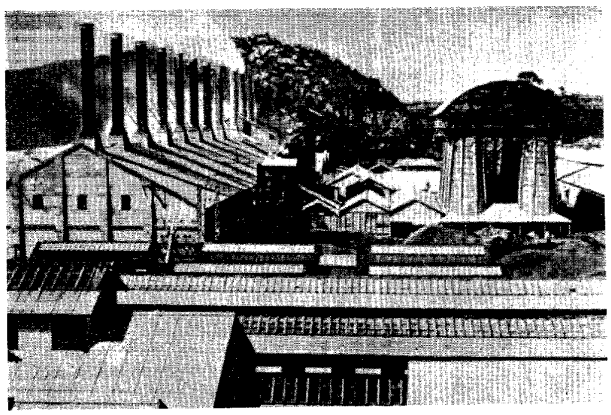

FIGURE IX - 31. *Okayama Prefecture.*
Okayama, 1936. Chemical plant of Shinagawa Shirorenga K. K.

1938, Japan produced 141,829 metric tons of caustic soda by the electrolytic process and 298,931 tons by the Solvay process, a total of nearly 441,000 metric tons. Present requirements are estimated at not more than 350,000 metric tons a year, of which about 240,000 tons goes to the rayon industry (Topic 95, K). A basic raw material both for caustic soda and soda ash is salt (Topic 94, A, (4)).

The level at which the electrolytic industry operates depends on the demand for chlorine. At capacity operation about 200,000 tons of chlorine and 225,000 tons of caustic soda would be produced. In wartime, chlorine is used for explosives, poison gases, and decontaminating and disinfecting agents. In peacetime, large quantities were consumed in the paper and textile industries. Almost 60% of the electrolytic capacity is in Southwest Japan (TABLE IX - 30).

Caustic soda not supplied by the electrolytic industry must be supplied by the Solvay industry. The entire Solvay industry of Japan is located in Southwest Japan and is believed to have considerable excess capacity at the present time.

TABLE IX - 30.
ELECTROLYTIC CHLORINE AND CAUSTIC SODA CAPACITY SOUTHWEST JAPAN, ESTIMATED 1937

PREFECTURE AND LOCATION	COMPANY	ANNUAL CAPACITY IN METRIC TONS OF CHLORINE*
Kyūshū		
Miyazaki-ken		
Nobeoka	Asahi Bemberg Kenshi KK	12,700
Fukuoka-ken		
Kokura	Ōsaka Soda KK	5,300
Yawata (Kurosaki)	Nippon Kasei KK	3,500
Omuta	Mitsui Kozan KK	7,100
Shikoku		
Kōchi-ken		
Kōchi	Nankai Sarashiko KK	2,100
Kagawa-ken		
Sakaide	Shikoku Soda KK	8,100
Ehime-ken		
Niihama	Sumitomo Kagaku Kogyo KK	8,200
Southwest Honshū		
Yamaguchi-ken		
Tonda	Toyo Soda Kogyo KK	12,900
Okayama-ken		
Kotoura	Ozaki Senryo KK	1,600
Hyōgo-ken		
Amagasaki	Toyo Jinzo Hiryo KK	4,300
Amagasaki	Velvet Sekken KK	1,800
Amagasaki	Ōsaka Soda KK	7,900
Takasago	Kanegafuchi Boseki KK	3,200
Ōsaka-fu		
Ōsaka	Ōsaka Sarashiko KK	1,600
Osaka	Rasa Kogyo KK	3,500
Osaka	Sakai Ryuso KK	2,700
Sakai	Yamatogawa Senkojo KK	3,200
Wakayama-ken		
Kozaika	Nankai Sarashiko KK	2,100
Aichi-ken		
Nagoya	Showa Soda KK	13,300
Nagoya	Tokai Soda KK	1,600
Total Southwest Japan		106,700

* The formation of each ton of chlorine is accompanied by the formation of 1.128 tons of caustic soda.

(6) *Explosives.*

No quantitative information is available, but many explosives plants are known to be located in Southwest Japan (FIGURE IX - 59 and Topic 95, E). Their distribution is similar to that of the sulfuric acid plants (Topic 95, B, (4)).

C. Industrial machinery.

The tendency of any industrialized country at war to use the technical skills and equipment of machinery producers to meet the most serious shortages in the military program as they arise makes the available data on the Japanese machinery and machine tool industry, based as they are largely on pre-1941 sources, subject to considerable error as a description of current conditions. Nevertheless, it is doubtful whether any considerable change has occurred in the areas in which production is concentrated, in the degree of concentration, or in lists of leading firms. The companies listed may be making somewhat different products now, but the changes will all be in the direction of more urgently required products. The number of important plants may have increased, especially in Kyūshū and the western end of Honshū.

The large number of plants engaged in producing great variety of machinery and equipment used in every industry has made it impossible to secure satisfactory statistics on the industry as a whole or its most significant parts, except for some fragmentary data on machine-tool production. Somewhat over 50% of total Japanese output is produced in Southwest Japan. Almost all of this is concentrated in the central industrial belt with about 35% in the greater Ōsaka-Kōbe industrial district and about 18% in the Nagoya district (FIGURE IX - 60).

(1) *Machine tools.*

The pressure which the military situation has developed for increased output of aircraft and ships has undoubtedly kept Japan's requirements for machine tools at a high level. Existing facilities must be hard pressed to keep up with this demand in view of the large-scale of prewar imports and the heavy equipment and high degree of skill required to produce machine tools themselves. Japanese machine tool production is not one of the more heavily concentrated industries. There are 20 plants of major importance, about ½ of which are in Southwest Japan.

As is characteristic of most types of precision metal products, the Nagoya and Ōsaka industrial areas in the central Honshū industrial belt are the centers of machine tool production in the area covered by this study. Together they turn out perhaps 40% of total Japanese machine tool production (FIGURE IX - 60).

Important plants are also located at Hiroshima at the west end of the Inland Sea and at Karatsu (Saga-ken) in northern Kyūshū. A list of the 7 most important plants in Southwest Japan with brief notes on their specialties is given in TABLE IX - 31.

TABLE IX - 31.
PRINCIPAL MACHINE TOOL PLANTS IN SOUTHWEST JAPAN

ISLAND PREFECTURE AND LOCATION	COMPANY
Kyūshū	
Saga-ken	
Karatsu	Karatsu Tekkosho KK (1)
Southwest Honshū	
Hiroshima-ken	
Gion-mura, Asa-gun	Mitsubishi Denki KK (2)
Ōsaka-fu	
Fukuizumi-machi, Semboku-gun	Ōsaka Wakayama Tekkosho KK (3)
Aichi-ken	
Nagoya	Mitsubishi Denki KK (4)
Kusunuki-mura, Nishi-Kasugai-gun	Okuma Tekkosho KK (5)
Asahi-machi, Higashi-Kasugai-gun	Okuma Tekkosho KK (6)
Kachikawa-machi, Higashi-Kasugai-gun	Okuma Tekkosho KK (7)

NOTE: Plant 1 is that of an old-line company with the reputation of making the best heavy-duty machine tools in Japan. It also makes gear-cutting and grinding machines for the aircraft-engine industry. Plants 2 and 4 belong to a company which is probably the largest producer of machine tools in Japan. One of these plants employs 10-12,000 men, although it is not certain that they are engaged in producing machine tools rather than electrical equipment. Plant 3 manufactures a number of machines needed by the aircraft industry, including internal grinders. Plants 5 to 7 are the 3 new factories of an old-line company, and are located just outside metropolitan Nagoya, close to new and important industrial developments. Grinding and threading machines made by Okuma are believed to be made in these plants.

(2) *Other industrial machinery.*

No recent estimates of Japanese machinery manufacturing capacity and production have been made. In 1938, Ōsaka prefecture produced 25%, Aichi prefecture 18%, Hyōgo prefecture 9%, and other parts of Southwest Japan 8%, of Japan's total value of machinery and tools production, excluding elec-

trical equipment. TABLE IX - 32 gives an incomplete list of leading manufacturers in 1940, excluding machine-tool makers and manufacturers of electrical equipment. To this list there should be added various manufacturers of railroad equipment (Topic 95, G), and machinery plants owned by some of the larger shipyards (Topic 95, F), and by the Japanese Government.

TABLE IX - 32.
LEADING MACHINERY MANUFACTURERS, SOUTHWEST JAPAN, 1940

ISLAND, PREFECTURE AND LOCATION	COMPANY	TYPES OF MACHINERY AND EQUIPMENT PRODUCED
Kyūshū		
Fukuoka-ken		
Kokura	Okuma Tekkosho KK	Metallurgical, military and naval ordnance, lumber, textile, precision.
Southwest Honshū		
Hiroshima-ken		
Gion-machi, Asa-gun	Toyo Kikai KK	Construction
Hyōgo-ken		
Kawanishi-machi, Kawabe-gun	Ōsaka Tekko KK	Internal combustion engines, construction, spinning.
Amagasaki	Ōsaka Kikai Seisakusho KK	Forging, mining, oil refining, spinning.
Kōbe	Toa Kinzoku Kogyo KK	Construction,
Futami-machi	Toa Kinzoku Kogyo KK Kinzoku	chemical industry, spinning, mining.
Ōsaka-fu		
Ōsaka (2 plants)	Ōsaka Tekkosho KK	Internal combustion engines, construction, spinning.
Ōsaka (2 plants)	Ōsaka Kikai Seisakusho KK	Forging, mining, oil refining, spinning.
Ōsaka (4 plants) Kasuga-mura, Mishima-gun (2 plants)	Ōsaka Seisa Zoki KK	Transportation, chemical industry, construction, gear wheels.
Ōsaka (2 plants)	Kubota Tekkosho KK	Internal combustion engines, chemical industry, iron manufacturing, mining, construction.
Ōsaka (2 plants)	Saguchi Kikai Seisakusho KK	Compressors, cranes, dredging.
Ōsaka (4 plants)	Matsumoto Chuzo Tekkosho KK	Mining, chemical machinery.
Aichi-ken		
Kachikawa-machi, Higashi-Kasugai-gun	Okuma Tekkosho KK	Metallurgical, military and
Asahi-machi, Higashi-Kasugai-gun	Okuma Tekkosho KK	naval ordnance, lumber industry, textile, precision.
Kurenuki-mura, Nishi Kasugai-gun	Okuma Tekkosho KK	
Nagoya	Ōsaka Kikai Seisakusho KK	Forging, metal and oil refining, spinning.

(3) *Gears and bearings.*

(*a*) *Precision gears.* The Mizaguchi Gear Works at Tsukuda (Ōsaka-fu) is believed to have been in 1942, one of the very few manufacturers specializing in precision gears and probably the only manufacturer of the largest size speed-reduction gears and training rings in Japan. This plant has a gear hobber, believed to be the only one of its kind in the Far East in 1939, which is probably the chief bottleneck in the supply of reduction gears for warships of the Japanese Navy. If destroyed, it would take about a year to design and produce a new gear-cutting machine. Destruction of other special equipment at this plant would, for at least a year, stop production of large training circles used on battleships.

(*b*) *Anti-friction bearings.* Prewar production of bearings in Japan was largely of medium sizes, and the Japanese have had difficulties in expanding production of the very small bearings used, for example, in magnetos, and of the very large ones needed in steel or aluminum rolling mills.

About 95% of Japan's production of anti-friction bearings is concentrated in 4 firms operating 14 plants, 7 of which, including the largest in Japan, are in Southwest Japan. This area has 60% of Japanese capacity in bearings production.

It has been estimated that Japanese stockpiles of bearings are close to exhaustion, and production is believed to be just meeting requirements. A considerable quantity of high-precision machine tools occur in the bearing-manufacturing plants, which often manufacture their own specially designed machine tools.

Toyo Bearing Seizo KK, with 2 plants in Kuwana (Mie-ken) and 1 plant at Ryogen-mura (Hyōgo-ken), is Japan's largest producer of anti-friction bearings. These plants have slightly more than 50% of Japan's total capacity and about 90% of the capacity located in Southwest Japan.

The importance of anti-friction bearings in war implements, the full use of capacity, the concentration of production, the greatly diminished or non-existent stockpile, and the tight position in high-precision machine tools render the anti-friction bearing production highly important as a target for air attack.

D. Electrical machinery and equipment.

The Japanese electrical machinery and equipment industry is not highly concentrated nor, in general, vulnerable to attack. A large portion of current output goes into combat equipment, and wartime requirements have necessitated a considerable expansion of the industry.

Southwest Japan does not contain a major fraction of Japan's total production of electrical equipment, although some individual items are produced in important proportions. It is estimated that the area is responsible for 5% of Japan's radio tube production, 33% of incandescent lamp production, 35% of wire and cable production, 60% of new boiler production for steam power plants, 30% of electric power turbine and heavy generator production, and 50% of small motor and generator production. Most of these facilities are in either the central industrial area of Kōbe-Ōsaka-Nagoya or in northern Kyūshū. They are shown on FIGURE IX - 60.

(1) *Radio and radar tubes.*

Data on Japanese production of radio and radar tubes are fragmentary. Fourteen Japanese companies operating 15 factories are known to be producing tubes for radio and radar. Two companies, the Tōkyō Shibaura Denki KK and the Nippon Denki KK (operating 3 factories outside of Southwest Japan) are estimated to be making 80% of the total Japanese output of tubes. Of the 6 major Japanese factories which almost monopolize the industry, only 1 is located in Southwest Japan. This is the Kawanishi Denki Kikai KK factory in Kōbe (Hyōgo-ken).

One of the most important components of radio and radar tubes is tungsten (Topic 94, A). Two subsidiaries of the

Tōkyō Shibaura Denki KK, the principal producers of drawn tungsten filament, are located in Southwest Japan, both in Kyūshū, and are responsible for an estimated 10% of Japanese production. These are the Nippon Yakin KK Moji (Fukuoka-ken) plant and the Nippon Tungsten KK Fukuoka (Fukuoka-ken) plant.

It is believed probable that new capacity for the production of radio and radar tubes has been established by curtailing incandescent lamp production, since a part of lamp-making facilities can be converted to the production of tubes. Southwest Japan produced about 81,000,000 incandescent lamps or about ⅓ of Japan's production in 1938. Of the output of this area, 65% by value came from Ōsaka-ken. The largest incandescent lamp producer in Southwest Japan, accounting for about 75% of total area production, is the Tōkyō Shibaura Denki KK with factories in Ōsaka (Ōsaka-fu), and Kokura (Fukuoka-ken).

(2) Electrical communications equipment.

The production of telephone, telegraph, and wireless communications instruments in Japan made great strides before the war. In the immediate prewar years Japan exported increasing amounts of telephonic and telegraphic equipment. No recent information on output is available, but major producing factories are believed to be the same. Of the 235 factories manufacturing telegraph and wireless equipment in Japan in 1939, 52 were located in Southwest Japan. Leading producers in this area are the Nippon Tsushin Kogyo KK plant at Ōsaka, the Matsushita Musen KK plants at Kadoma-mura (Ōsaka-fu), and at Ōsaka, and the Oki Denki KK plant, likewise at Ōsaka.

(3) Wire and cable.

The largest Japanese wire and cable factory is located in Southwest Japan. Of the estimated 35% of total Japanese production assigned to Southwest Japan, 25% is represented by the Sumitomo Denki Kogyo KK factory in Ōsaka. Other wire and cable producers of importance are the Dainichi Densen KK factory in Amagasaki (Hyōgo-ken) and the Furukawa Denki Kogyo KK factory in Moji (Fukuoka-ken).

(4) Boilers.

The Mitsubishi factories in Kōbe (Hyōgo-ken) and Nagasaki (Nagasaki-ken) are estimated to account for over 60% of Japan's new boiler production for steam power plants. These are the only known installations producing boilers for this purpose in Southwest Japan. (Marine boilers, turbines and engines are discussed in Topic 95, F).

(5) Heavy generators and turbines.

Only 4 factories in Japan produce generators of 5,000 KVA capacities or over. Two of these factories are located in Southwest Japan. It is estimated that in 1943 the Mitsubishi Denki KK factories at Kōbe and Nagasaki accounted for 19% and 12% respectively of Japanese heavy-generator production. These factories are also large producers of turbines.

(6) Small motors and generators.

Six factories in this area produce well over ½ the total output of small motors and generators in Japan. These are the Tōkyō Shibaura Denki KK plant in Asahi-mura, Mie-gun (Mie-ken), the Mitsubishi Denki KK and Meidensha KK plants in Nagoya, and the Yasukawa Denki KK plant in Yawata (Fukuoka-ken).

E. Ordnance.

Production of an adequate supply of light munitions, including small arms, ammunition, and field artillery up through 75 mm., has not yet posed too difficult a problem for the Japanese. Organization of munitions production has probably been improved and many former textile and miscellaneous machinery factories have been converted to this work.

The Japanese position with respect to heavy weapons, such as field artillery of 105 mm. and larger naval guns, appears to be much less favorable and may be a weak spot in their war production program. There is evidence, not yet conclusive, that heavy forging capacity is extremely limited in Japan. This capacity is in demand not only for ordnance production, but also for the merchant and naval ship construction programs, and may be a bottleneck for all.

Information bearing on the layout and output of particular Japanese munitions plants is scanty. The great increase in munitions output during the war has made prewar data obsolete and of little value. Captured enemy equipment, an important source of current intelligence on munitions production, has to date been in small volume and has not received thorough and integrated analytical treatment.

Ōsaka, Fukuoka, and Hiroshima prefectures are without doubt the most important munitions districts in Southwest Japan. Each of these prefectures contain large government arsenals for the development and storage of weapons as well as concentrations of private industrial plants manufacturing ordnance and ordnance components (FIGURE IX - 60).

(1) Arsenals.

Two of Japan's major naval bases are located in the area at Kure (Hiroshima-ken) and at Sasebo (Nagasaki-ken). In addition to their extensive facilities for the construction and repair of naval vessels, both have elaborate shore establishments with forge and machine shops suitable for the manufacture of heavy naval ordnance (Topic 95, F).

Japanese government arsenals probably contain the best equipped machine shops in all Japan. They imported large quantities of foreign-built precision machine tools before the war and have continued to receive not only the cream of Japanese machine-tool production, but also small shipments of critical precision equipment from Germany, Sweden, and possibly Russia.

Virtually all new models of weapons as well as new signal equipment, fire control devices, and miscellaneous field equipment are developed in the research and experimental laboratories associated with the arsenals. These establishments also fabricate prototypes of military equipment to serve as the basis for the mass production activities of private munitions plants. It is not known whether the shell-filling process in ammunition production is customarily carried on in government or in private plants in Japan.

(2) Other plants.

Insofar as the picture can be constructed from meager prewar data supplemented by fragments of indirect intelligence, TABLE IX - 33 summarizes the location and activities of prin-

cipal munitions plants, arsenals, and other plants in Southwest Japan.

TABLE IX - 33.
PRINCIPAL MUNITIONS PLANTS IN SOUTHWEST JAPAN

ISLAND, PREFECTURE AND LOCATION	COMPANY	PROBABLE PRODUCTS
Kyūshū		
Fukuoka-ken		
Kokura	Army Arsenal	Weapons development and storage
Kokura	Nippon Chisso Kayaku KK	Detonators
Kokura	Nitto Kakokin Seizo KK	Fuzes
Honami-mura, Kaho-gun	Nippon Kayaku Seizo KK	Detonators
Kurume	Tomioka Shisho KK	Explosives
Wakamatsu	Nippon Seitetsu KK	Guns
Chiyo-machi, Chikushi-gun	Watanabe Tekkosho KK	Aircraft cannon
Hakozaki	Showa Tekkosho KK	Guns
Saga-ken		
Karatsu	Army Arsenal	Guns
Nagasaki-ken		
Sasebo	Naval Arsenal	Naval vessels, ordnance, aircraft
Southwest Honshū		
Hiroshima-ken		
Kure	Naval Arsenal	Naval vessels, ordnance
Hyōgo-ken		
Kōbe	Kōbe Seikosho KK	Aircraft machine guns
Kōbe	Konan Koku Kogyo KK	Small arms
Himeji	Mitsubishi Jukogyo KK	Heavy artillery
Amagasaki	Ohtani Steel Company	Heavy gun forgings
Sonoda-mura, Kawabe-gun	Nitto Tankosho KK	Heavy gun forgings
Ōsaka-fu		
Ōsaka	Nippon Tanko KK	Heavy forgings
Ōsaka	Army Arsenal	Guns
Ōsaka	Army Arsenal	Guns
Kasuga-mura, Mishima-gun	Ōsaka Seisa Zoki KK	Guns
Kajima	Ōsaka Mechanical Industrial Works	Heavy gun forgings
Aichi-ken		
Nagoya	Toyowa Jukogyo KK	Ordnance parts
Nagoya	Mitsubishi Jukogyo KK	Heavy artillery
Nagoya	Army Arsenal	Fire control devices
Toyahashi	Dai Nippon Heiki KK	Anti-aircraft and Anti-tank guns

F. Shipbuilding and ship repair.

By the middle of 1944, Japan's losses of merchant and naval vessels had so reduced the number of ocean-going ships that she was unable to find the transport required both to supply military forces committed in various areas and to move the volume of raw materials necessary for maintaining 1943 levels of industrial output. Faced with this shortage, Japan has been forced to curtail imports of industrial raw materials, although the more strategic materials have been cut less drastically than less essential items. In order to make ship construction equal current losses, Japan would have to build merchant vessels at the rate of at least 2,500,000 gross tons in 1944.

(1) *Steel shipbuilding.*

It is forecast for 1944 that Japanese shipyards as a whole will produce some 700,000 gross tons of steel merchant vessels, the equivalent of 325,000 gross tons in wooden vessels, and 400,000 displacement tons of naval ships. Southwest Japan will probably produce 470,000 tons of merchant vessels (about 67%) and 325,000 tons of naval vessels (about 80%). Two-thirds of Japan's principal shipyards, ⅘ of the large drydocking facilities and ⅞ of the second-class shipyards are in Southwest Japan (FIGURE IX - 61). It may be noted that Japanese battleships and carriers are frequently built in drydock.

Of the 11 principal yards, 7 are strung along the north coast of the Inland Sea from Hiroshima to Ōsaka, 3 are in Kyūshū (Nagasaki prefecture) and 1 is on the north coast of Honshū (Kyōto prefecture) (TABLE IX - 34).

Included among the principal yards are the 3 government navy yards, 1 at Sasebo in Kyūshū, 1 at Kure (Hiroshi-ken) near the west end of the Inland Sea, and the third at Maizuru (Kyōto-fu) on the Japan Sea. Kure is equipped to build and drydock the largest-type vessels of the Japanese fleet, Sasebo (Nagasaki-ken) is the principal repair base of the fleet, and Maizuru is important for construction of destroyers and light cruisers.

The second-class shipyards are concentrated in Ōsaka-ken and in Shimonoseki-kaikyō area, with scattered establishments elsewhere along the Inland Sea (TABLE IX - 35).

(2) *Marine engines and equipment.*

It is estimated that Southwest Japan produces ¾ of Japan's marine engines. Most principal shipyards have their own engine facilities as indicated in TABLE IX - 34.

