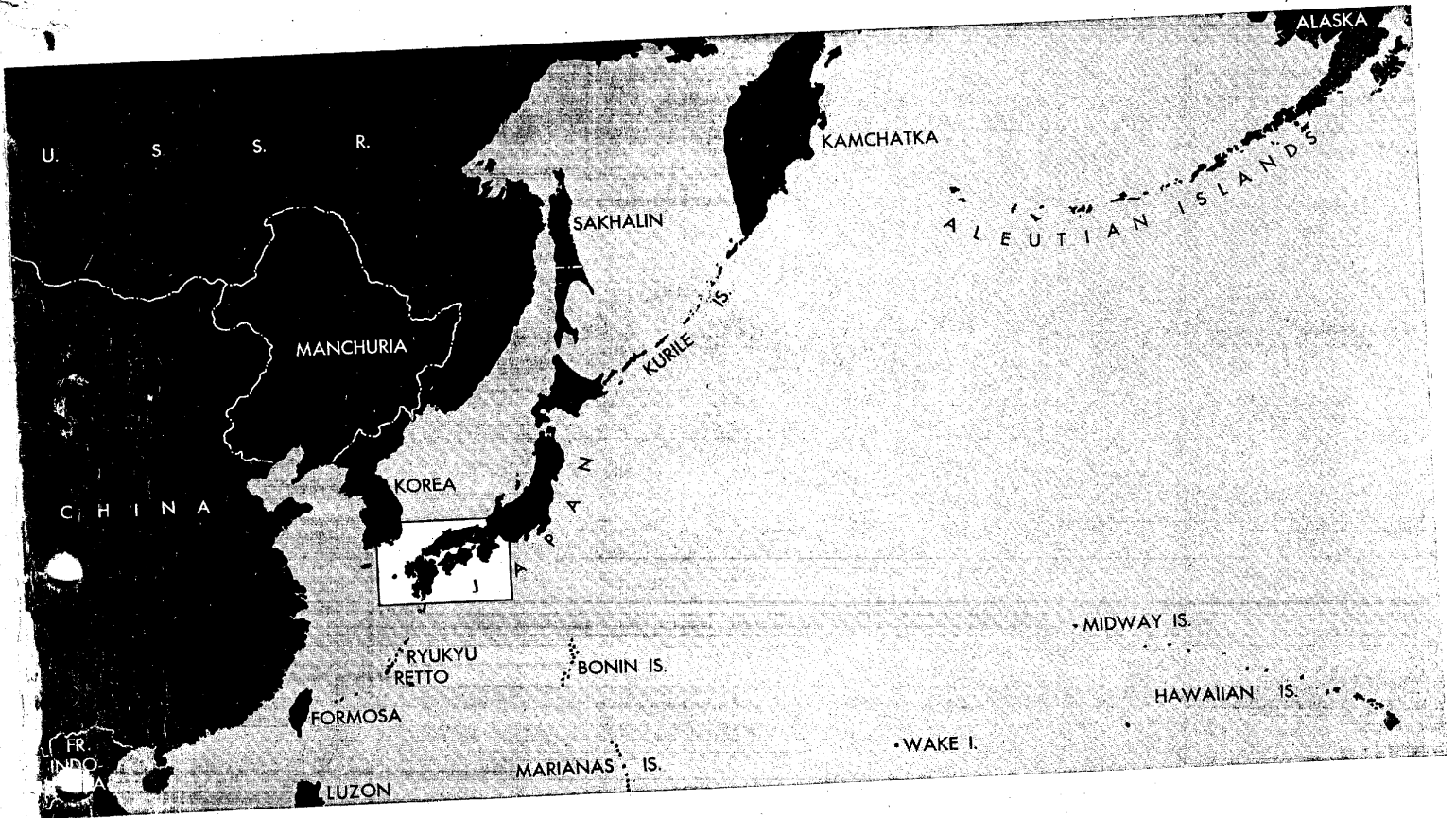


JANIS 84 CHAPTER I

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JOINT ARMY-NAVY INTELLIGENCE STUDY

OF

SOUTHWEST JAPAN:

Kyūshū, Shikoku, and Southwestern Honshū

BRIEF

AUGUST 1944

Hardcopy document
Released-in-Full

DOCUMENT NO. 1
 NO CHANGE IN CLASS.
 DECLASSIFIED
 CLASS. CHANGED TO: TS S C
 NEXT REVIEW DATE: _____
 AUTH: HR 70-2
 DATE: 12/15/80 REVIEWER:

25X1

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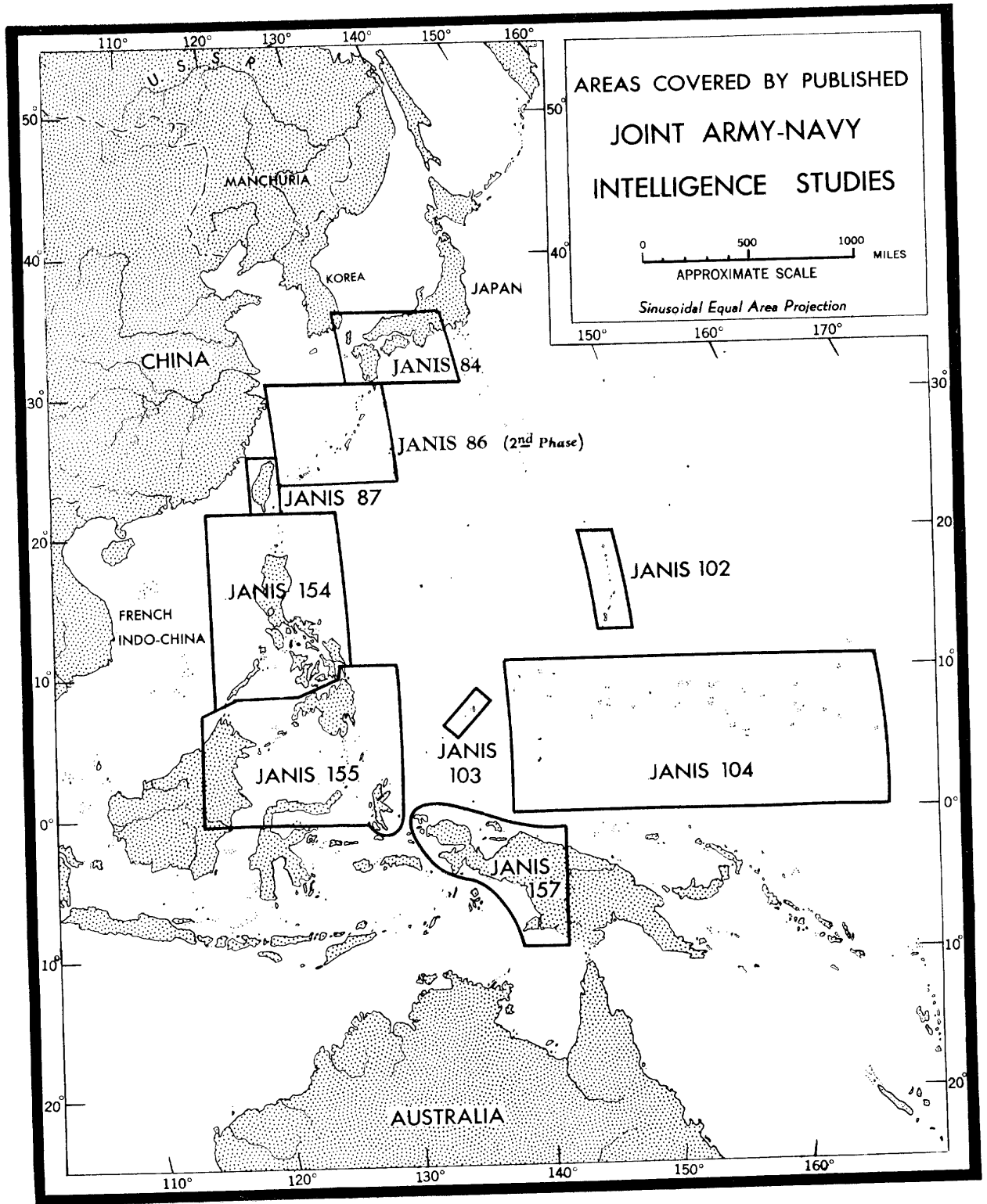


FIGURE I - 1.