The leading producers of marine turbines are believed to include, in addition to the large shipyards, Hitachi Seisakusho KK at Ōsaka, and Kōbe Seikosho KK at Kōbe.

(3) *Wooden shipbuilding.*

In 1943, Japan began increasing wooden ship construction. Several of the largest shipping and shipbuilding companies became interested in the program. It is forecast that Japan proper will produce 400,000 gross tons of wooden ships in 1944 and that the areas under her control will produce 250,000 gross tons. In view of the inefficiency of wooden tonnage compared with steel tonnage, this will add the equivalent of about 325,000 tons of steel bottoms. Yards scattered widely along the coast of Southwest Japan are contributing about ⅔ of the output of wooden ships in Japan proper (TABLE IX - 36).

Under the wooden shipbuilding program, 6 standardized classes of vessels are being produced. Vessels of 300, 250, and 200 gross tons are powered by steam; vessels of 250, 150, and 100 gross tons use sails and auxiliary. FIGURE IX - 32 illustrates the 150-ton type of vessel.

TABLE IX - 34.
PRINCIPAL SHIPYARDS IN SOUTHWEST JAPAN, 1944

Size definitions for merchant shipyards: small, under 375'; medium, 375'-450'; large, over 450'.

ISLAND, PREFECTURE AND LOCATION	COMPANY	BUILDING WAYS	DRY DOCKS	REMARKS
Kyūshū				
Nagasaki-ken				
Kōyagijima-machi, Nishi Sonoki-gun	Kawaminami Kogyo KK (formerly Matsuo Zosensho KK)	No. and size unknown	No. and size unknown	Greatly increased importance in last few years. Probably engaged in both naval and merchant construction. Has engine manufacturing facilities.
Nagasaki	Mitsubishi Jukogyo KK	2 medium 4 large	2 large 1 medium	Works consists of 2 main plants, Tategami Shipyard and Akunoura Engine Works. Major producers of engines, turbines, and boilers (FIGURES IX - 42, 43, 44, 45).
Sasebo	Naval Base			See CHAPTER XIII.
Southwest Honshū				
Hiroshima-ken				
Habu-machi and Sannoshō-machi, Mitsugi-gun	Ōsaka Tekkosho KK	4 medium 3 large	1 large 2 medium 3 small	Works has 2 yards on Inno-shima Habu-machi and Sannoshō-machi, Habu the more important. Inno-shima works increased greatly in significance since start of the China hostilities.
Kure	Naval Base			See CHAPTER XIII.
Okayama-ken				
Hibi-machi	Tama Zosensho KK	5 large	1 small 2 large	Engaged in merchant and naval construction. Engine manufacturing facilities. Produces boilers.
Hyōgo-ken				
Kōbe	Kawasaki Jukogyo KK	2 medium 6 large	1 medium	Capable of building largest types of merchant and naval vessels. Has engine manufacturing facilities. Major producer of engines, turbines, and boilers (FIGURE IX - 47).
Kōbe	Mitsubishi Jukogyo KK	1 small 4 medium	2 medium (floating) 1 large (floating) 1 large (graving projected)	Specializes in repair of vessels and in construction of medium and small cargo vessels. Produces engines, turbines (FIGURE IX - 48).
Ō-machi, Ako-gun	Harima Zosensho KK	3 large 1 large projected	1 large 1 projected	Engaged in merchant and naval construction. Engine manufacturing facilities. Produces boilers.
Ōsaka-fu				
Ōsaka	Ōsaka Tekkosho KK	2 small 4 large	1 medium 1 large	Ōsaka Tekkosho KK in Ōsaka has 2 yards, Sakurashima and Chikko. Engages in both merchant and naval construction. Has engine manufacturing facilities.
	Fujinagata Zosensho KK	3 small 3 medium	2 small 1 large	Engages in small merchant and naval construction. Has engine manufacturing facilities.
Kyōto-fu				
Maizuru	Naval Base			See CHAPTER XIII.
Shiga-ken				
Tsuruga	Unknown		1 large	Graving dock of 10,000 ton capacity reported under construction in 1941.
Aichi-ken				
Nagoya	Uraga Senkyo KK	3 size unknown		Reported building freighters and tankers up to 8,000 tons.

TABLE IX - 35. SELECTED SECOND CLASS SHIPYARDS IN SOUTHWESTERN JAPAN, 1944

Size definitions: small, under 375'; medium, 375' - 450'; large, over 450'.

ISLAND, PREFECTURE AND LOCATION	COMPANY	BUILDING WAYS	DRY DOCKS	REMARKS
Kyūshū				
Fukuoka-ken				
Wakamatsu	Tochigi Senkyo KK	2 medium	1 medium	June 18, 1944 one cargo ship under construction on building way, hull almost complete; one 275' cargo ship in drydock, 4 boats av. 60' in open area near boat basin, probably under construction or being repaired. (Reported)
Southwest Honshū				
Yamaguchi-ken				
Hiko-shima, Shimonoseki	Mitsubishi Jokogyo KK	4 small	2 medium 1 small	Specializes in repair and construction.
Hiko-shima, Shimonoseki	Ōsaka Tekkosho KK		2 small	
Ko-seto (between Honshū and Hiko-shima)	Dockyard	3 small	7 small	

TABLE IX - 35. (*Continued*).

ISLAND, PREFECTURE AND LOCATION	COMPANY	BUILDING WAYS	DRY DOCKS	REMARKS
NW bank of Hayatomo-seto (Shimonoseki Strait)	Dockyard	1 small	1 small	
W bank of Hayatomo-seto (Shimonoseki Strait)	Shipyard	1 medium		
S tip of Hiko-shima	Shipyard	2 small		
Kasadojima	Kasadojima Senkyo KK		1 large	
Hiroshima-ken				
Higashi-mura, Mitsugi-gun	Mukaijima Senkyo KK		1 small 1 medium	
Ōsaka-fu				
Ōsaka	Harada Zosen	2 small	2 small	
Ōsaka	Ōno Tekko Zosensho	5 small	2 small	
Ōsaka	Sano Yasu Senkyo Kojō		1 size unknown	
Ōsaka	Namura Zosensho KK		2 small	
Ōsaka	Kizugawa Zosen Tekkosho		1 small	
Ōsaka	Amagasaki		2 small	
Ōsaka	Nitta Senkyo Zosensho		1 small	
Ōsaka	Aizawa		1 large	
Ōsaka	Uchida Zosensho	3 small 3 medium		
Ōsaka	Toba	2 large		
Ōsaka	Hashimoto	1 unknown length 1 small		
Ōsaka	Horai		1 unknown length	
Ōsaka	Shirao Shokichi		1 small	
Ōsaka	Ōbara Zosen Tekkosho KK	1 small	1 small	

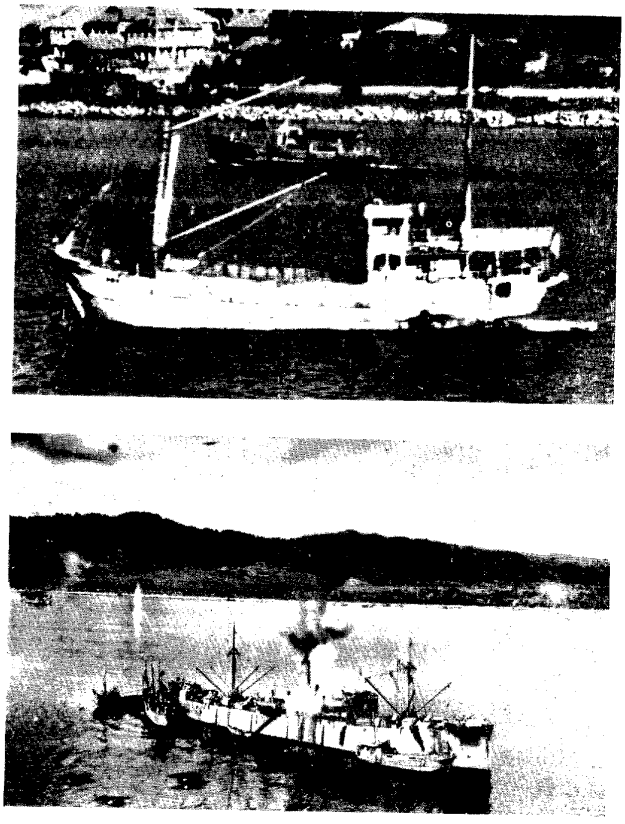

FIGURE IX - 32. *Southwest Japan.*

Location unknown, probably 1943. Upper, 100-foot wooden ship; lower, 100-foot wooden ship alongside 400-foot steel vessel. These are examples of standardized construction developed during the war.

TABLE IX - 36.
WOODEN SHIPYARDS IN WESTERN JAPAN, 1944

ISLAND, PREFECTURE AND LOCATION	COMPANY
Kyūshū	
Kagoshima-ken	
Location unknown	Umigata Zosen
Miyazaki-ken	
Tono-ura	Tatsuma Kyūshū Kisen
Ōita-ken	
Location unknown	Higashi Kyūshū Kisen
Fukuoka-ken	
Wakamatsu	Fukuoka Shipbuilding, Iron and Steel Works 3 small building yards ownership unknown.
Nagasaki-ken	
Location unknown	Unzen Zosen
Kumamoto-ken	
Location unknown	Tatsuma Hachiyo Zosen
Shikoku	
Kōchi-ken	
Location unknown	Listed by one source as owned by Shikoku Zosen Kōchi Moku Zosen and by another as owned by Ugai Zosen
Tokushima-ken	
Okazaki-aza, Muya-machi, Itano-gun	Okinosu Zosen Kenzo
Kagawa-ken	
Sakade-mura, Soji-gun	Moku Zosen Kenzo
Takuma-mura, Mitoyo-gun	Sanuki Shipyard
Ehime-ken	
Hakata-mura, Ochi-gun	Oura Hikiage Senkyo Goshi Kaisha
Location unknown	Listed by one source as owned by Iyo Zosen and by another as owned by Kodama Shipbuilding Co.

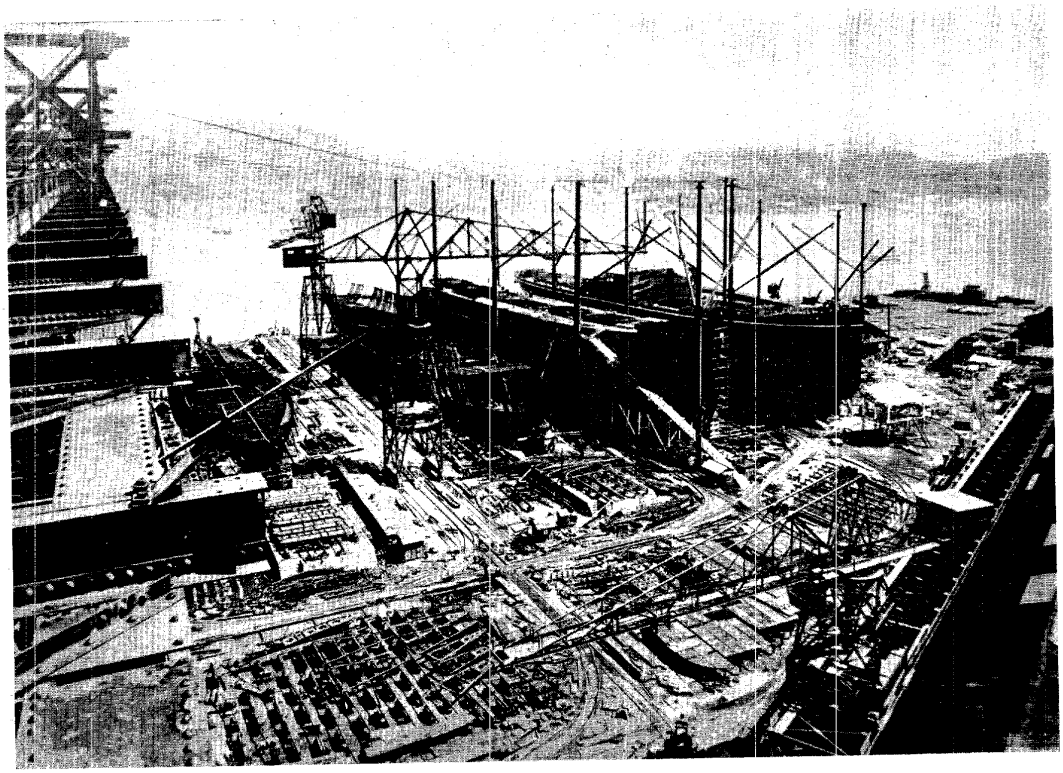

FIGURE IX - 33. *Nagasaki Prefecture.*
Nagasaki, 1935, looking SW. Building ways of Mitsubishi Jukogyo K. K. This is one of the 2 largest private shipyards in Japan.

TABLE IX - 36. (*Continued*).

ISLAND, PREFECTURE AND LOCATION	COMPANY
Southwestern Honshū	
Yamaguchi	
Shimonoseki (Hiko-shima)	5 building yards, ownership unknown
Hiroshima-ken	
Location unknown	Chūgoku Zosen
Onomichi	Nissan Zosen
Onomichi	Hamane Zosen
Okayama-ken	
Location unknown	7 yards
Tottori-ken	
Location unknown	Yonago Zosen
Shimane-ken	
Matsue	Shipyard
Hyōgo-ken	
Kōbe	Numerous yards
Osaka-fu	
Location unknown	Hinomaru Shipyard
Location unknown	Ōsaka Wood & Iron Shipbuilding Works
Locations unknown	Numerous other yards
Wakayama-ken	
Kushimoto-machi, Nishi-muro-gun	Kishu Zosen
Location unknown	Wakayama Zosen Sho
Aichi-ken	
Location unknown	Meitetsu Aichi Zosen
Toba-machi	Unknown

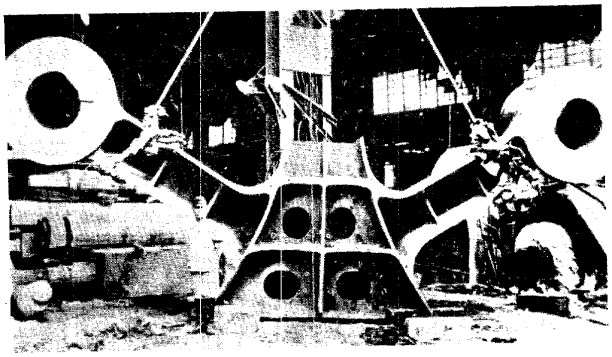

FIGURE IX - 34. *Nagasaki Prefecture.*
Nagasaki, 1938. Probably Mitsubishi Jukogyo K. K. dockyard plant. Shaft bracket for a Nippon Yusen Kaisha ocean liner.

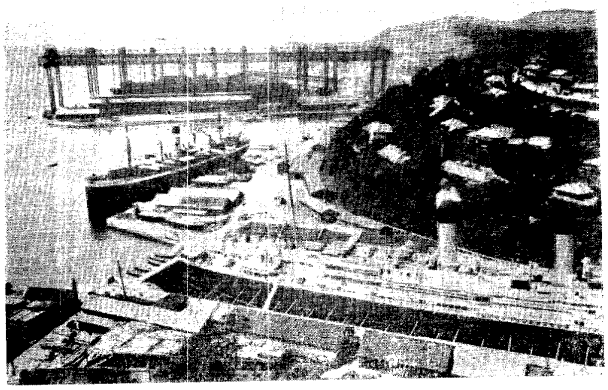

FIGURE IX - 35. *Nagasaki Prefecture.*
Nagasaki, 1930, looking S. View from Mitsubishi No. 3 dock to building ways. Gantry crane is over first and largest of buildings ways

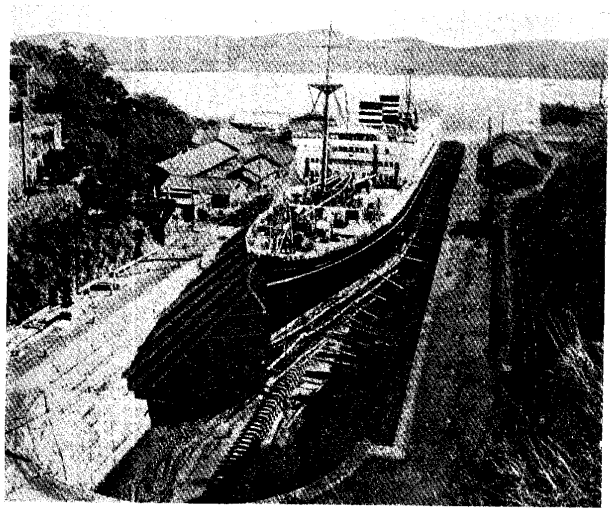

FIGURE IX - 36. *Nagasaki Prefecture.*
Nagasaki, before 1929, looking E. Mitsubishi No. 3 graving dock, 728 feet in over all length and 96½ feet in width at entrance.

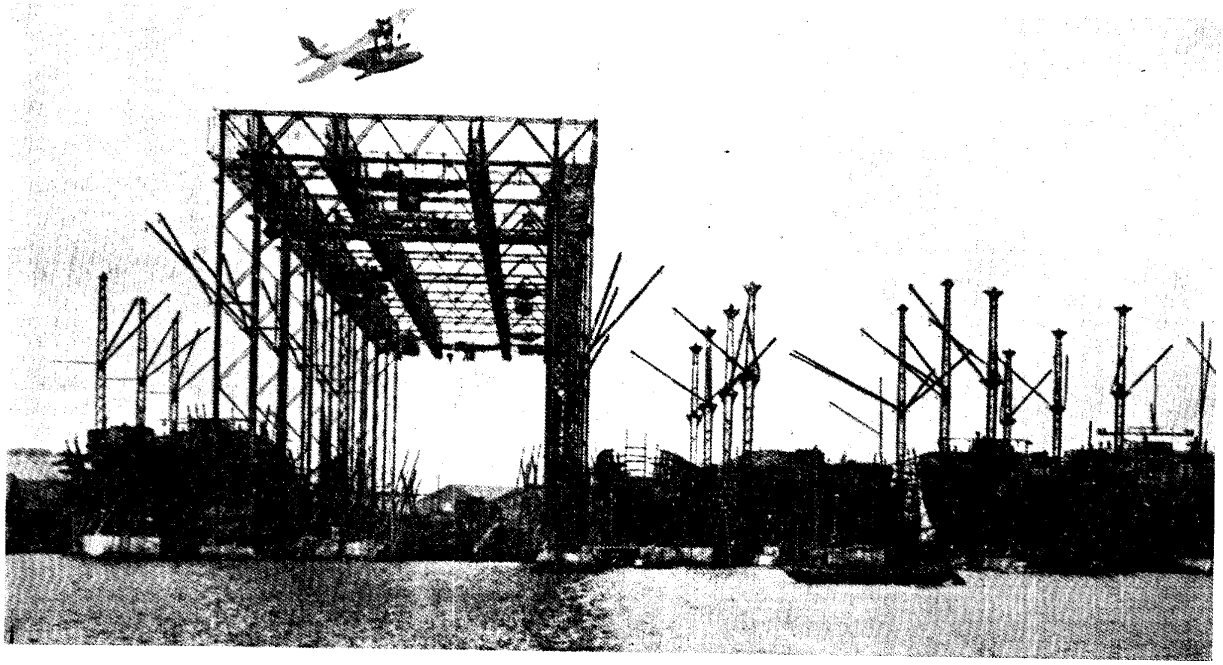

FIGURE IX - 37. *Hyōgo Prefecture.*
Kōbe, 1931. Kawasaki shipyard. Shares top rank in Japan with Mitsubishi at Nagasaki.

FIGURE IX - 38. *Hyōgo Prefecture.*
Kōbe, date unknown. Interior of machine shop at Mitsubishi shipyard.

G. Railroad equipment.

Wartime traffic increases have placed a heavy strain upon the equipment of Japanese railroads. Additions to rolling stock have kept pace with minimum requirements but the equipment industry has been unable to provide the railroads with a comfortable margin in locomotives and cars because of demands made on its facilities by production of other badly needed items. Some of the rolling stock output has probably been exported.

Southwest Japan produced, in 1937, 84% of the railroad equipment output of Japan proper, by value. This percentage is thought to have increased still further in recent years. Plants believed to have produced rolling stock in recent years are shown on FIGURE IX - 61, and listed in TABLE IX - 37.

(1) *Locomotives.*

The 1944 production of steam and electric locomotives in Japan proper is estimated at a maximum of 500 units. The 1937 production was 485 units. From 200 to 300 locomotives each year are placed in service on railroads in Japan and the balance of production is exported to the Asiatic mainland.

Over 90% of locomotive production is in Southwest Japan, according to 1937 statistics.

(2) *Cars.*

Railroad car production in Japan is estimated for 1944 at about 11,000 freight cars and a maximum of 600 passenger cars. Less than 10% of total car production is believed exported.

Plants in Southwest Japan turn out 75% of the railroad cars produced in all Japan, according to 1937 statistics.

(3) *Important centers of production.*

Ōsaka and Kōbe are leading centers of parts manufacture and have important plants producing finished locomotives and cars. The locomotive works of Kisha Seizo KK at Ōsaka is 1 of the largest in Japan. This plant has also produced boilers, construction and spinning machinery, and iron girders. At Kōbe, the extensive installations of Mitsubishi Jukogyo KK and Kawasaki Jukogyo KK (with the associated Kawasaki Sharyo KK) turn out a variety of products ranging from warships to engines and machinery of various types, as well as locomotives (Topic 95, C). The 2 plants in and near Nagoya, like the 1 at Ōsaka, produce boilers and machinery of various sorts as well as cars and locomotives.

The most significant center of production outside the Ōsaka-Kōbe and Nagoya districts is in Hiroshima-ken at Itosaki, where a plant was completed in 1943 with a reported annual capacity of 150 locomotives.

TABLE IX - 37.
RAILWAY EQUIPMENT MANUFACTURERS IN SOUTHWEST JAPAN

ISLAND, PREFECTURE, AND LOCATION	COMPANY	PRODUCT
Kyūshū		
Fukuoka-ken		
Kokura	Toyo Sharyo KK	Cars
Nagasaki-ken		
Nagasaki	Mitsubishi Jukogyo KK	Locomotives and cars
Kumamoto-ken		
Kumamoto	Fujita Tekkosho KK	Cars
Southwest Honshū		
Yamaguchi-ken		
Kudamatsu	Hitachi Seisakusho KK	Locomotives

TABLE IX - 37. (*Continued*).

ISLAND, PREFECTURE, AND LOCATION	COMPANY	PRODUCT
Hiroshima-ken		
Itosaki	Mitsubishi Jukogyo KK	Locomotives
Shimane-ken		
Sakai	Unebachi Sharyo KK	Cars
Hyōgo-ken		
Kōbe	Kawasaki Sharyo KK	Locomotives and cars
Ōsaka-fu		
Ōsaka	Endo Tekkosho KK	Locomotives
	Hatsudoki Seizo KK	Locomotives
	Kato Sharyo Seisakusho KK	Cars
	Kisha Seizo KK	Locomotives and cars
	Kusuki Seisakusho KK	Locomotives and cars
	Ōsaka Tekkosho KK	Cars
	Tanaka Sharyo KK	Cars
	Unemachi Sharyo KK	Cars
Aichi-ken		
Nagoya	Nippon Sharyo Seizo KK	Locomotives and cars
Namuri	Nippon Sharyo Seizo KK	Locomotives and cars

H. Motor vehicles and tanks.

The Japanese motor vehicle industry, virtually non-existent prior to 1936, is, by western standards, still extremely small. Its aggregate annual capacity has been assessed at from 70,000 to 90,000 vehicles of all types. If trucks alone are produced, as current intelligence suggests, Japanese motor-vehicle-manufacturing capacity is probably of the order of 60,000 one and one-half ton or larger vehicles per year, plus fewer than 1,000 tanks.

The industry has to date apparently been able to fulfill all essential wartime requirements. The Army's losses in combat have been small, gains by conquest substantial, and domestic truck requirements are negligible. Shortage of fuel and repair parts has prevented trucks from securing an important position in industrial transport. Tank production is so small as to represent little drain on truck component or assembly facilities.

Toyoda Jidosha Kogyo KK, located near Nagoya, and Kawasaki Jukogyo KK at Kōbe, both in the central industrial belt, account for nearly all the motor-vehicle-manufacturing capacity in Southwest Japan, and for perhaps 40% to 50% of the capacity of the entire Japanese motor vehicle industry. Some tanks are produced in this area.

The Toyoda Jidosha Kogyo KK, located in Koromo near Nagoya, is the largest motor vehicle plant in Japan in terms of floor area, but its past production record has been less impressive than that of its principal rival, Nissan Jidosha KK, located in the Tōkyō area. The Koromo plant has assembly capacity for from 20,000 to 30,000 vehicles per year, but its present vehicle output, which consists entirely of military trucks, probably does not exceed 5,000 to 8,000 per year. Reports have been received to the effect that the plant has been at least partly converted to higher priority war production, but the precise degree of conversion has not been ascertained.

The Kawasaki Jukogyo KK plant at Kōbe was relatively small, at least until 1941. This plant has since been reported enlarged and converted to tank production. Mitsubishi Jukogyo KK has also been reported to be using its Nagasaki plant for tank manufacture.

The American General Motors Company had a fairly extensive motor-vehicle-assembly plant in Ōsaka prior to the war (FIGURE IX - 39). The present use to which the buildings are put is unknown, but it has been reported that the equipment

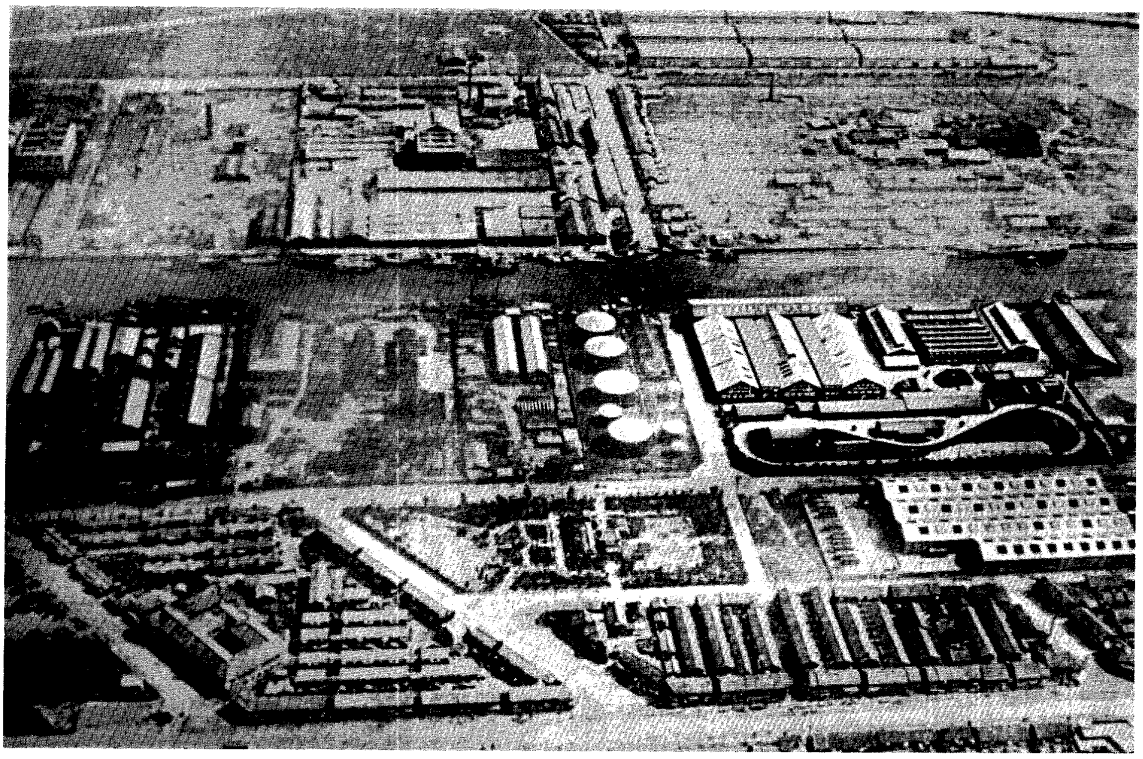

FIGURE IX - 39. *Ōsaka Prefecture.*
Ōsaka, date unknown. General Motors Plant, an important automobile assembly plant before the war. Present use of buildings unknown, possibly aircraft; equipment reported shipped to continent for service and repair work.

was dismantled and shipped to the continent for service and repair work in Manchuria and North China.

I. Aircraft.

Aircraft now commands top priority in the Japanese war production program. Since 1941, strenuous efforts have been made to increase plane output by the construction and equipment of new manufacturing facilities, by conversion of plant capacity less essential to the war program, and by diversion of labor and material resources to the aircraft program. Under this stimulus, aircraft production in Japan has increased rapidly, but current output is still small according to American standards. Production of combat aircraft during 1943 is estimated to have been 56% above 1942 on a weight basis and to have increased even more in terms of number of planes, since the average unit weight of Japanese aircraft output was decreasing. It is forecast that production during 1944 may advance 50% above 1943 (weight basis) provided no bombing of aircraft factories or other interruptions to production take place.

The heavy pressure against the Japanese air forces during the spring and summer of 1944 has been reflected both in efforts to secure further increases in plane production, and in an increasing concentration upon fighter planes in the aircraft production program. Currently, nearly 75% of new production consists of fighters and torpedo bombers, the 2 types most urgently required for Inner Zone defensive operations.

Late in 1943 Southwest Japan was producing roughly 400 finished operational type aircraft per month--about ⅓ of Japan proper's total. It contributed about an equal share of the aircraft engines. The 2 most important concentrations of aircraft manufacture in the area are the industrial districts centering in Nagoya and Ōsaka (FIGURE IX - 62).

(1) Principal manufacturers.

Direct and reasonably current intelligence about Japanese aircraft production, by type of plane and by plant, is available from captured enemy materiel. However, in the absence of aerial reconnaissance, little reliable current information concerning the layout or physical characteristics of specific aircraft plants can be obtained.

Under the Munitions Ministry and the control associations, the administration of Japanese aircraft production is in the hands of a few large private companies, namely Mitsubishi (FIGURE IX - 40), Nakajima, Aichi, Kawasaki, and Sumitomo. The government arsenals have confined their activities largely to research and development and to the manufacture of prototypes to be used as a basis for private mass production. A significant exception is the Sasebo Naval Arsenal, which has continuously produced a particular type of single-engine float plane fighter.

The aircraft manufacturing operations of Mitsubishi Hikoki KK, a subsidiary of Mitsubishi Jukogyo KK and 1 of the 2 largest companies in the industry, are localized in a complex of plants in and near Nagoya. Included in this complex is the largest single aircraft manufacturing establishment in all Japan, the Mitsubishi aero-engine works and related factories in Nagoya.

The second most important aircraft company in Southwest Japan, and the fourth most important in the Japanese aircraft industry, is Kawasaki Kokuki Kogyo KK. This company's operations center in Ōsaka but extend outward toward Nagoya with several plants scattered through the industrialized area between these 2 cities. At Akashi-shi (Ōsaka-fu), Kawasaki has a large aero-engine works. Engines from the Akashi-shi plant and major airframe components erected in other plants in the Ōsaka area, are assembled at Kagamigahara (Sohara-mura, Gifu-ken), 20 miles north of Nagoya. This plant, though much smaller than the Mitsubishi Nagoya establishment, is important as the exclusive source of Japan's newest and best fighter planes.

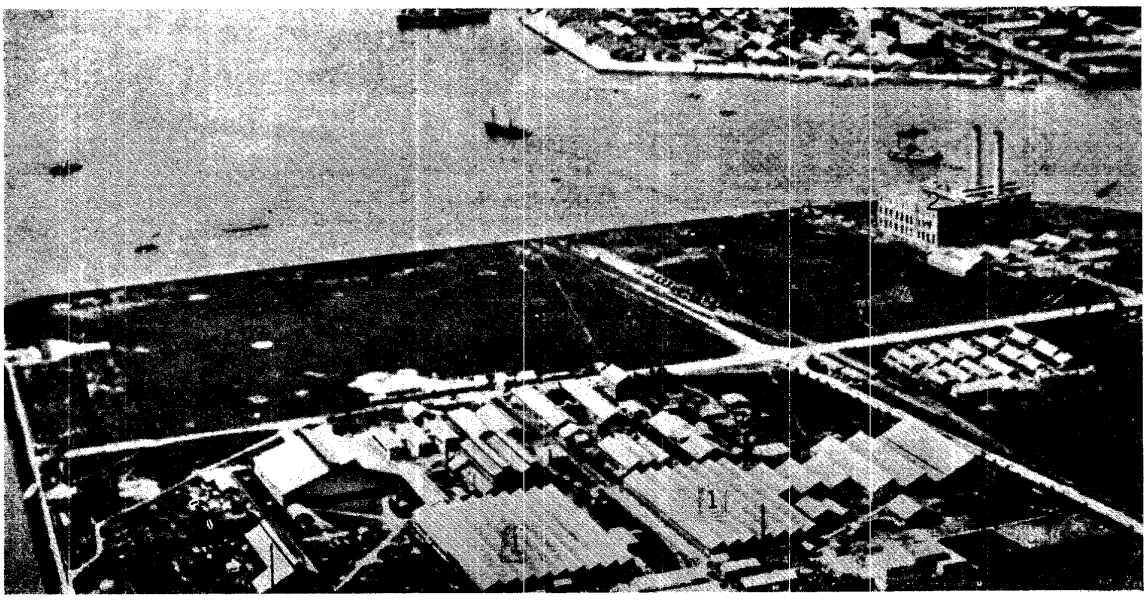

FIGURE IX - 40. *Nagoya Prefecture.*
Nagoya, 1932, looking E. Airview of (1) Mitsubishi aircraft plant on Nagoya harbor and (2) steam power plant.

(2) Manufacture of components.

Feeding into the large assembly operation of these companies are several hundred component and sub-assembly factories. Many of the component and sub-assembly factories are converted establishments, in contrast to the engine and assembly plants, which are for the most part either specialized new plants (for example Kagamigahara), constructed since the outbreak of the war, or integrated establishments formed by major additions to existing prewar plants (for example, Mitsubishi, Nagoya). There are indications that bits and pieces of work are farmed out by some component producers to small family-scale establishments.

Although in general aircraft component manufacture is not highly concentrated either in ownership or location, important clusters of component manufacturers may be found (FIGURE IX - 62). The principal concentrations of this type in Southwest Japan are summarized in TABLE IX - 38.

TABLE IX - 38.
PRINCIPAL MANUFACTURERS OF CRITICAL AIRCRAFT COMPONENTS, SOUTHWEST JAPAN, 1944

ISLAND, PREFECTURE AND LOCATION	COMPANY	PRODUCTS
Kyūshū		
Fukuoka-ken		
Ōno-mura, Chikushi-gun	Miyata Seisakusho KK	Landing gear
Nagasaki-ken		
Nagasaki	Mitsubishi Hikoki KK	Propeller governors
Southwest Honshū		
Yamaguchi-ken		
Iwakuni	Teikoku Jinzo Kenshi KK	Landing gear
Okayama-ken		
Okayama	Nakajima Chuzosho KK	
Hyōgo-ken		
Naruno-mura	Kawanishi Kokuki KK	
Ōsaka-fu		
Ōsaka	Nippon Koku Seiki Kogyo KK	
Ōsaka	Sumitomo Kinzoku Kogyo KK	Propeller blades and governors
Aichi-ken		
Nagoya	Okamoto Kogyo KK	Constant speed propeller governors
Nagoya	Mitsubishi Denki KK	Magnetos
Nagoya	Daido Denki Seiko KK	Aircraft starters

(3) Engine manufacturing.

The Mitsubishi plant at Nagoya produces at least 25% of all aircraft engines, and is the largest single source. All Mitsubishi engines are radial and are closely patterned after standard American designs, modified by a few improvements of German and Japanese origin. Though few reliable structural details concerning the Mitsubishi plant are available, this establishment is believed to be very large, mainly of modern reinforced concrete construction.

The Kawasaki Akashi plant, largely built since the outbreak of war, is undoubtedly one of the most modern and best equipped in all Japan. It is the only known producer of in-line, liquid-cooled combat engines.

(4) Final assembly.

Mitsubishi's facilities in and near Nagoya are integrated with the company's engine manufacturing activities. Few details are available except that assembly capacity is of the same magnitude as engine capacity, about 25% of the total for all Japan. The company fabricates and erects major airframe components and also produces many types of specialized aircraft component instruments and armament. Mitsubishi produces all types of planes and is the principal source of light and medium bombers.

Kawasaki's Kagamigahara assembly facilities are likewise unknown, but direct evidence indicates that the plant has about reached maturity, with a capacity of no more than 100 fighters per month.

There is a small aircraft plant at Sasebo (Nagasaki-ken). This plant is a branch of the naval arsenal and comprises research and development laboratories, machine shops for the fabrication of prototypes, and a small integrated establishment which has been engaged in the manufacture of float plane fighters.

(5) Modification and repair.

This process, not strictly a part of the manufacturing operation but rather concerned with the fitting of instruments, armament, and secret devices, and with the repair of both battle and non-operational damage, is apparently also highly concentrated at a few points both in Japan and in outside areas under Japanese control. Reconnaissance has revealed a large aircraft plant at Ōmuta (Fukuoka-ken) in Kyūshū. In the absence of careful checking on the interpretation of these photographs and in the absence of direct evidence concerning any production at this plant, it is reasonable to assume that it is probably a modification and repair center, ranking in importance with or above a few others located in Formosa, Korea, and Manchuria.

J. Rubber tires.

Japan is believed to have stockpiles of rubber, and her minimum requirements for truck tires are well below productive capacity. Needs for airplane tires have, of course, increased greatly.

Based on 1940 estimated data, about ¾ of Japan's tire capacity of 5,700 per day was in the Southwest area. This amounts to somewhat under 60% when all territory now controlled by Japan is included. At that time, output was centered in the Dunlop Tire Company in Kōbe and the plants of the Bridgestone Company at Fukuoka (FIGURE IX - 41) and Kurume in Fukuoka-ken, Kyūshū. In all probability these are still major producers. Present capacity of the Kōbe plant is estimated at the equivalent of 2,900 truck tires per day and the combined capacity of the other 2 at about 2,200 per day.

K. Textiles.

Japan's textile economy, employing close to 1,500,000 persons in the decade ending in 1937, has shrunk to relatively small proportions. A large synthetic fiber industry, built up between 1933 and 1939 and located mainly in Southwest Japan, now provides most of the clothing material for the population of the islands. Silk, once exported in large quantities, helps to relieve the shortage only slightly. Cotton-spinning mills are producing little more than ⅕ of the 1937 yarn output, using small quantities of inferior Chinese cotton mixed with a high proportion of synthetic staple fiber and some short silk fiber. The military forces use all the available wool and, after military and industrial requirements are met, the supply of all clothing fibers left for civilians is only about ⅛ of prewar civilian consumption.

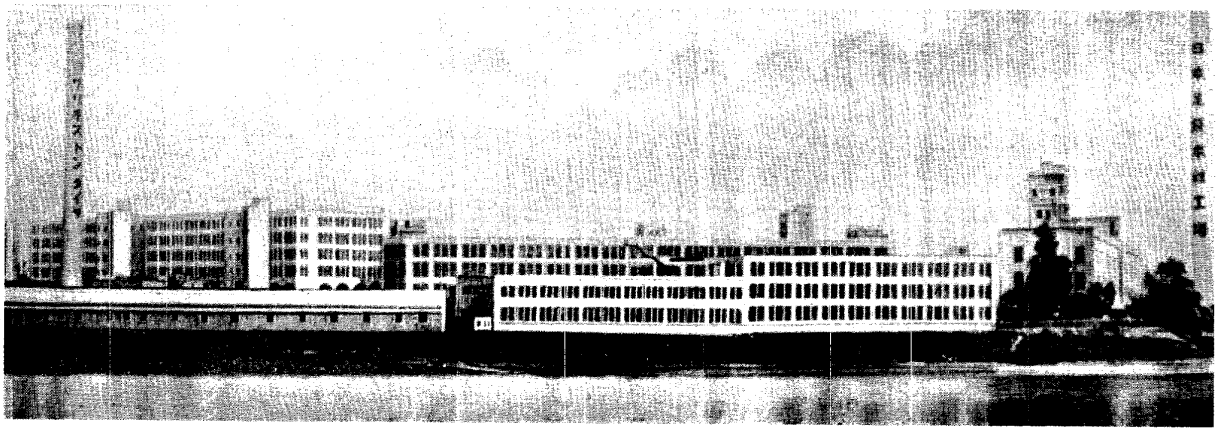

FIGURE IX - 41. *Fukuoka Prefecture.*
Kurume, date unknown, looking SE. Nippon Rubber Company plant on Chikūgo river at right; portion of former Bridgestone Tire Company plant at left.

(1) Synthetic fiber.

Although rated plant capacity in Japan reached an over-expanded total of about 800,000 metric tons a year in 1940, hardly ¼ of it is utilized now. Output is chiefly staple fiber, rather than rayon, and is held down both by the limited supply of high-grade bleached sulfite pulp and, more generally, by low priorities given to labor, fuel, and chemical raw materials for this industry. About 240,000 metric tons of caustic soda are required, calling in turn for about 480,000 tons of imported industrial salt. Thirty leading mills have a capacity of 560,000 metric tons, 93% of which is in 26 mills (FIGURE IX - 50) in Southwest Japan. Twelve of these plants, averaging somewhat larger than the rest, are along the northern shores of the Inland Sea (FIGURE IX - 63), and others are in Shikoku, but it is possible that the few plants now in operation include a higher proportion of the ones located on or near the Japan Sea, either in this area or farther to the northeast, with easier access to the major sources of rayon pulp.

(2) Rayon pulp.

Production of pulp usable either for synthetic fiber or nitrocellulose is mainly in Karafuto, Hokkaidō, and northern Honshū. Only 2 minor mills are believed to be located in Southwest Japan, 1 in Miyazaki-ken (FIGURE IX - 42) and 1 in Yamaguchi-ken (FIGURE IX - 43).

(3) Cotton spinning.

Southwest Japan produced 80% of Japan's cotton yarn, by value, in 1937, with more than 50% in the central industrial belt from Kōbe and Ōsaka to Nagoya (including the neighboring prefectures of Wakayama and Mie). Spinning of cotton-type yarns is believed to be concentrated now in the larger and more efficient mills, an even higher proportion of which are in the Southwest area (FIGURE IX - 63). Some unused textile machinery has been transferred to the continent and some scrapped. Buildings are believed to have been converted to war production in many cases.

(4) Silk reeling.

As indicated in Topic 94, C, (1), silk cocoon production in 1944 will fall short of 200,000 metric tons, or less than ⅔ the 1934-1939 average. This will provide less than 20,000 tons of raw silk and 8,000 tons of silk waste. Some of the raw silk is cut to be used as staple fiber in mixed yarns.

Silk reeling is a fairly large-scale factory industry in Japan, located mainly in the population centers of primarily agricultural areas. Ten per cent of the 1937 output, by value, occurred in Aichi-ken, which is on the edge of the oldest and most concentrated silk reeling area, but an additional 33% was spread through the remainder of Southwest Japan.

(5) Weaving.

In Japan cotton weaving is much less concentrated than spinning, and a very substantial proportion of the output before the war was done in household workshops. This was even more the case with silk weaving. In 1930 there were 474,000 persons engaged in weaving or knitting of all types of textiles, of whom only 260,000 were workers in factories with 5 or more employees.

L. Pulp and paper.

Although fiberboard boxes may receive wartime priority, it is likely that the well developed Japanese paper pulp and paper industries are in general operating much below capacity.

(1) Pulp.

Southwest Japan plays a relatively small role in pulp production, with only 17% of the pulp output of Japan in 1938 and only 8% of total production in Japan, Karafuto, Korea, and Manchuria. This output is highly concentrated in Kumamoto and Gifu prefectures, both considerable lumber producers, and in the Ōsaka district, a center for all wood-using industries. Most of the pulp mills in the area have digesters and produce soda and sulfate, or sulfite types of pulp. The major production, however, is of wood pulp suitable only for newsprint. Principal mills are located in FIGURE IX - 53 and listed, with capacities, in TABLE IX - 39. Rayon or nitrating-type pulp mills are discussed separately in Topic 95, K.

(2) Paper and products.

Cardboard and paper board production of the area, about 110,000 metric tons in 1938 (46% of the total for Japan), was important in Saga-ken (Kyūshū) and in Hiroshima and Okayama prefectures on the northern shores of the Inland Sea.

FIGURE IX - 42. *Miyazaki Prefecture.*
Nobeoka, 1937, looking NE. Rayon plant of Asahi Bemberg Kenshoku K. K.

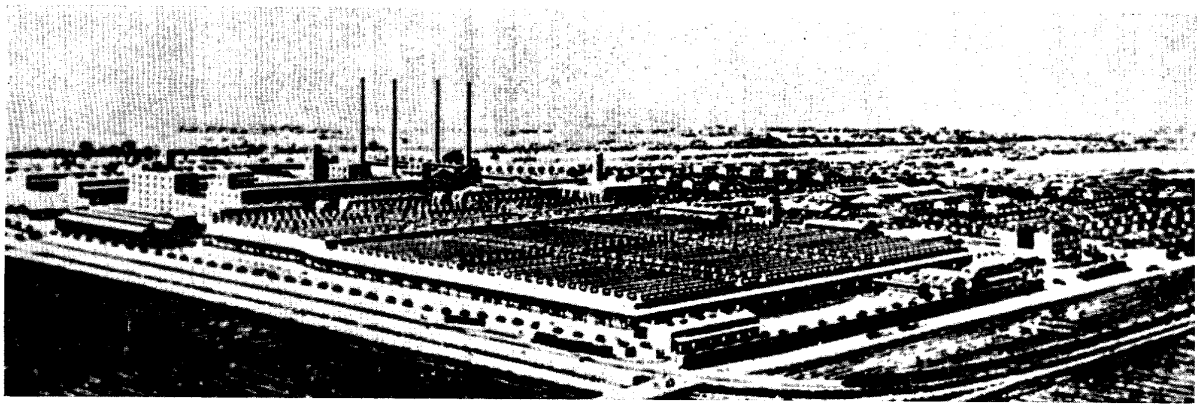

FIGURE IX - 43. *Yamaguchi Prefecture.*
Iwakuni, date unknown. One of the largest rayon plants of Japan, owned by Teikoku Jinken K. K.

Cardboard box production is heavily concentrated in Ōsaka-ken (38% by value of all Japanese production in 1938) and to a lesser extent in the north Kyūshū and Nagoya industrial districts. Southwest Japan has a deficiency in newsprint supplies. Its 1938 output of 82,000 metric tons was only 17% of the total for Japan.

TABLE IX - 39.
PRODUCTION OF PRINCIPAL PAPER PULP MILLS IN SOUTHWEST JAPAN, 1937-1939 AVERAGES (PARTLY ESTIMATED)

ISLAND, PREFECTURE AND LOCATION	COMPANY	PULP PRODUCTION (IN METRIC TONS)	PAPER PRODUCTION (IN METRIC TONS)
Kyūshū			
Kumamoto-ken			
Yatsushiro	Oji Seishi KK	31,000	32,500
Kami Matsukuma-mura, Yatsushiro-gun	Oji Seishi KK	20,000	36,500
Southwest Honshū			
Okayama-ken			
Okayama	Okayama Seishi KK	5,000	11,000
Hyōgo-ken			
Amagasaki	Oji Seishi KK	5,700	13,500
Ōsaka-fu			
Exact location unknown	Toyo Boseki KK	10,000	
Exact location unknown	Namiwa Seishi KK	6,500	
Ōsaka	Rasa Pulp Kogyo KK	6,600	
Aichi-ken			
Nagoya	Oji Seishi KK	8,600	4,500
Gifu-ken			
Nakatsu-machi, Ena-gun	Oji Seishi KK	25,000	25,000

96. Electric Power

At the end of 1943 the electric power generating plants of Japan proper had a total capacity of 13,400,000 kilowatts with a total output for 1943 estimated at about 49,000,000,000 kilowatt-hours. These plants, numbering perhaps 1,200, range in size from small hydro and thermal plants of 1,000 kilowatts to the giant Amagasaki No. 2 Steam Plant with a capacity of 375,000 kilowatts. Several hundred smaller plants are also in operation but their contribution to the total power output is insignificant. To a large extent, the production of electric power is dependent upon rainfall, and droughts in the last few years have thrown a heavier burden on the supply and transportation of coal, particularly in the drier months.

The electric power supply of Southwest Japan is organized about a small number of "grids" or transmission networks, made up of several hundred hydro and steam generating plants. Apart from those factories which have private or "captive" power plants on the premises, no single generating plant or small number of plants is responsible for the energy used by any specific consumer, industry, or locality. Even the factories deriving electricity from their captive plants often have alternative connections with the public supply grids. Inadequacies in integration of the networks, previously caused by the operation of several companies within the same grid, has been largely eliminated by the centralization of management in generation and transmission in the Nippon Hassoden KK (Japan Electric Generation and Transmission Company), and administrative centralization of distribution through regional distribution monopolies. Electric power capacity, output, vulnerability, fuel requirements, and consumption, can be discussed only in terms of the grids or the areas which they supply.

A. The grids.

There are 4 major grids in Southwest Japan: Kyūshū, Shikoku, Chūgoku (covering the prefectures of Okayama, Hiroshima, Shimane, Tottori and Yamaguchi), and Ōsaka-Nagoya (covering the prefectures east from Hyōgo, to and including Aichi, Gifu, Fukui, Toyama, Ishikawa and the western parts of Shizuoka, Yamanashi, and Nagano). They are more or less cut off from each other and from neighboring grids by differences in frequency and by poor inter-connections, partly as a result of the difficulty or impossibility of stringing and maintaining high tension wires across the straits or the open sea between the islands. For similar reasons, the Kyūshū grid is subdivided into 3 sub-areas with somewhat better interconnections than those among the major grids: (1) Kokura-Tobata-Yawata (covering those cities and nearby areas), (2) West Kyūshū (covering roughly the remainder of Fukuoka prefecture, also Nagasaki, Saga, and the western portions of Miyazaki, Kumamoto, and Kagoshima prefectures), and (3) East Kyūshū (consisting of Ōita prefecture and the eastern parts of Miyazaki, Kumamoto, and Kagoshima prefectures).

FIGURES IX - 64 to IX - 66 show the Kyūshū, Shikoku, and Chūgoku supply areas. A similar figure showing the Ōsaka-Nagoya and Tōkyō supply areas will be included in JANIS 85.

B. Capacity and production.

Southwest Japan contains about ⅓ of the generating capacity and energy output of Japan proper. It is estimated that in 1943 its installed generating capacity of 8,300,000 kilowatts (62% of Japan proper) produced about 29,000,000,000 kilowatt-hours (59% of Japan proper), distributed by type and among the grids as shown in TABLE IX - 40.

TABLE IX - 40.

ELECTRIC POWER CAPACITY AND PRODUCTION, SOUTHWEST JAPAN, 1943

AREAS	CAPACITY (IN THOUSAND KW)			PRODUCTION (IN MILLION KWH)		
	HYDRO	FUEL	TOTAL	HYDRO	FUEL	TOTAL
Ōsaka-Nagoya	2,305	2,420	4,725	11,100	5,150	16,250
Chūgoku	240	515	755	1,150	1,150	2,300
Shikoku	160	230	390	750	350	1,100
Kyūshū	700	1,700	2,400	3,650	5,700	9,350
Kokura-Tobata-Yawata	40	915	955			
West Kyūshū	430	670	1,100			
East Kyūshū	230	115	345			
Total	3,405	4,865	8,270	16,650	12,350	29,000

C. Vulnerability.

In Southwest Japan, except for the Kokura-Tobata-Yawata sub-area, the power supply is derived largely from hydroelectric plants which carry the base load througnout the year. The newest and most efficient fuel plants operate throughout the year, but for the most part full plant capacity is used to supplement the decline in hydroelectric production during the dry season (November through February, and August). During the dry season, when the available facilities are pressed into service, reserve capacity is low. On the other hand, during the greater part of the year a partial set of substitute facilities (most of the fuel plant capacity) lies ready for use. In the dry season, reserves in Southwest Japan grids range from 6% to 10% of utilized capacity. This is in sharp contrast to wet season reserve capacity which with the exception of the Kokura-Tobata-Yawata sub-area, ranges from 30% to 60% of utilized capacity. In the Kokura-Tobata-Yawata sub-area, fuel plants constitute the bulk of energy supply, and there the reserves are comparatively narrow throughout the year (15% or less of utilized capacity).

To the reserve within each grid area should be added the limited supplies of energy which may be transferred from other grids. Ōsaka-Nagoya may obtain a maximum of 490,000 kilowatts in the wet season and 205,000 kilowatts in the dry season from the Tōkyō grid even though they operate on different frequencies (60 cycles for Ōsaka-Nagoya and 50 cycles for Tōkyō) by means of a string of double-frequency hydroelectric plants situated between the 2 areas and hooked on to both grids. Chūgoku-chihō might receive some 30,000 kilowatts from the Kokura-Tobata-Yawata area and vice-versa by way of the Moji-Shimonoseki Tunnel high tension cable, but this is limited by the capacity of the cycle-changing equipment installed there. Shikoku has no electrical connections with the rest of Japan. The 3 Kyūshū sub-areas can obtain power from each other to the following extent:

Kokura-Tobata-Yawata—40,000 kilowatts from West and East Kyūshū via existing transmission lines.

West Kyūshū—115,000 kilowatts in the wet season and

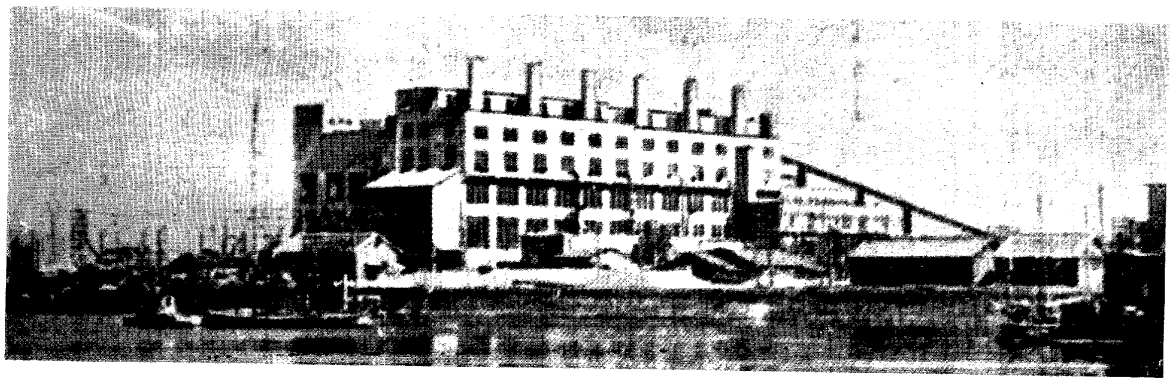

FIGURE IX - 44. *Fukuoka Prefecture.*
Ōmuta, date unknown. Minato steam power plant.

50,000 kilowatts in the dry reason from double-frequency hydroelectric plants normally serving East Kyūshū.

East Kyūshū—80,000 kilowatts in the wet season and 20,000 kilowatts in the dry season from double-frequency hydroelectric plants normally serving West Kyūshū, also 40,000 from Kokura-Tobata-Yawata existing transmission lines.

In all of these cases, the transfer of energy from other grids is, of course, limited by the extent of firm power loads of consumers within the grid.

D. Important generating plants.

Almost all generating plants of top-most importance in Southwest Japan are fuel plants located in or near a few large cities. Hydro plants, both in capacity and location, are adapted to the available water flow and consequently are scattered inland and are of relatively low capacity. Fuel plants are located near industrial concentrations and have a relatively large capacity. The cities and suburbs of Amagasaki, Ōsaka, Nagoya, Kōbe, Okayama, Ube, Hiroshima, Niihama, Kokura, Tobata, Yawata, Nagasaki, Ōmuta, and Fukuoka are the centers of power generation in Southwest Japan.

A list of the most important generating plants with installed capacities by grid is given in TABLE IX - 41.

TABLE IX - 41.
MAJOR ELECTRIC POWER GENERATING PLANTS, SOUTHWEST JAPAN, 1943

LOCATION	NAME OF PLANT	CAPACITY (IN KILOWATTS)
Kyūshū Supply Area		
(Kokura-Tobata-Yawata Sub-area)		
Fukuoka-ken		
Tobata	Tobata Steam Plant	209,000
Yawata	Nippon Seitetsu-sho Yawata No. 4 Steam Plant	124,600
Kokura	Kokura No. 2 Steam Plant	78,240
Kokura	Kokura Steam Plant	50,000
Kokura	Kokura No. 1 Steam Plant	40,000
(West Kyūshū Sub-area)		
Fukuoka-ken		
Ōmuta	Minato Steam Plant (FIGURE IX - 44)	162,000
Ōmuta	Shin Karyoku Steam Plant	104,000
Ōmuta	Oura Steam Plant	34,000
Tatara-mura, Kasuya-gun	Najima Steam Plant (FIGURE IX - 45)	60,000
Miyazaki-ken		
Morotsuka-mura, Nishi Usuki-gun	Tsukabaru Hydro Plant*1 (FIG. IX - 46)	50,000
Nagasaki-ken		
Ainoura-machi, Kita Matsuura-gun	Ainoura Steam Plant	50,000
(East Kyūshū Sub-area)		
Miyazaki-ken		
Morotsuka-mura, Nishi Usuki-gun	Tsukabaru Hydro Plant*1	50,000
Shikoku Supply Area		
Ehime-ken		
Saijo-machi, Nii-gun	Saijo Steam Plant	60,000
Niihama	Niihama Steam Plant	40,000
Chūgoku-chihō Supply Area		
Yamaguchi-ken		
Ube	Ube No. 2 Steam Plant	75,000
Onoda-machi, Asa-gun	Onoda Steam Plant	70,000
Shimonoseki	Shimonoseki Maeda Steam Plant (FIGURE IX - 47)	23,750
Hiroshima-ken		
Saka-mura, Aki-gun	Saka Steam Plant	51,200
Okayama-ken		
Samban-mura, Jodo-gun	Samban Steam Plant	75,000
Ōsaka-Nagoya Supply Area		
Hyōgo-ken		
Amagasaki	Amagasaki No. 2 Steam Plant	375,000
Amagasaki	Amagasaki No. 1 Steam Plant (FIGURE IX - 48)	318,000
Amagasaki	Amagasaki Steam Plant	140,000
Shikama	Shikama No. 3 Steam Plant (FIGURE IX - 49)	77,000
Hiro-mura, Shikawa-gun	Nippon Seitetsu-sho Hirohata Steam Plant	75,000
Kōbe	Minatogawa Steam Plant	65,960

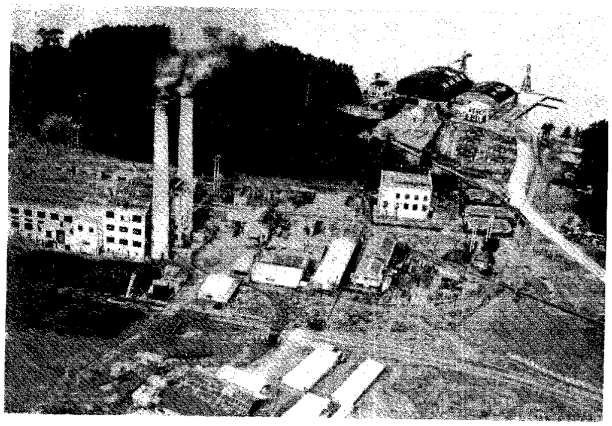

FIGURE IX - 45. *Fukuoka Prefecture.*
Najima, date unknown. Najima steam power plant.

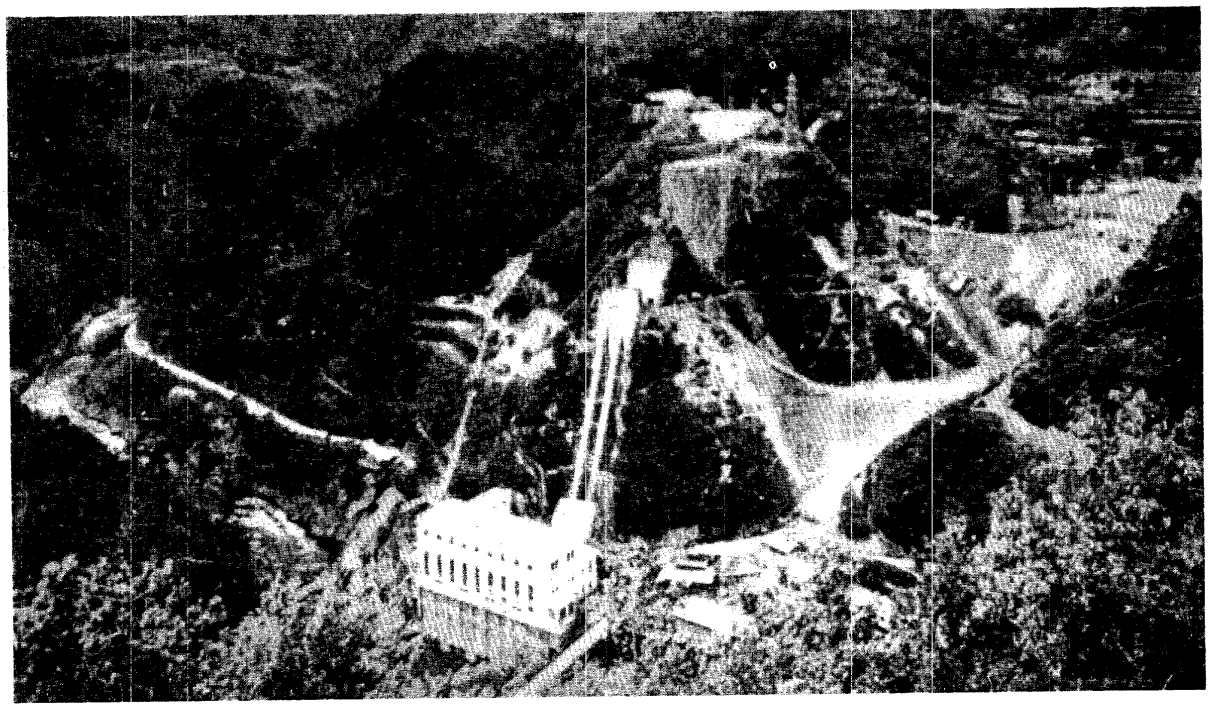

FIGURE IX - 46. *Miyazaki Prefecture.*
Morotsuka-mura, Nishi Usuki-gun, 1938. Tsukubaru hydroelectric plant.

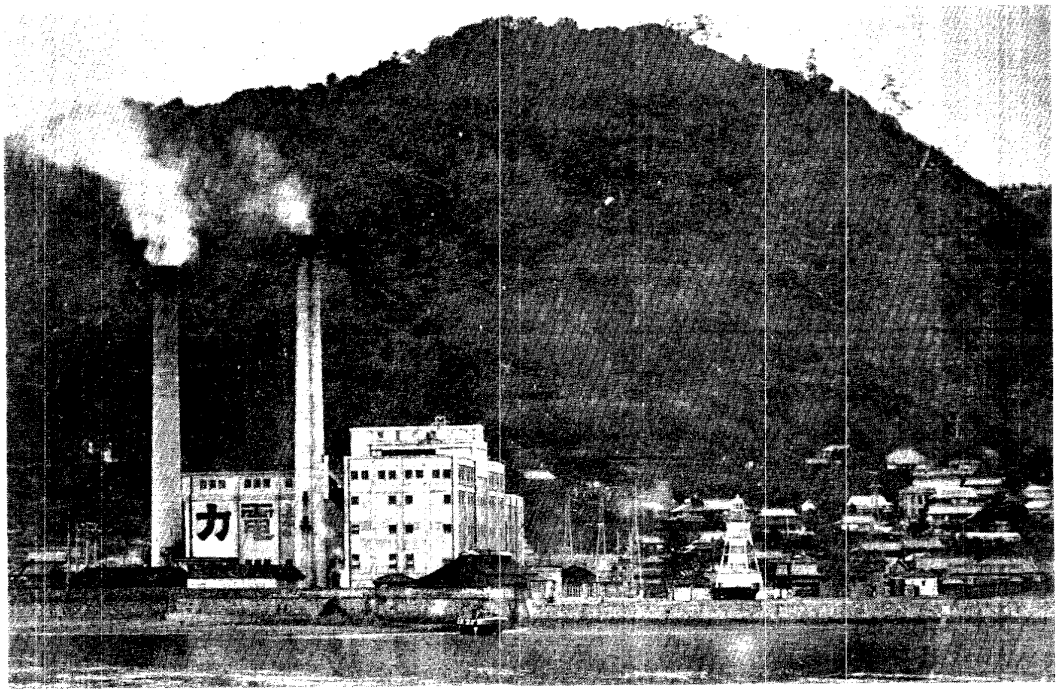

FIGURE IX - 47. *Yamaguchi Prefecture.*
Shimonoseki, date unknown, looking S. Shimonoseki Maeda steam power plant.

TABLE IX - 41. (*Continued*).

LOCATION	NAME OF PLANT	CAPACITY (IN KILOWATTS)
Ōsaka-fu		
Ōsaka	Kasugade No. 2 Steam Plant	65,000
Ōsaka	Kasugade No. 1 Steam Plant	63,250
Ōsaka	Kizugawa Steam Plant	63,000
Aichi-ken		
Nagoya	Meiko Steam Plant	212,000
Nagoya	Nagoya Karyoku Steam Plant (FIGURE IX - 50)	144,000
Toyama-ken		
Uchiyama-mura, Shimo Niikawa-gun	Kurobe No. 3 Hydro Plant [1]	90,000
	Kurobe No. 2 Hydro Plant [2]	65,200
Higashi Yamami-mura, Higashi Tonami-gun	Komaki Hydro Plant	72,700

* Capacity listed is wet season capacity.
[1] Plant serves both West and East Kyūshū grids.
[2] Plants serve Tōkyō grid as well.

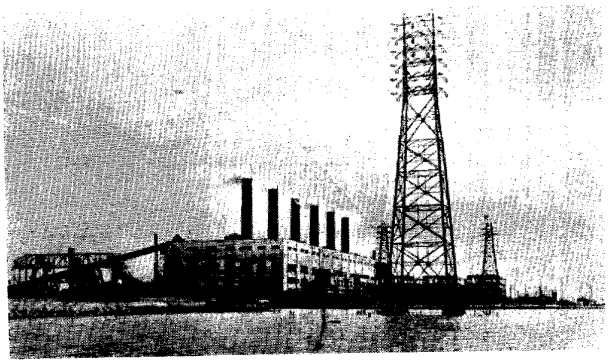

FIGURE IX - 48. *Hyōgo Prefecture.*
Amagasaki, date unknown. Amagasaki No. 1 steam power plant. This plant, together with the Amagasaki No. 2 steam power plant 400 yards away, accounts for 14% of the capacity of the Ōsaka-Nagoya supply area.

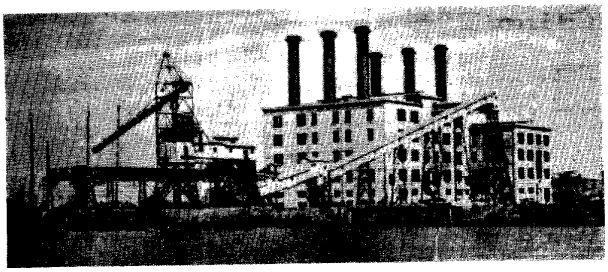

FIGURE IX - 49. *Hyōgo Prefecture.*
Shikama, date unknown. Shikama No. 3 steam power plant.

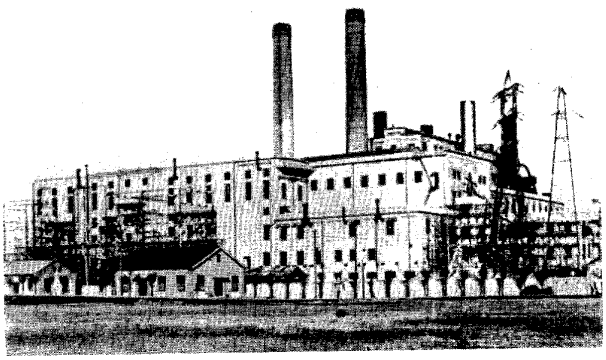

FIGURE IX - 50. *Aichi Prefecture.*
Nagoya, date unknown. Nagoya Karyoku steam power plant.

E. Fuel requirements.

As indicated by TABLE IX - 41, over the course of the year Southwest Japan relies about as heavily on fuel-generated power as on hydroelectric power. This is in strong contrast to the rest of Japan where the ratio of hydroelectric production to fuel-plant production in 1943 is estimated at 15 to 1. Most of the fuel required for power generation in Japan proper is used in Southwest Japan. It is estimated that about 11,800,000 metric tons of coal (of 11,500 B.t.u. quality), or 90% of all coal used to operate electric power in Japan proper in 1943, was consumed by the public utility, and "captive" power plants of Southwest Japan. Of this amount, about 5,500,000 metric tons were required by Kyūshū, 4,900,000 tons by the Ōsaka-Nagoya grid, 1,100,000 tons by the Chūgoku-chihō grid, and 315,000 tons by Shikoku.

F. Current characteristics.

All current publicly sold and almost all current privately generated is 3-phase, alternating current. It is transmitted at voltages of from 33 to 154 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 traction purposes the energy is converted to direct current by rotary converters or mercury arc rectifiers and transformed generally to 1,500 volts. For all electrolytic processes and variable speed motors used in industry, it is converted to direct current by converters or rectifiers in the consuming factories. Prevailing frequencies of the grids are either 50 or 60 cycles as follows:

60 cycles	Ōsaka-Nagoya, Chūgoku, Shikoku, West Kyūshū
50 cycles	Kokura-Tobata-Yawata, East Kyūshū

G. Transmission and distribution.

With a few exceptions, current is transmitted by high tension overhead wires strung along steel towers. Distribution is handled in the large cities by underground cables, and elsewhere by overhead wires strung on wooden poles. Transmission lines are of 2 sorts, the long-distance lines leading from hydroelectric plants to sub-stations (at voltages of from 66 to 154 kilovolts), and the short lines leading from fuel plants to sub-stations or connecting sub-stations (at voltages of from 33 to 77 kilovolts).

Of the 4 supply areas in Southwest Japan, only the Ōsaka-Nagoya area has a highly developed grid. There are 7 principal transmission lines, each with a capacity of 154 kilovolts. Four of these bring power to Ōsaka from clusters of hydroelectric plants: on the Kiso-gawa 2 lines, on the Hida-gawa, and on the Sho-kawa. Two others transmit power to Nagoya from hydroelectric plants on the Tenryū-kawa; and the Hida-gawa, Kurobe-kawa and Sho-gawa. The remaining 154 kilovolt line connects Ōsaka and Nagoya. In addition, numerous lines of 77 kilovolts and 66 kilovolts tap the power of the smaller rivers and the fuel plants, and hook up the larger lines.

Heavy reliance on fuel plants in North and West Kyūshū and in Chūgoku-chihō has made unnecessary great volume, super-high tension lines connecting hydroelectric plants with consumers, and prevented inter-connections of any great capacity. In East Kyūshū and Shikoku there are no important

energy arteries. High tension lines lead from each major river to the nearest city, but no single line is of outstanding importance.

H. Utilization.

The principal consumers of electric power in Southwest Japan are the iron and steel, light metals, coal mining, and certain chemical (calcium carbide, cyanamide, chlorine, and hydrogen) industries. Residential illumination is estimated to require only about 5% of the power produced, with commercial illumination taking perhaps an equal amount.

The principal consumers of electric power by supply area in 1937 and the approximate percentage of area power consumption accounted for are listed in TABLE IX - 42.

TABLE IX - 42.
CONSUMPTION OF ELECTRIC POWER, SOUTHWEST JAPAN, 1937

OSAKA-NAGOYA	%	CHŪGOKU	%	SHIKOKU	%	KYŪSHŪ	%
Textiles	18.6	Rayon	28.5	Textiles	25.1	Iron & Steel	19.4
Iron & Steel	7.1	Textiles	12.6	Metal Mining	19.9	Coal Mining	17.6
Residential	6.9	Residential	7.5	Rayon	13.3	Cyanamide & Carbide	13.7
Machinery	5.9	Cement	5.8	Residential	7.7	Hydrogen for ammonia	4.6
Rayon	5.3	Paper and allied products	3.9	Cement	3.5	Cement	4.6
Cyanamide & Carbide	4.1	Coal Mining	3.8	Chlorine	3.2	Metal Mining	3.8
Gas and Electric	3.3	Gas and Electric	3.3			Residential	3.8
Paper and allied products	2.5	Machinery	2.9			Gas and Electric	2.9
Cement	2.4	Metal Mining	2.7			Paper and allied products	2.5

It will be noted that energy consumption was more diversified in western Honshū and Shikoku than in Kyūshū where 3 industries utilized half the power production. Furthermore, in recent years the textile industry, which was a leading consumer in Southwest Honshū and Shikoku, has declined considerably. Aluminum and magnesium production, which require large quantities of energy, were in their infancy in 1937. Naval and military ordnance, shipbuilding and aircraft production are now major consumers. Residential consumption has probably not been reduced, but since much more energy is now produced, it requires a much smaller percentage of area energy at present.

97. *Commerce*

The structure of Japanese foreign commerce is in part a reflection of an insular geographic position, and in part an outgrowth of the meagerness of natural resources on the main islands. The pressures of industrialization have caused the development of large shipbuilding, trading, shipping, and manufacturing concerns. These have served as the agencies through which raw materials have been imported, and processed goods and services have been exported. Cotton textiles and raw silk were Japan's principal exports (in value) before the war but are now insignificant (Topic 95, K).

Shimonoseki-kaikyō (Shimonoseki Straits), separating northern Kyūshū and western Honshū, are only 125 miles from Korea; within a radius of about 800 miles from the Moji-Shimonoseki area may be tapped all the natural resources of Korea, most of those of Manchuria, and many of those of China. Japanese dependence on overseas trade, primarily from the west and secondarily from the south, is so great that her entire war effort would collapse within a few months if an effective blockade were imposed on shipments from these directions.

A. Imports from Korea, Manchuria, and North China.

Upon the shipments from the west depends the maintenance of the iron and steel industry of both northern Kyūshū and western Honshū. From 2,000,000 to 3,000,000 metric tons a year of coking coal moves in from this direction, particularly from North China. Also drawn from the west are several million tons of iron ore, a few million tons of pig iron, and several hundred thousand tons of steel ingots. In addition, small but significant amounts of manganese and tungsten are brought across from the mainland. Upwards of 9,000,000 metric tons of non-coking coal are obtained, destined mainly for Honshū. In 1944, several tens of thousands of tons of cotton will be taken to Japan proper from Occupied China. The surplus synthetic oil production of Korea and Manchuria provides several hundred thousand metric tons for Japan proper, much of which is transported to Southwest Japan. To meet shortages in non-ferrous metals, Japan goes to Korea and Manchuria for aluminum and magnesium, lead and zinc. In staple foods the supplies from the west are of some importance; from Korea will be obtained perhaps 400,000 metric tons of rice in 1944, and from Manchuria and Korea together about 1,000,000 metric tons of soybeans.

B. Imports from the south.

Petroleum from the East Indies (Topic 94, B, (3)), bauxite from Bintan (Topic 94, A, (3)), iron ore from the Philippines and possibly Malaya (Topic 95, A), rice from Indochina, Formosa and other territories (Topic 91, A), and sugar from Formosa and Okinawa-shima (Topic 91, F, (4)) are the largest and most important tonnages brought into the main islands of Japan from the south.

Fuel oil, aviation gasoline, and lubricants refined from crude oil in the East Indies are distributed directly to the Navy and other users so far as possible, but surpluses are brought to Japan, so far as shipping facilities will allow, to maintain and, if possible, increase stocks in Japan. Bauxite from Bintan is partially converted to alumina or aluminum in Formosa and Korea before reaching Japan.

Of Japan's rice imports of perhaps 2,000,000 metric tons a year, about 1,500,000 tons come from the south. Southwest Japan's rice deficit is roughly 60% of the entire country's. All sugar imports come from the south; Southwest Japan requires less than ½ of these.

Of other imports from the south, nickel ore, roughly 300,000 metric tons a year from the Celebes, to be refined chiefly in Southwest Japan, is of great importance to alloy steel production in the Ōsaka and Nagoya areas and elsewhere in Japan (Topic 94, A, (2)). Potentially, 125,000 metric tons of copper matte and concentrates may be brought from the Philippines, possibly via Formosa. Other imports from the Philippines are likely to include chromite and manganese and possibly as much as 1,000,000 metric tons of iron ore.

Because of shipping shortages, lead, zinc, tin, and rubber are probably not coming in sizable quantities from the south, although the first 2 of these are badly needed.

C. Ports.

Shipments from North and Central China originate chiefly at Chin-huang-tao (coal), Tsingtao (iron and coal), Tientsin-Tangku (coal), Lung-yen (salt and other commodities), and the mouth of the Yangtze (iron). An increasing number of cargoes from North China are being diverted to railroads through Manchuria and Korea, or through a roundabout shipping route via Jinsen, Korea. Manchurian shipments come mainly from Dairen, but some commodities pass by rail to southern Korean ports or to Seishin at the northern tip of Korea. The more important commodity movements from Korea stem from Chinnampo, Jinsen, Fusan, and Seishin.

The various routes from these export points converge for the most part on Shimonoseki-kaikyō. A few new ports, such as Hakata serving Fukuoka in Fukuoka-ken, have been developed both in Southwest Japan and north along the Japan Sea in order to relieve shipping congestion.

The ports of Moji, Wakamatsu, and Yawata, located at the northern tip of Kyūshū, and Ōsaka, and Kōbe in the Inland Sea, are considered to be of prime importance for Japanese imports. Ranking second in importance now are the ports of Amagasaki (between Ōsaka and Kōbe), Nagasaki, Himeji (Hyōgo-ken), and Nagoya.

D. Inter-island shipments.

The principal inter-island commerce of Japan is the movement of coal from Kyūshū to Honshū. Moji and Wakamatsu are probably the main export points. Pig iron, rolled steel products, cement, refined metals, and probably chemical products also flow from Kyūshū to Honshū. Shikoku ships out smaller tonnages of non-ferrous metals, ferrous concentrates, and salt for food or industrial uses. Coastwise shipping is still heavily used for inter-island commerce; but Allied submarine activity and the need for vessels to move cargoes from the Asiatic mainland have diverted much of the traffic within a single island to the railroads. The Moji-Shimonoseki tunnel, 1 tube of which was completed in 1942 and the other in early 1944, is of some importance in handling traffic between Kyūshū and Honshū.

98. *Finance*

A. Currency.

The currency unit of Japan is the *yen,* which is divided into 100 *sen* or 1,000 *rin.* The currency in circulation consists mainly of notes of the Bank of Japan in denominations of 1, 10, 20, 50, 100 *yen* and a small amount of 200 *yen* notes. The notes of the Bank of Chōsen and the Bank of Taiwan also circulate freely, the former in denominations of 1, 5, 10, and 100 *yen* and the latter in denominations of 1, 5, 10, 50 and 100 *yen.* Subsidiary currency in circulation consists of coins in denominations of 5 *rin* and 1 *sen* (bronze or aluminum), 5 and 10 *sen* (nickel or aluminum), and 20 and 50 *sen* (silver), and state notes in denominations of 10, 20, and 50 *sen.*

The Bank of Japan exercises the exclusive right of issuing bank notes as legal tender throughout the Empire. The notes of the Bank of Chōsen and of the Bank of Taiwan are legal tender only in Korea and Formosa, respectively. In practice, however, the notes of these 2 banks are generally accepted and circulate freely at par in Japan proper, Korea, and Formosa. The note issue of the Bank of Japan as of 31 December 1939 is given by denominations in TABLE IX - 43.

TABLE IX - 43.
NOTE ISSUE OF THE BANK OF JAPAN
31 December 1939

DENOMINATION (YEN)	VALUE (1,000 YEN)	PER CENT OF TOTAL
1	55,549	1.40
5	349,947	9.30
10	2,200,680	60.25
20	61,875	1.50
50	.....	...
100	1,010,971	27.55
200	7	...
Total	3,679,031	100.00

By 31 March 1944, the total note issue of the Bank of Japan had increased to 10,992,000,000 *yen,* or nearly 3 times the 1939 amount.

Notes of the Bank of Japan were manufactured by the Bank itself from a distinctive quality of paper said to be made from a certain kind of mulberry tree. Coins were minted by the Imperial Mint in Ōsaka.

In December 1943, new types of 1-, 5-, and 10-*yen* notes were issued which omitted the English words on the back of the notes, as well as the phrase, "This note is redeemable in gold," and altered the phrase, "Bank of Japan convertible note," to "Bank of Japan note."

B. Foreign exchange value of the *yen.*

Because of the differences in the standard of living and the evaluation of consumption goods as between Japan and western countries, it is difficult to establish a purchasing power parity between the *yen* and other currencies. The exchange rate was pegged at 23-7/16 cents per *yen* for several years before the war, while the official wholesale price index rose nearly 70% between 1936 and mid-1941. A substantial inflation of prices has undoubtedly occurred since then, especially in the black markets for consumer goods. Relaxation of strict price controls would lead to a rapid jump in prices. The advance in United States wholesale prices has been only about 30% from 1936 to 1944.

Except for Japan's exchange controls, exchange value of the *yen* would have been much lower than the official rate of 23-7/16 cents, even in 1941. In New York, *yen* bank notes (as distinct from bank drafts and telegraphic transfers which were subject to official control) sold at 10 to 15 cents in mid-1941. In Shang-hai, in early 1941, *yen* notes sold as low as 7 cents and rose to above 10 cents only when the Yokohama Specie Bank supported the market by heavily buying *yen* notes.

C. The banking system.

It is not possible to discuss banking in the area covered by this study apart from Japan's whole banking system. The salient features of the banking system at the present time may be briefly summed up as (1) dominant control exerted over the

whole credit system of the country by the Bank of Japan, (2) a tremendous part played in the expansion and support of war industries by the banking system, (3) use of the banking system by the government as a means of collecting savings and selling government bonds to absorb some of the expanded currency issue, (4) inflationary growth of bank loans and deposits in relation to government debt and currency in circulation, and (5) concentration of ownerships and control of the large private banks in the hands of a few important family groups which use their banking funds and credit from the central bank mainly for their groups' own industrial and commercial enterprises.

Five groups of banks, divided according to their principal functions, comprise most of the financial institutions of Japan; these are: the central banking group, the ordinary banks, the savings banks, the industrial credit institutions, and the agricultural and development credit institutions.

(1) *The central banking system.*

(*a*) *The Bank of Japan* (*Nippon Ginko*). The Bank of Japan, directly controlled by the Ministry of Finance, acts as the central bank of the Empire and dominates the entire banking system. It is the sole bank of issue for Japan proper, acts as the fiscal agent of the government, and serves as the final source of credit for other banks. Besides its services to the government, it acts mainly as a bankers' bank, its private customers being limited to a few individuals of high standing.

The tripling of the Bank of Japan's note issue from 1939 to 1944 occurred through the Bank of Japan's lending to other banks, through its loans to or bond underwriting on behalf of the government, and through its open market operations. It provided the basis for expansion of bond investments and loans of the entire banking system, resulting in a great increase in bank deposits.

The total of government obligations issued, mainly to finance the war, increased nearly 602% from about 10,913,000,000 *yen* in December 1939 to 65,668,000,000 *yen* in October 1943. These bonds largely passed into the hands of the banks and government organizations which collect private savings (see below), but a considerable part of it went into private hands. Added to this credit expansion was an increase in loans by other banks of about 30,000,000,000 *yen*.

The comparatively small flow of new money and central bank credit into the system is vital to the smooth operation of the financial mechanism. An interruption of the flow or the failure of a part of the mechanism or new demands placed upon it, for example by currency hoarding, might intensify the dislocation of business and industry which would be caused by a general attack upon the Japanese mainland.

On the balance sheet of the Bank of Japan for 31 December 1940 was an item of 501,302,000 *yen* of gold and silver bullion. In the 30 June 1941 balance sheet, this had increased to 555,236,000 *yen*, the increase probably being accounted for by the Bank's taking over 13,458,000 *yen* in bullion from the Bank of Chōsen and the Bank of Taiwan and the dollar balances held by the New York office of the Yokohama Specie Bank for account of the Bank of Japan. The item, "Special Fund for Foreign Exchange, 300,000,000 *yen*," also represents mainly gold, in this case newly mined, acquired for sale abroad. Holdings of bullion may have increased since the publication of these balance sheets, as it is reported that the government has continued to encourage the mining of gold in Korea and (possibly) Formosa.

(*b*) *Southern Regions Development Bank* (*Nanyo Kaihatsu Ginko*). The Southern Regions Development Bank (or Southern Development Bank) was created by the Japanese cabinet in January 1942 for the purpose of "supporting national currency and undertaking transactions necessary for the development of newly occupied regions in the south". The capital was fixed at 100,000,000 *yen*, "but since this amount would by no means be sufficient for the big task, the bank will be authorized to issue bonds to a sum not to exceed 10 times its capital". Actually, the bank operates as an agent for the Bank of Japan in occupied areas in the southern seas where it assumes charge of the issue of Japanese occupation currency under the direction of the local army administrations. The accounts of the branches operating in Manila, Singapore, and Soerabaya are presumed to be centralized in the head office of the bank of Japan in Tōkyō, and will be of interest in determining Japanese occupation expenditures and investments in invaded territories.

(*c*) *The Wartime Financing Bank.* The Wartime Financing Bank, another government institution set up in Tōkyō to provide funds for Japanese corporations for the purchase of commodities for storage for war purposes, has an authorized capital of 300,000,000 *yen*.

(2) *Other central banks and the five big ordinary banks.*

The main details of other banks with central banking functions (special banks) and of the principal commercial banks in Japan are summarized in TABLE IX - 44. Recent bank mergers in Japan have reduced the "big six" of Japanese ordinary banks to the "big five". These 5 banks represent the largest aggregation of capital engaged in commercial banking in the Empire and wield decisive influence in the development of Japanese heavy and light industries.

(3) *Savings institutions.*

Trust companies, savings banks, and the Postal Savings Banks, undertook the functions of collecting savings in the form of savings, fixed and trust accounts, and investment in medium or long-term loans and securities.

Trust companies accepted money deposits in the form of trusts, the most common type being "trust account under general direction," without restriction as to the trust company's use or investment of the money. Securities trust accounts were accepted for terms of 1 year or more and were of 2 types, 1 of which limited the type of investment to government bonds and the other without restriction as to type of securities. In mid-1941, 26 trust companies operated in Japan proper, with aggregate assets and liabilities of 3,707,000,000 *yen*. The banking functions of the trust companies constituted much the greater part of their operations.

Savings banks operated much the same as commercial banks, except that they were not allowed to issue or cash checks against fixed or savings deposits, unless such deposits were those of public agencies and coöperative associations.

TABLE IX - 44.

THE SPECIAL BANKS AND THE "BIG FIVE" ORDINARY BANKS OF JAPAN

BANK	CONTROL GOV'T. (G) PRIVATE (P)	LOCATION OF HEAD OFFICE	NUMBER OF BRANCHES IN JAPAN	CHIEF EXECUTIVES	PRINCIPAL OPERATIONS	CAPITAL & RESERVES (IN 1000'S OF YEN)	TOTAL ASSETS (IN 1000'S OF YEN)	AS OF DATE
Special Banks								
Bank of Japan (Nippon Ginko)	G	Tōkyō	17 branches 539 agencies	Viscount Shibusawa, Governor (1) Toyotaro Yuki, Counsellor Taniguchi, Vice-Governor	Central Bank	186,000	6,013,948	11 Oct. 1941
Bank of Chōsen (Chōsen Ginko)	G	Tōkyō	4	Jun-Ichi Matsubara, Governor	Central Bank for Korea	46,900	2,053,356	31 Dec. 1940
Bank of Taiwan (Taiwan Ginko)	G	Tōkyō	3	Yakichi Suitsu, President Masahiko Wada, Vice-President	Central Bank for Formosa	30,250	823,537	31 Dec. 1940
Yokohama Specie Bank (Yokohama Shokin Ginko)	P	Yokohama Tōkyō	5	Toshikata Okubo, President Hideshige Kashiwagi	Official Foreign Exchange Bank for the Empire	243,400	3,481,321	30 June 1941
Ordinary Banks ("Big Five")								
Imperial Bank (Teikoku Ginko— merger of Mitsui, Dai-Ichi, Jugo Banks)	P	Tōkyō	21	Torio Asahi, President Jukichi Shinkai, Vice-President Yasamuni Mitsui, Director Takahisa Mitsui, Director	Banking for Mitsui Companies	220,000 (1)	2,030,678	30 June 1941
Mitsubishi Bank (Mitsubishi Ginko— absorbed Dai Hyaku Bank)	P	Tōkyō	36	Takeo Kato, Chairman Baron Koyata Iwasaki, Director Hikoyata Iwasaki, Director Baron Ichizaemon Morimura, Auditor	Banking for Iwasaki family interests (Mitsubishi Companies)	175,071	2,105,614	30 June 1941
Sumitomo Bank	P	Ōsaka	79	Kensaku Ohdaira, Chairman Hayashi Okahashi, Chief Manager, Director Baron Kichizaemon Sumitomo, Director	Banking for Sumitomo interests	119,000	2,926,943	30 June 1941
Yasuda Bank (Yasuda Ginko— absorbed Showa and Daisan Bank)	P	Tōkyō	133	Henjima Yasuda, Chairman Zengora Yasuda, Director Hakoshiro Yasuda, Auditor	Banking for Yasuda enterprises	235,300	2,937,173	30 June 1941
Sanwa Bank	P	Ōsaka	150	Sadakiko Nakane, President Kiyozo Kikuchi, Director Baron Zenyemon Konoike, Director Kichirobei Yamaguchi, Dir. Katsuhiko Hamaguchi, Auditor	Banking for Yamaguchi and Konoike enterprises; financing of light industries	152,560	3,034,254	30 June 1941

(1) As of April 1944

The number of savings banks had declined to 72 by 1941, all of which were local institutions.

The Postal Savings Bank (Yubinchokin Ginko), operating through 15,000 local post offices throughout Japan proper, Korea, Formosa, and the islands that were mandated to Japan, provided savings and banking facilities in 1941 for about 60,000,000 depositors, or about ⅔ of the Empire's population. The minimum deposit was 50 *sen*, and the maximum balance except for group accounts was 3,000 *yen*. In mid-1941, the average deposit of depositors throughout the Empire had risen to 140 *yen*. By April 1944 the Postal Savings Bank's deposits totaled 20,000,000,000 *yen*, making it the most important single banking organization in the Empire.

The Postal Transfer System, a part of the Postal Savings Bank, operated a postal, check, and transfer service through the network of post offices for over 600,000 depositors. This checking and money transfer service was used especially by farmers, small business firms, professional men, and public bodies for the payment of pensions, annuities, and interest. The services of the Postal Savings Bank and the Transfer System were also used considerably for the promotion of sales of government bonds. Other services were collection of taxes and fees for municipalities, towns, and villages, and the collection of bills for merchants, and C.O.D. transactions.

The Deposit Funds Management Bureau of the Ministry of Finance bore the responsibility for the management and investment of postal savings, the Bank of Japan acting as its fiscal agent. This bureau also handled surplus funds of governmental bodies and the reserve accounts of savings banks.

(4) *Industrial credit institutions.*

A group of semi-governmental institutions was engaged especially in the financing of industrial activities of political, social, or strategic importance. The most important bank of this type was the Industrial Bank of Japan.

(*a*) *The Industrial Bank of Japan.* With a paid-up capital of 87,500,000 *yen*, the Industrial Bank of Japan's ownership was vested in 8,729 shareholders of its 4,000,000 shares. The government exercised control of the administration. The headquarters of the bank were in Tōkyō and branch offices were maintained in Ōsaka, Kōbe, Nagoya, Fukuoka, Fukushima, Toyama, Hiroshima, and Sapporo.

The Industrial Bank of Japan undertakes medium and long-term mortgage financing. Of particular significance was the bank's financing of national policy companies engaged in the development of strategic resources in Japan and occupied territories. The most important source of funds for its operations is the issuance of debentures.

(*b*) *The Central Bank of Commercial and Manufacturing Associations* (*Shoko Kumiai Chu Ginko*). The Central Bank of Commercial and Manufacturing Associations, set up in 1936 under the Industrial Bank of Japan, had in 1939 a paid-up capital of 4,700,000 *yen*. Under the control of the Minister of Finance and the Minister of Commerce and Industry, the bank was to coördinate the movement of funds of and to provide credit facilities to associations of exporters, merchants, and manufacturers, as well as their respective national federations.

(*c*) *National policy companies engaged in industrial financing*. Certain national policy companies were formed with ½ government and ½ private capital for the purposes of engaging in banking, colonial development and communications, and in the control and expansion of industries considered necessary for Japan's war economy in which private capital could not be induced to engage. Most of these companies were engaged primarily in agricultural financing in Japan or in colonial and dependent areas. Only a few national policy companies were engaged in industrial financing and market stabilization in the Japanese Empire. The most important of these was the Japan Fertilizer Company.

(5) ***Agricultural and development credit institutions.***

The Hypothec Bank of Japan (Nippon Kangyo Ginko) was the central organ of a group of semi-governmental mortgage-lending agencies and coöperative credit associations organized for the purpose of financing development of urban and agricultural properties and development of railways and public utilities.

After having absorbed 41 agricultural and industrial banks between 1921 and 1941, the Hypothec Bank of Japan in the latter year had a paid-up capital of 118,000,000 *yen*. Controlled by the government through its appointment of the governor, vice-governor, and directors as well as of supervisors of branch operations, the bank maintained its head office in Tōkyō and had about 100 branches in Japan proper and 3 in Formosa. The bank made loans on real property for development and agricultural purposes and acted as the central organ for agricultural and industrial banks, coöperative associations, and development and agricultural agencies.

(*a*) *Coöperative credit system*. The Central Bank for Coöperative Associations (Sangyo Kumiai Chuo Ginko), which operated through the branch network of the Hypothec Bank of Japan, has as its functions the receipt of deposits from and the provision of credit to coöperative associations, fishery associations, and their federations. Its authorized capital in 1940 was 35,700,000 *yen* of which 17,500,000 was subscribed by the government and 18,200,000 by associations and federations, the total paid-up capital being 32,900,000 *yen*. A total of 13,502 associations, or 87% of the total number in Japan proper, participated in the bank. The Minister of Finance and the Minister of Agriculture exercised control.

Coöperative associations were of 4 main types: credit, marketing, purchasing, and production. In 1939, 14,301 coöperative associations with 6,766,000 members were in existence in Japan proper, of which 12,787 with 5,489,000 members were classified as credit associations engaged in the collection of savings and granting of credit. The funds of the credit associations were derived from members' contributions and deposits, from reserve funds, and from borrowing from their federation or from the Central Bank for Coöperative Associations. Credit associations, especially since 1937, have been used more for collecting small savings for the government's use than for supplying credit to their members. Credit associations are organized into prefectural federations which act as go-betweens among the member associations and the Central Bank for Coöperative Associations.

(*b*) *Other credit institutions*. Other credit institutions in Japan proper include a few consumption credit organizations and mutual loan societies (Mujin), and many pawn shops. More important are 2 government-sponsored small loan banks. The Peoples Bank (Shomin Ginko) was organized in mid-1938 with 10,000,000 *yen* of government capital for the purpose of facilitating loans at low interest rates to medium size and small merchants and manufacturers, employees, and workers. Its operations and capital have been greatly expanded, with government support, since 1941. The Pension Bank (Onkyu Ginko) was established in 1938 with a capital of 30,000,000 *yen*.

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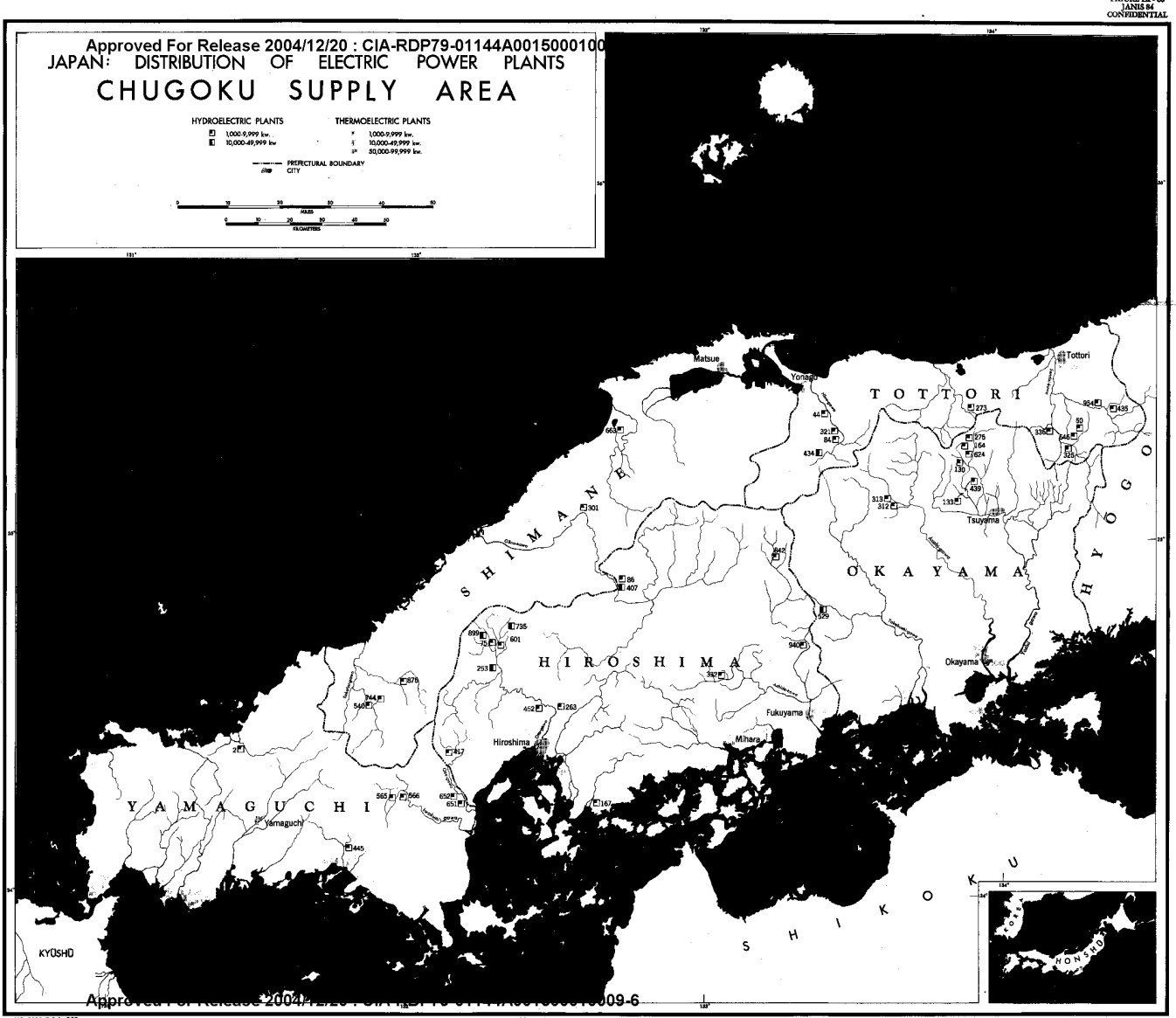

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FIGURE IX - 66. *Southwest Japan.*
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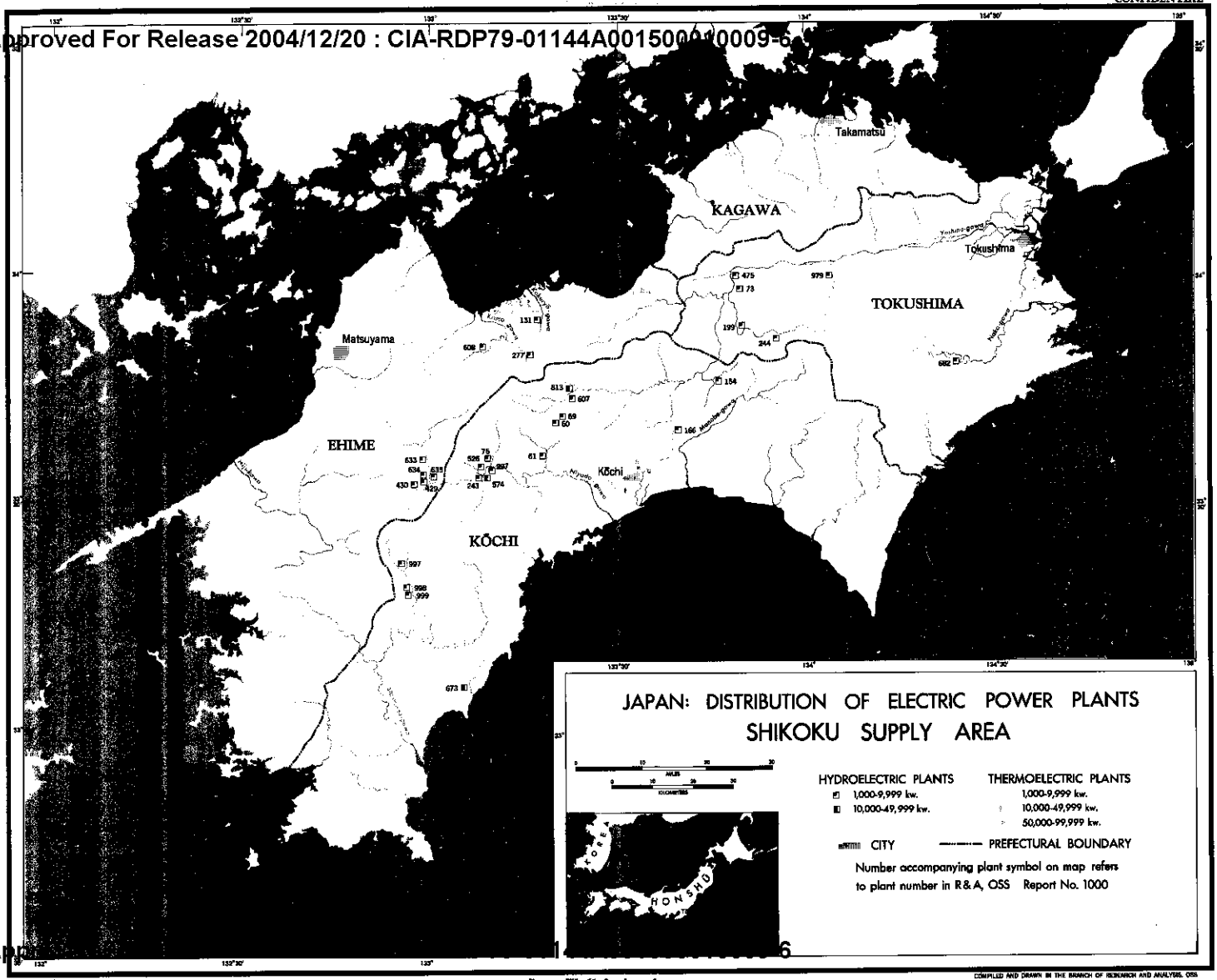

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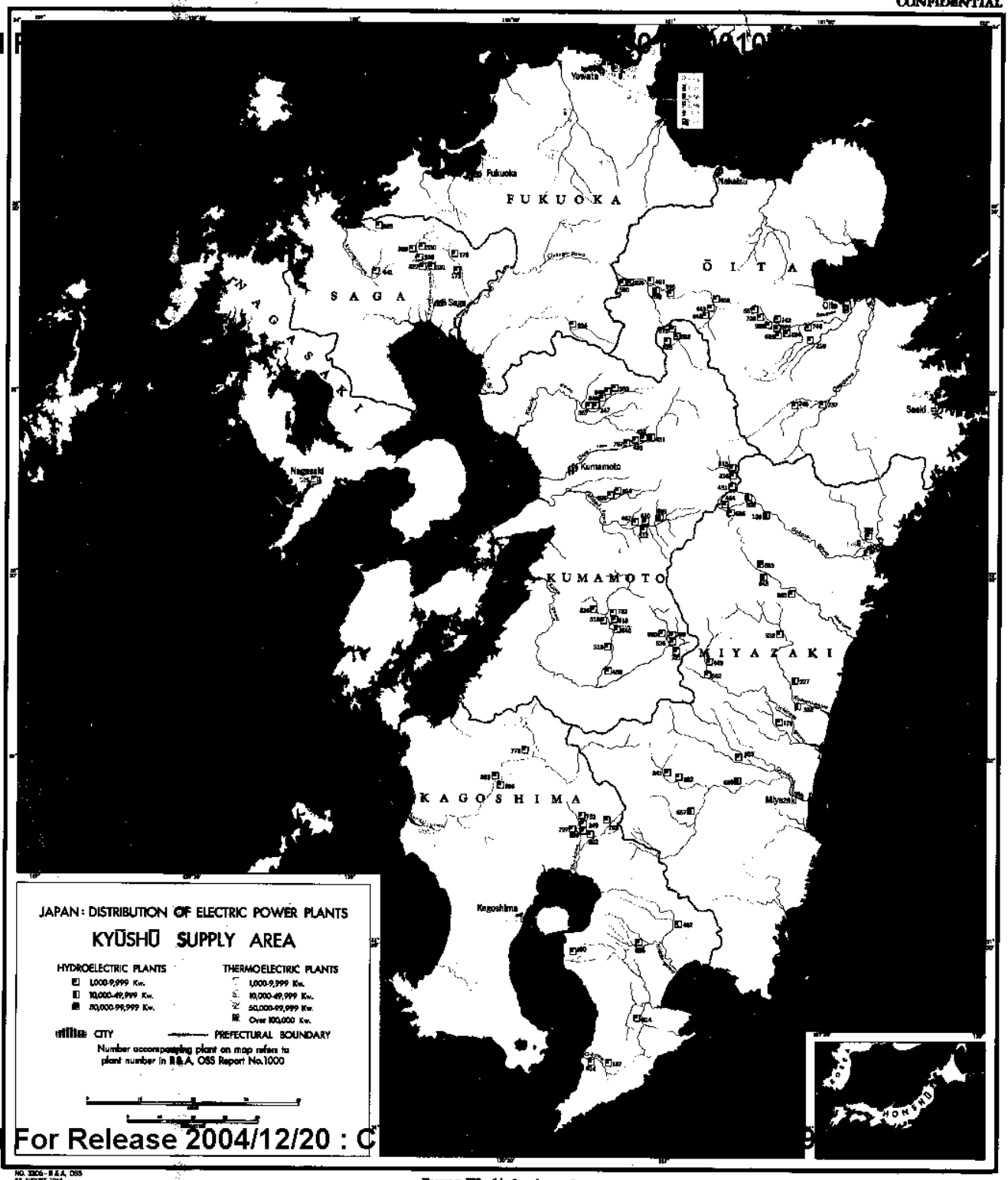

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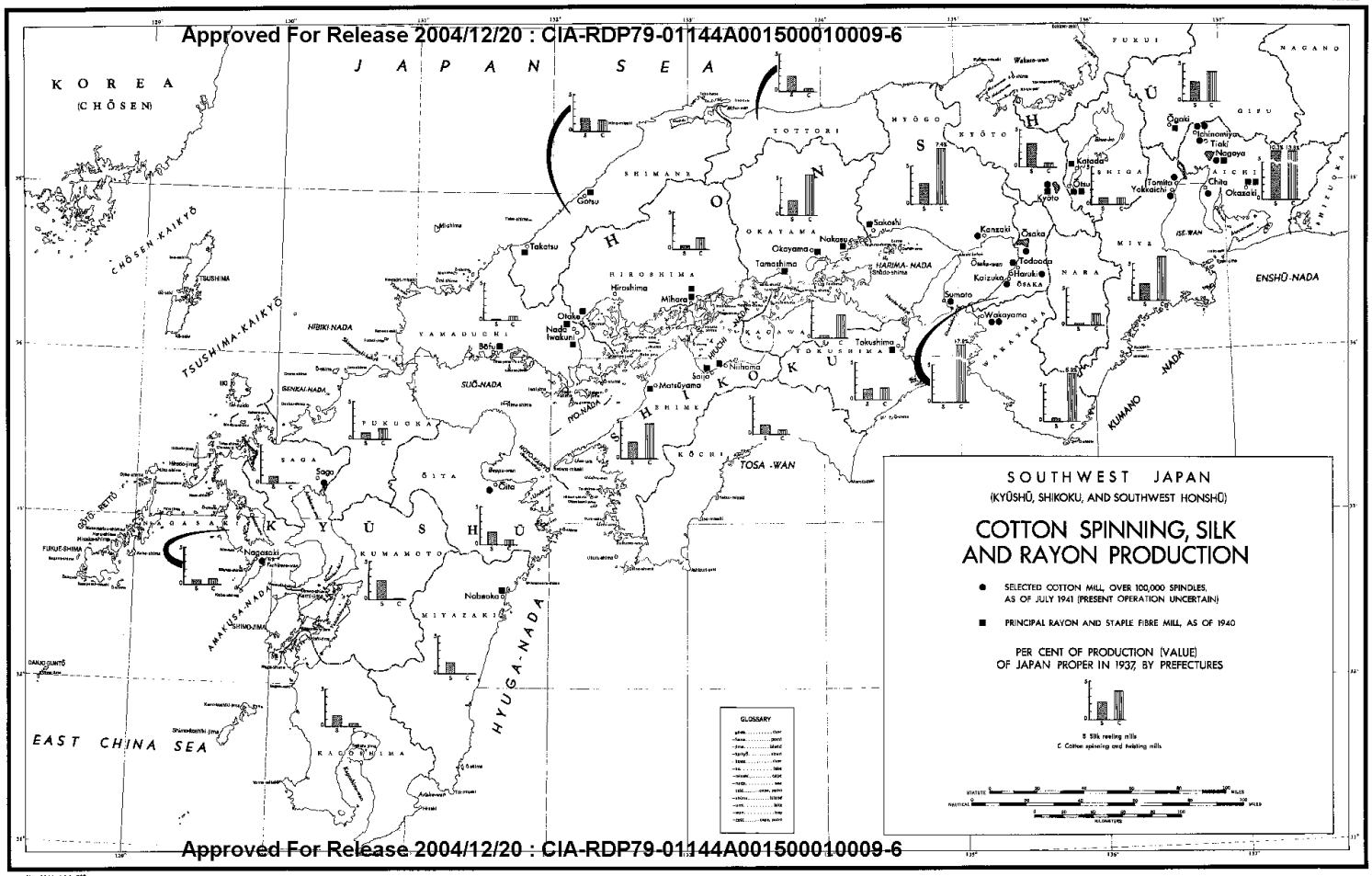

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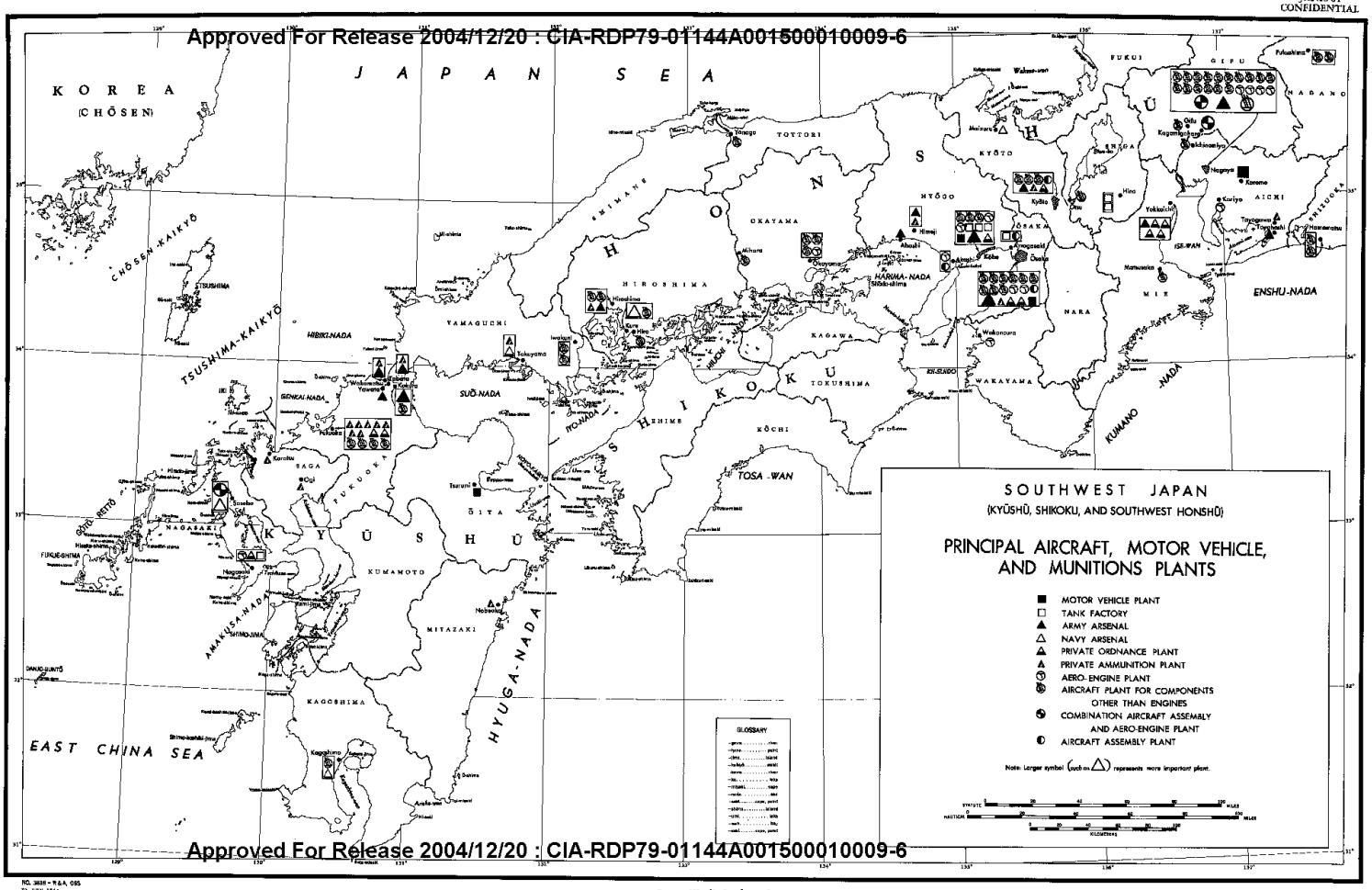

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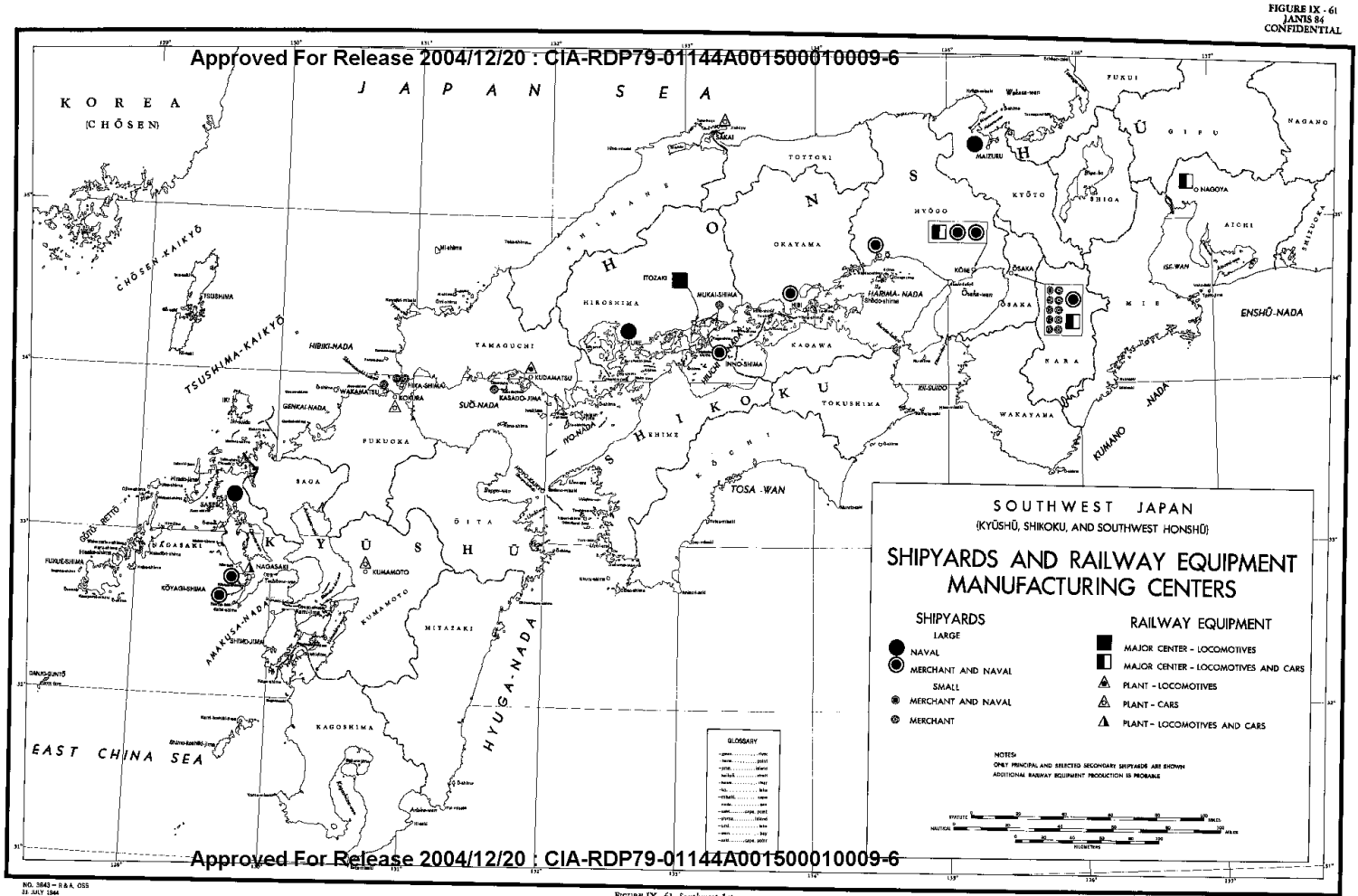

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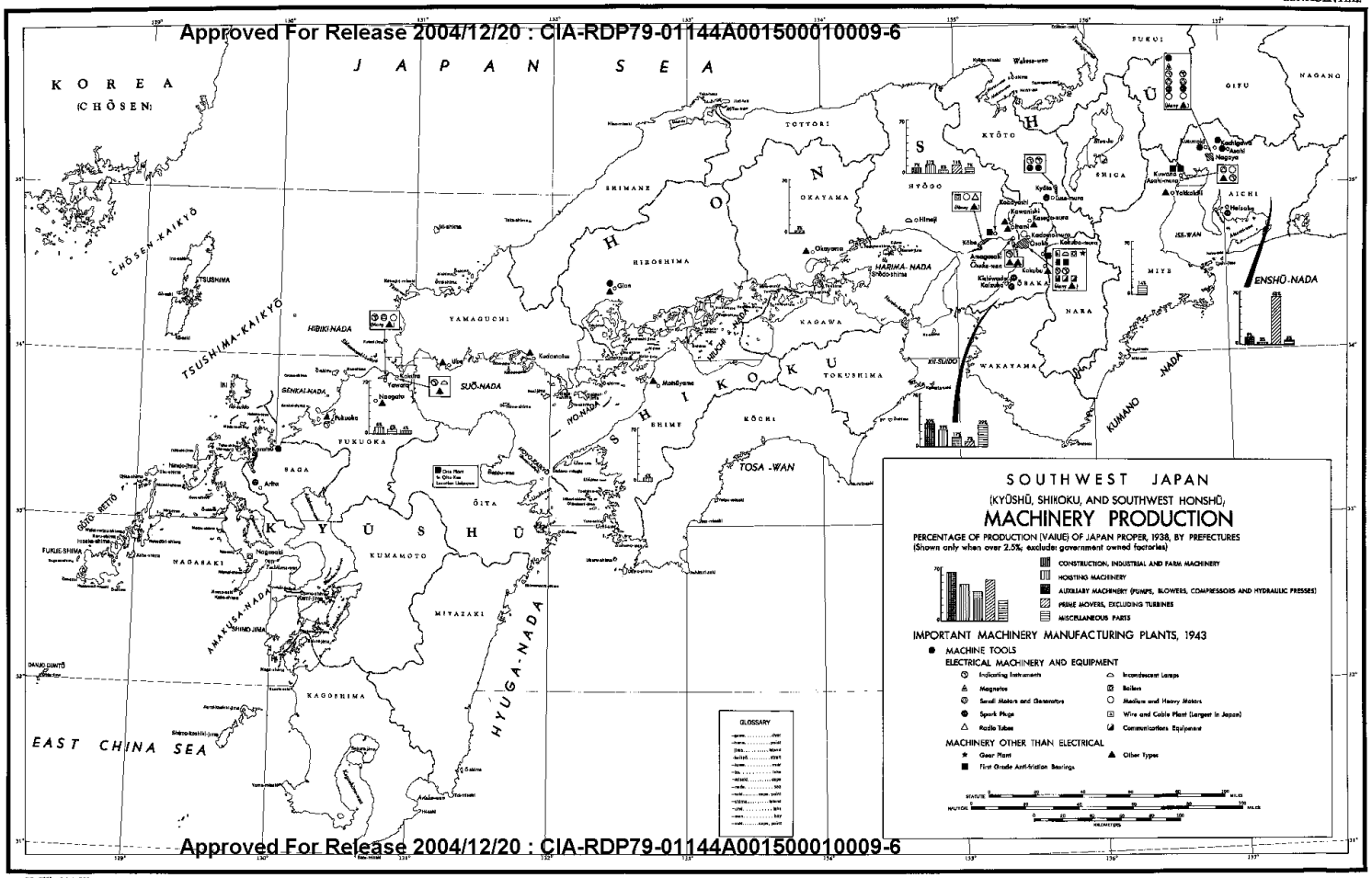

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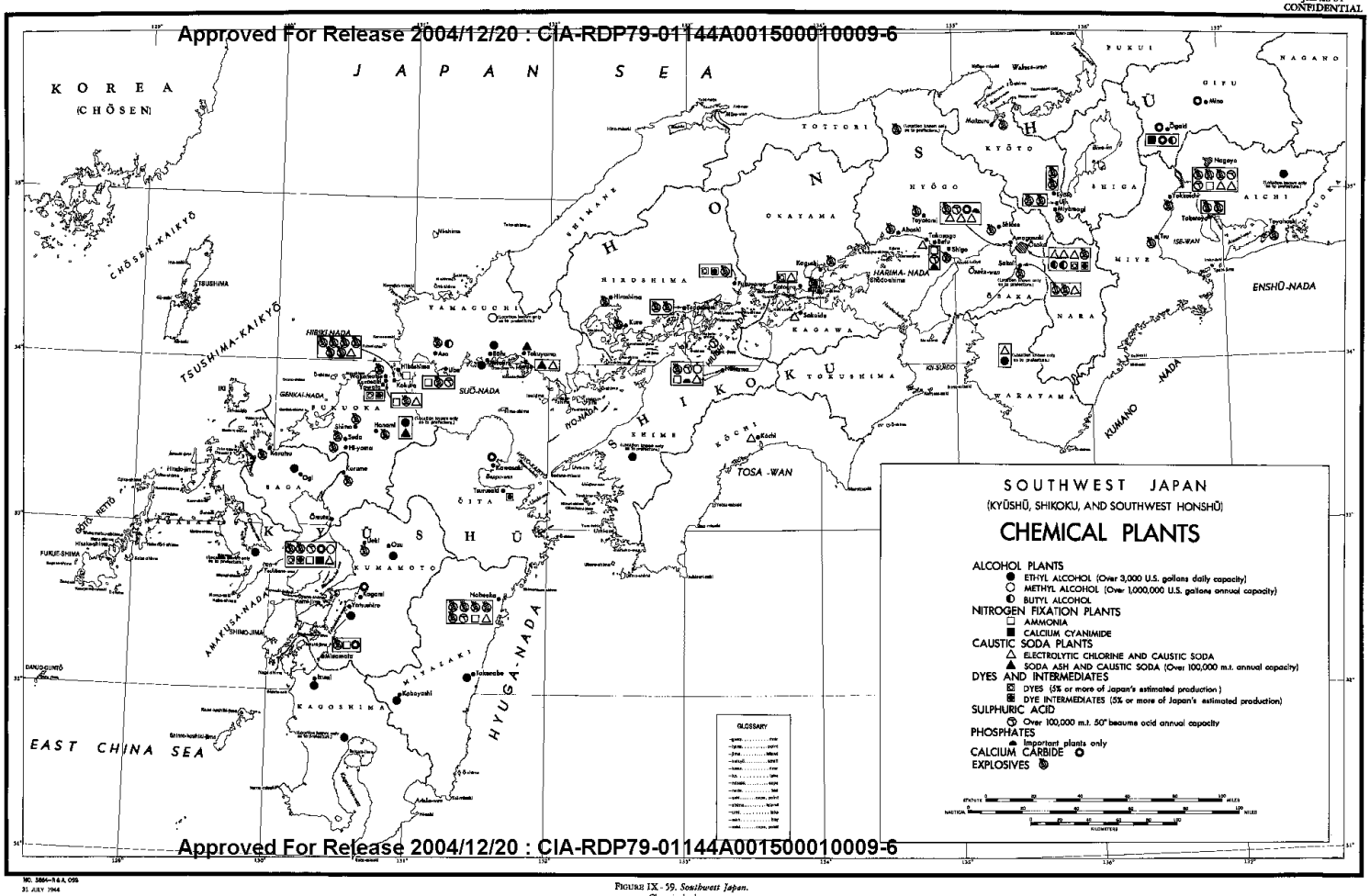

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- ■ CALCIUM CYANIMIDE

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- ▩ DYE INTERMEDIATES (5% or more of Japan's estimated production)

SULPHURIC ACID
- Ⓢ Over 100,000 m.t. 50° beaume acid annual capacity

PHOSPHATES
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CALCIUM CARBIDE ○

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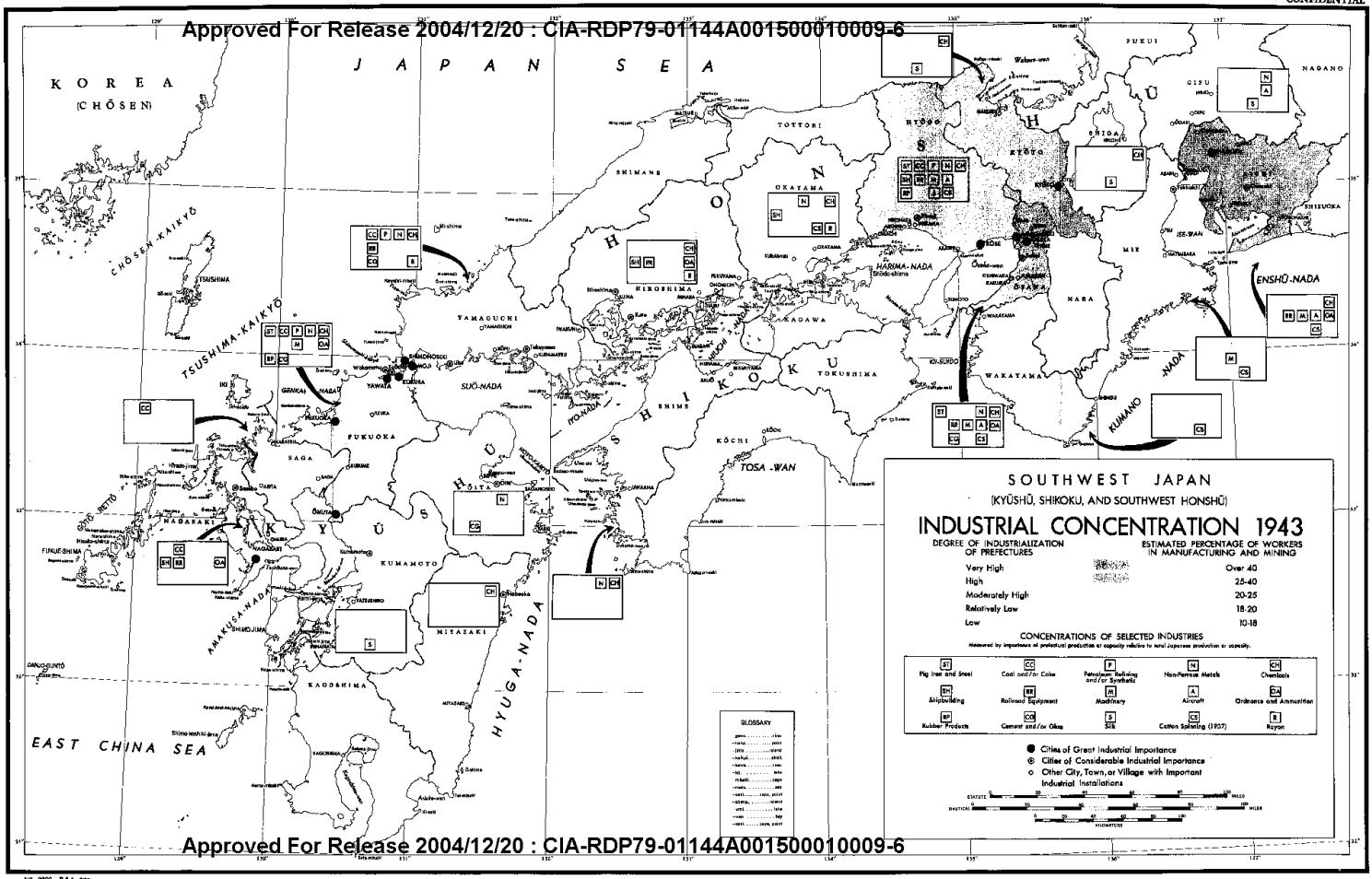

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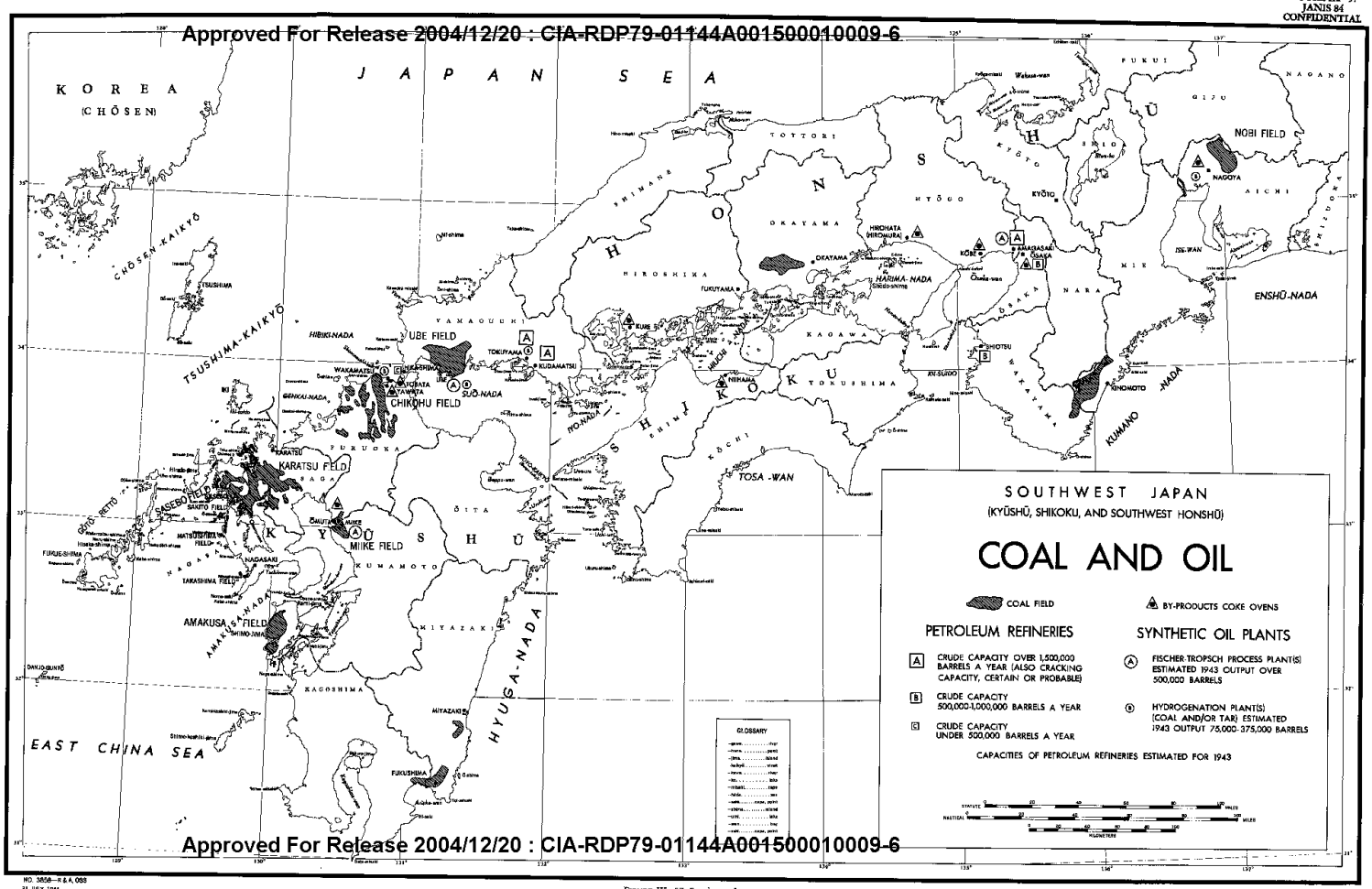

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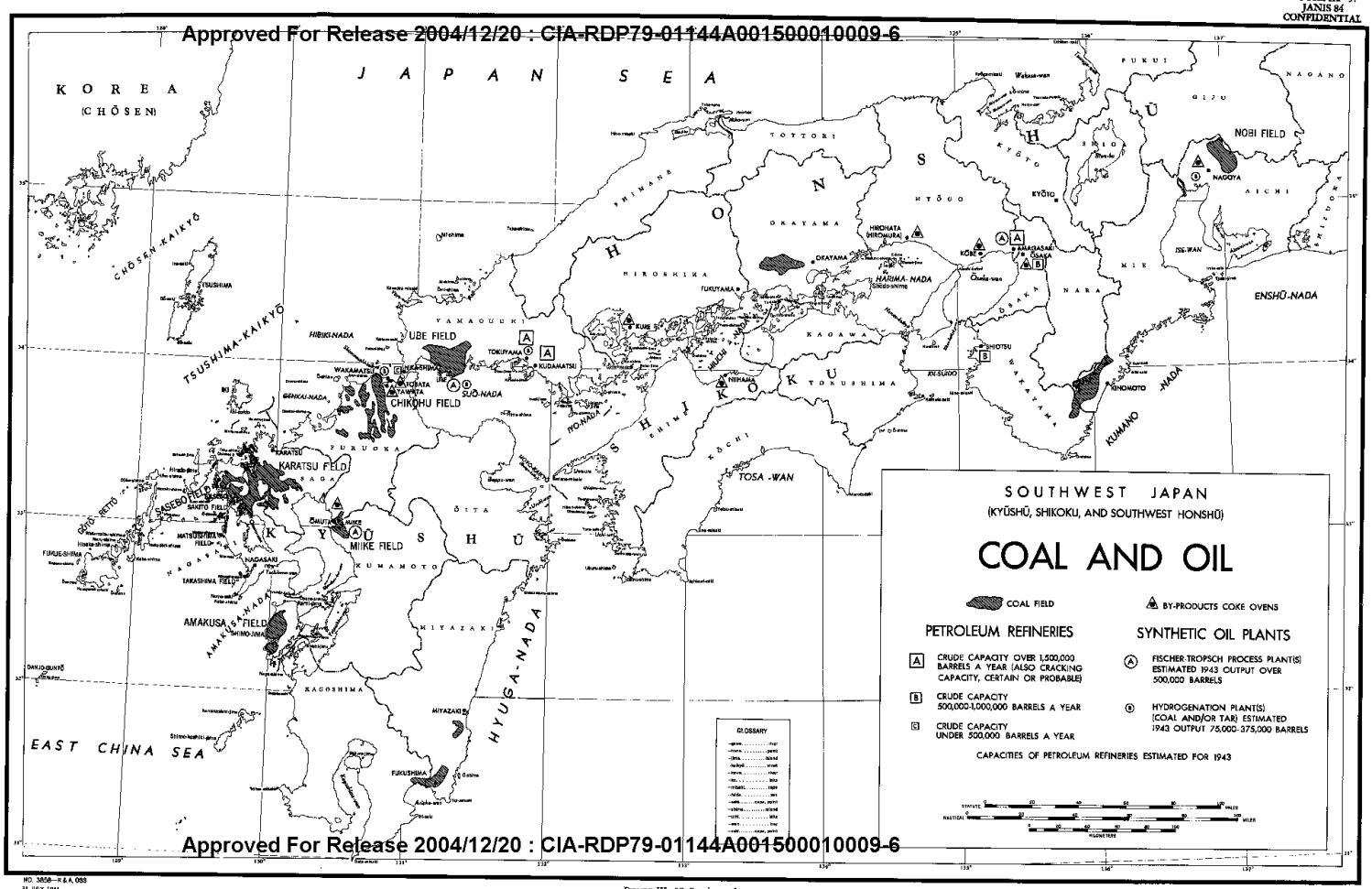

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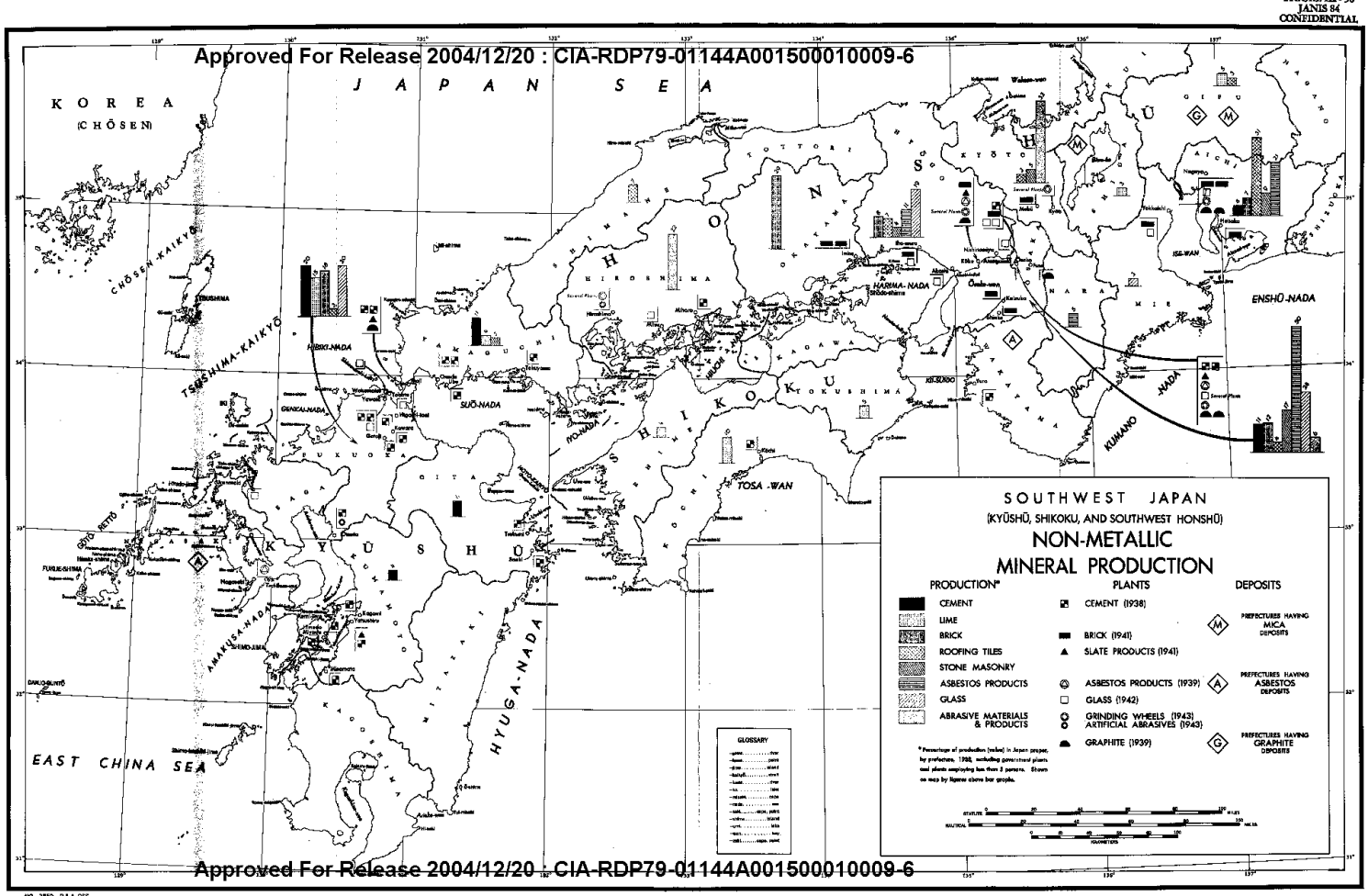

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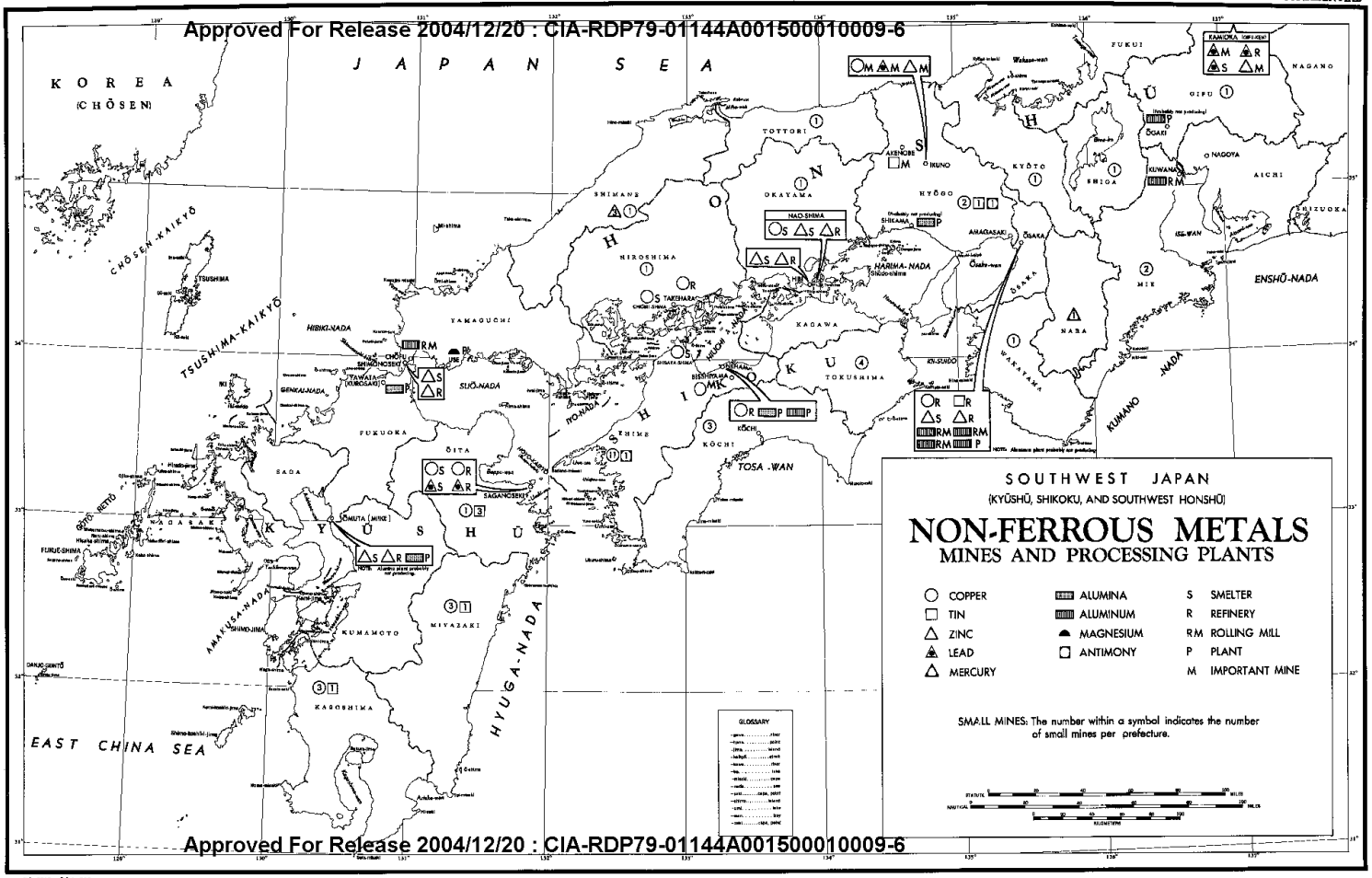

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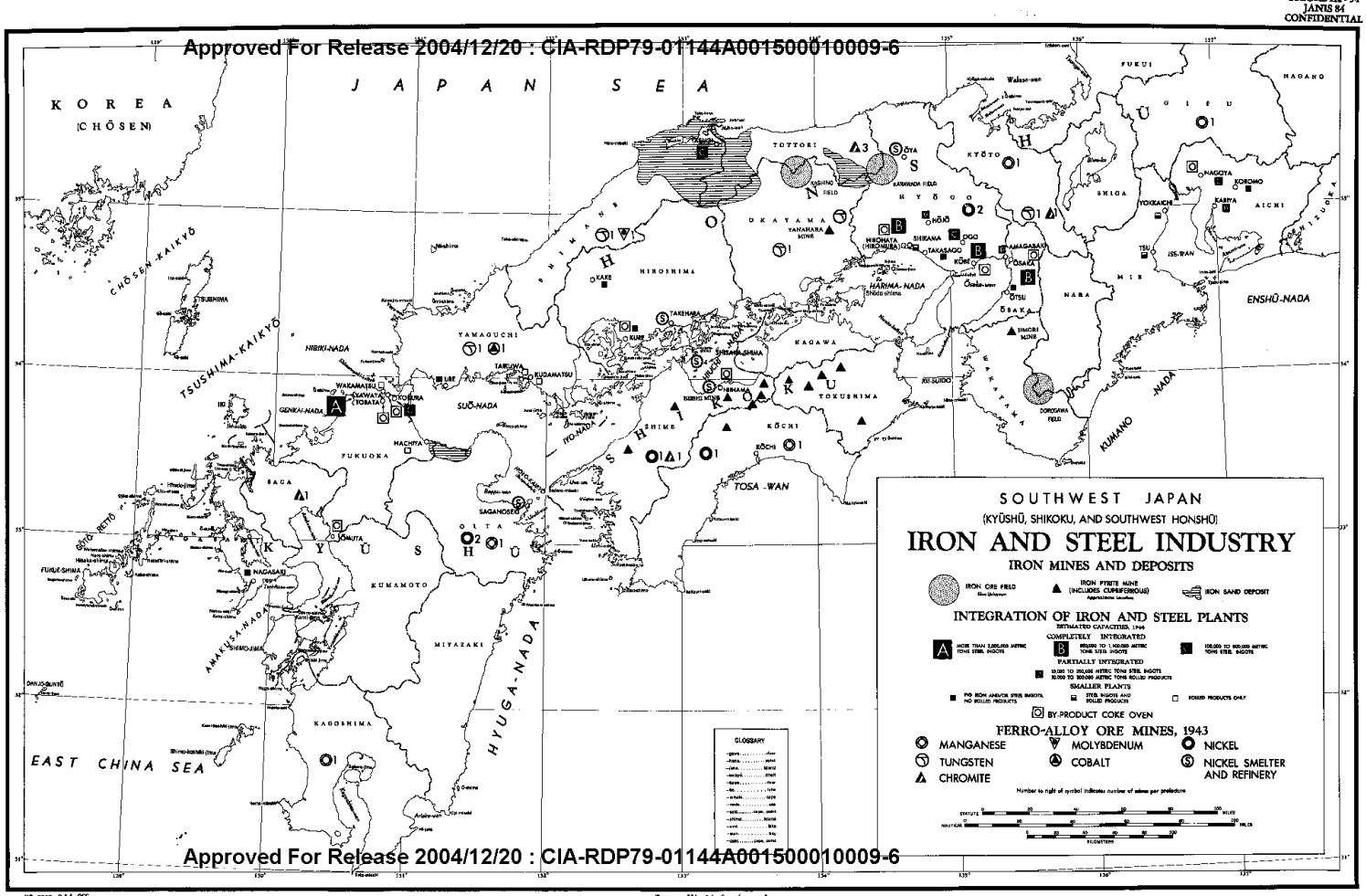

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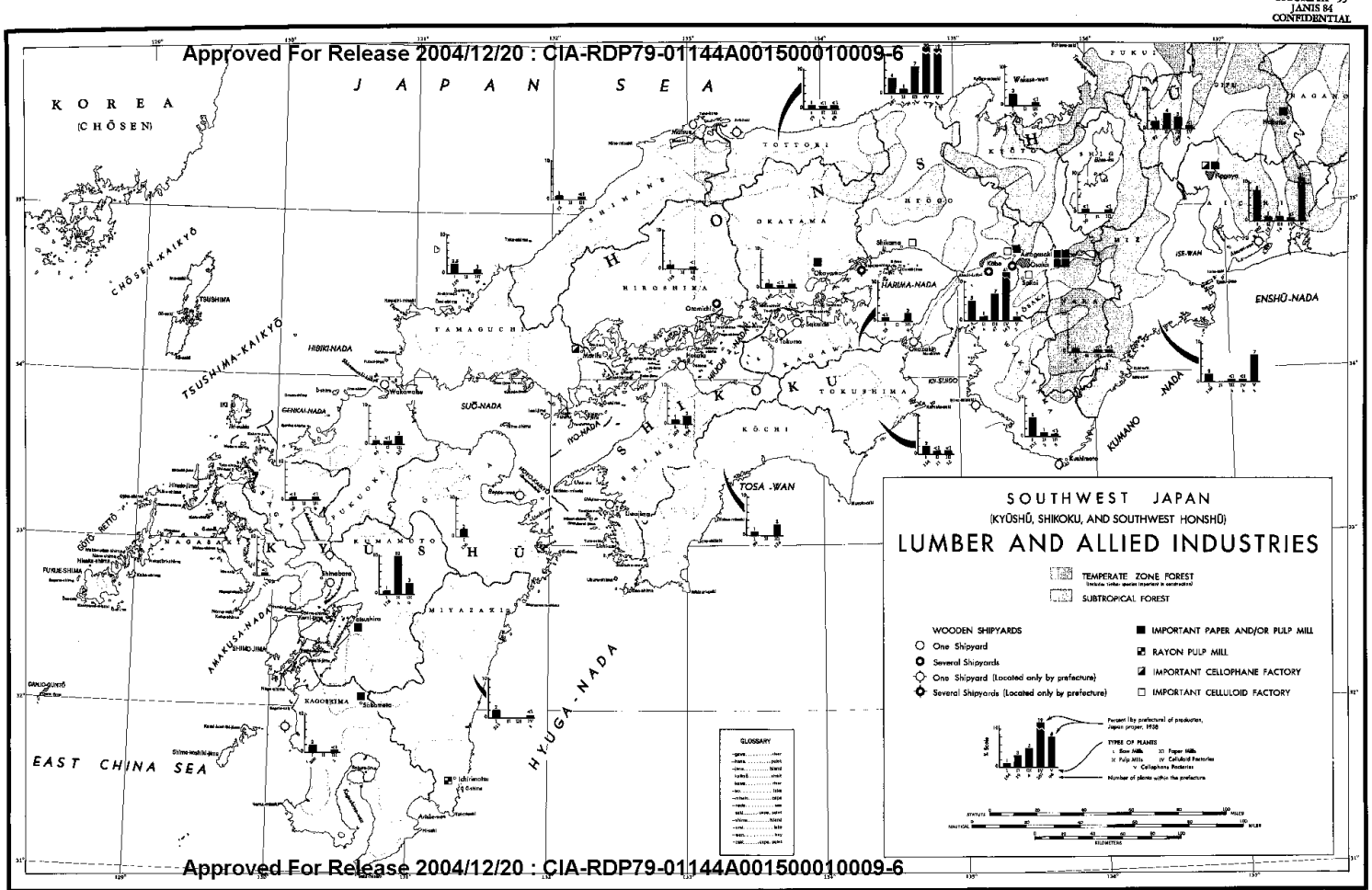

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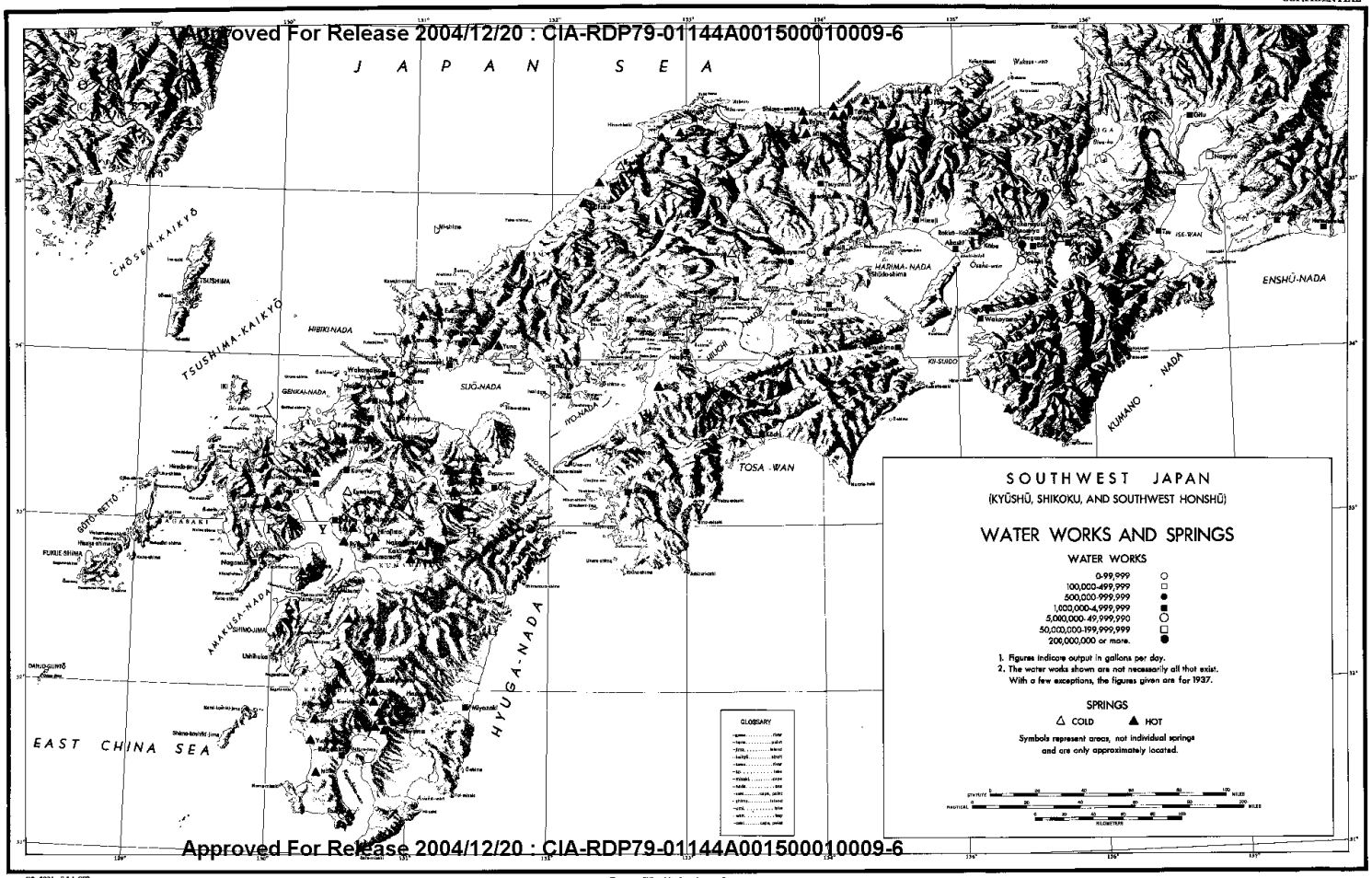

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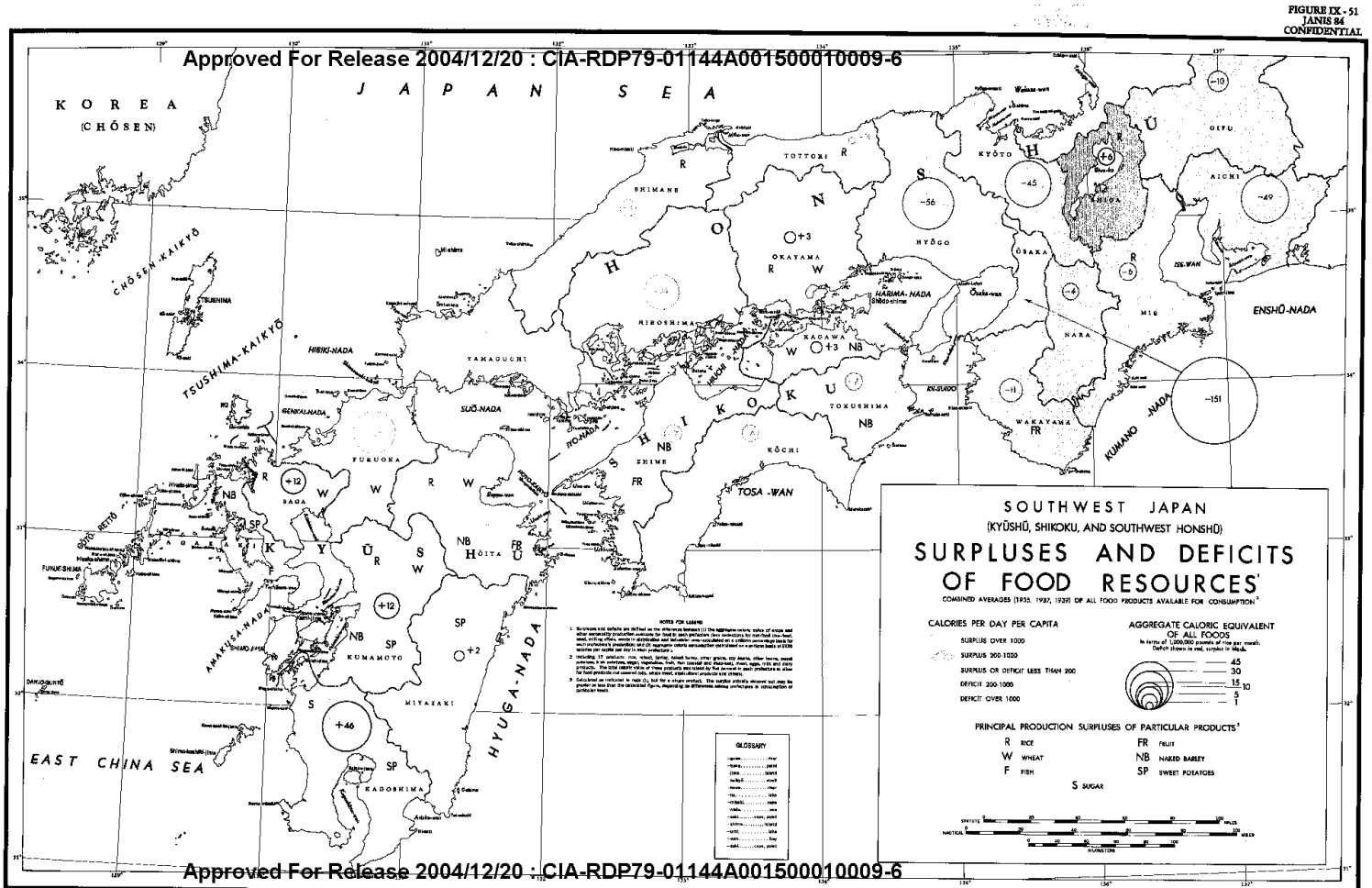

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