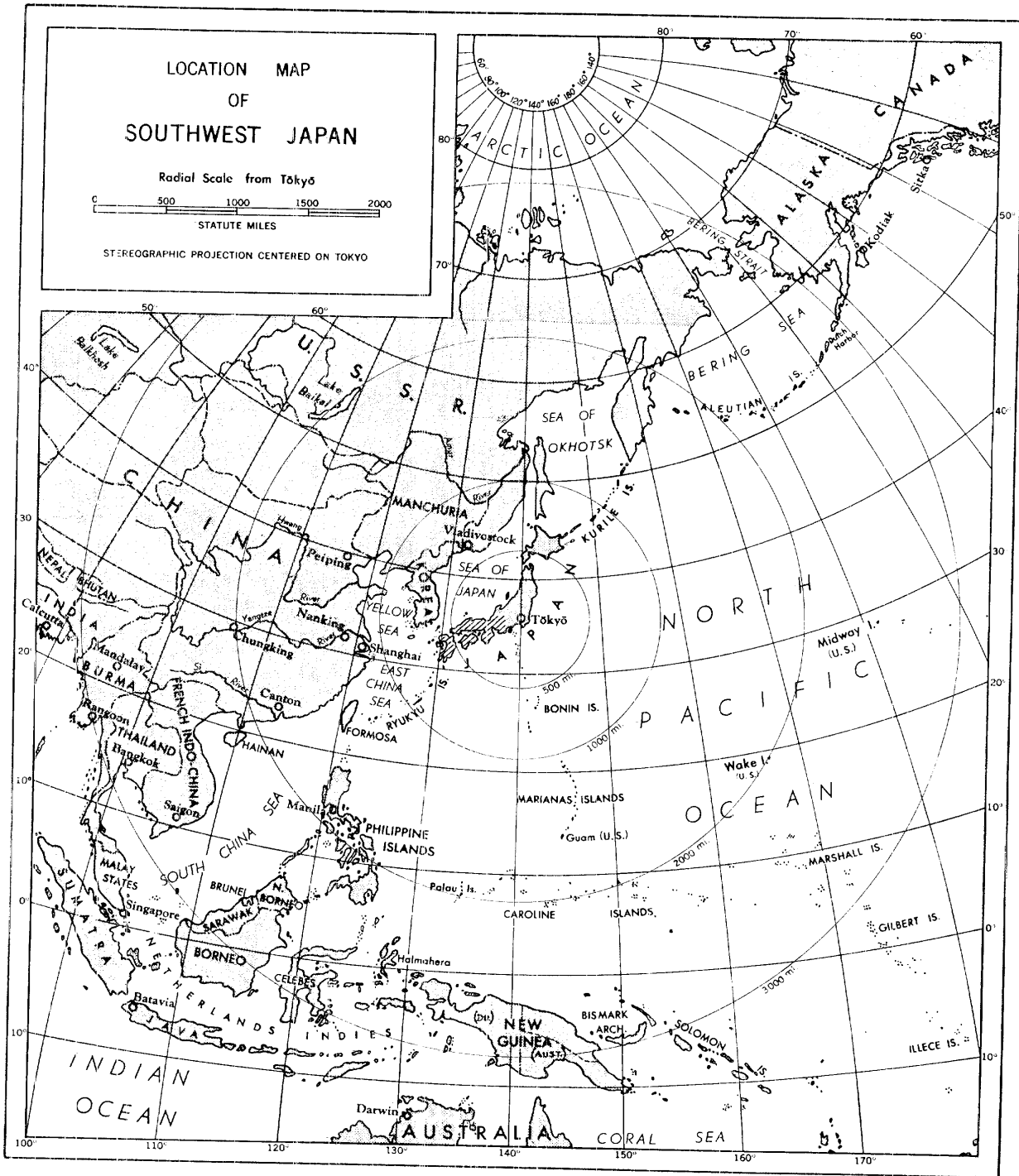


FIGURE I - 2.

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Chapter I

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Foreword

The purpose of this study is to make available, subject to limitations of time and material, one publication containing all the necessary detailed topographic information upon which may be based a plan for military operations in Southwest Japan (Kyūshū, Shikoku, and southwest Honshū). The study is intended also to provide an organized presentation of material to be used as a base on which to plot later information obtained from aerial reconnaissance and other sources available in the field. Data available in Washington up to 1 August 1944 have been incorporated in the study. A list of principal sources will be found at the end of each chapter.

To meet the varied requirements of users, the material is presented in 2 distinct patterns. CHAPTER I, entitled "Brief," is a condensation of the material presented in much greater detail in the succeeding chapters. It provides a "quick look", complementing the main body of the study.

This publication has been prepared from material contributed by a number of agencies of the United States Government, including the following: Aerology Section, Office of the Chief of Naval Operations; Assistant Chief of Air Staff, Intelligence; Board on Geographical Names; Coast and Geodetic Survey; Hydrographic Office; Joint Meteorological Committee; Military Intelligence Division; Office of Chief of Engineers (Army Map Service, Beach Erosion Board, Board of Engineers for Rivers and Harbors, Geological Survey); Office of Naval Intelligence; Office of Strategic Services; Office of the Surgeon General; Weather Division, Army Air Forces.

For convenience, contents have been made up into 2 volumes: Volume 1, text, and Volume 2, plans pouch. A table of contents will be found on the inside cover of each chapter. The text includes the following 14 chapters, all of which are "Confidential," except CHAPTER XI and XV, which are "Restricted."

CHAPTER I	BRIEF	CHAPTER VIII	CITIES AND TOWNS
CHAPTER II	MILITARY GEOGRAPHY	CHAPTER IX	RESOURCES AND TRADE
CHAPTER III	OCEANOGRAPHY	CHAPTER XI	HEALTH AND SANITATION
CHAPTER IV	COASTS AND LANDING BEACHES	CHAPTER XII	DEFENSES
CHAPTER V	CLIMATE AND WEATHER	CHAPTER XIII	NAVAL FACILITIES
CHAPTER VI	PORT FACILITIES	CHAPTER XIV	AIR FACILITIES
CHAPTER VII	TRANSPORTATION AND COMMUNICATIONS	CHAPTER XV	GAZETTEER AND MAP APPRAISAL

CHAPTER X, PEOPLE AND GOVERNMENT, will be published at a later date, with JANIS 85, and will cover all of Japan proper. A summary of this chapter appears in this study, CHAPTER I, Topic 10.

FIGURE I - 1 shows the areas covered by previously published JANIS studies.

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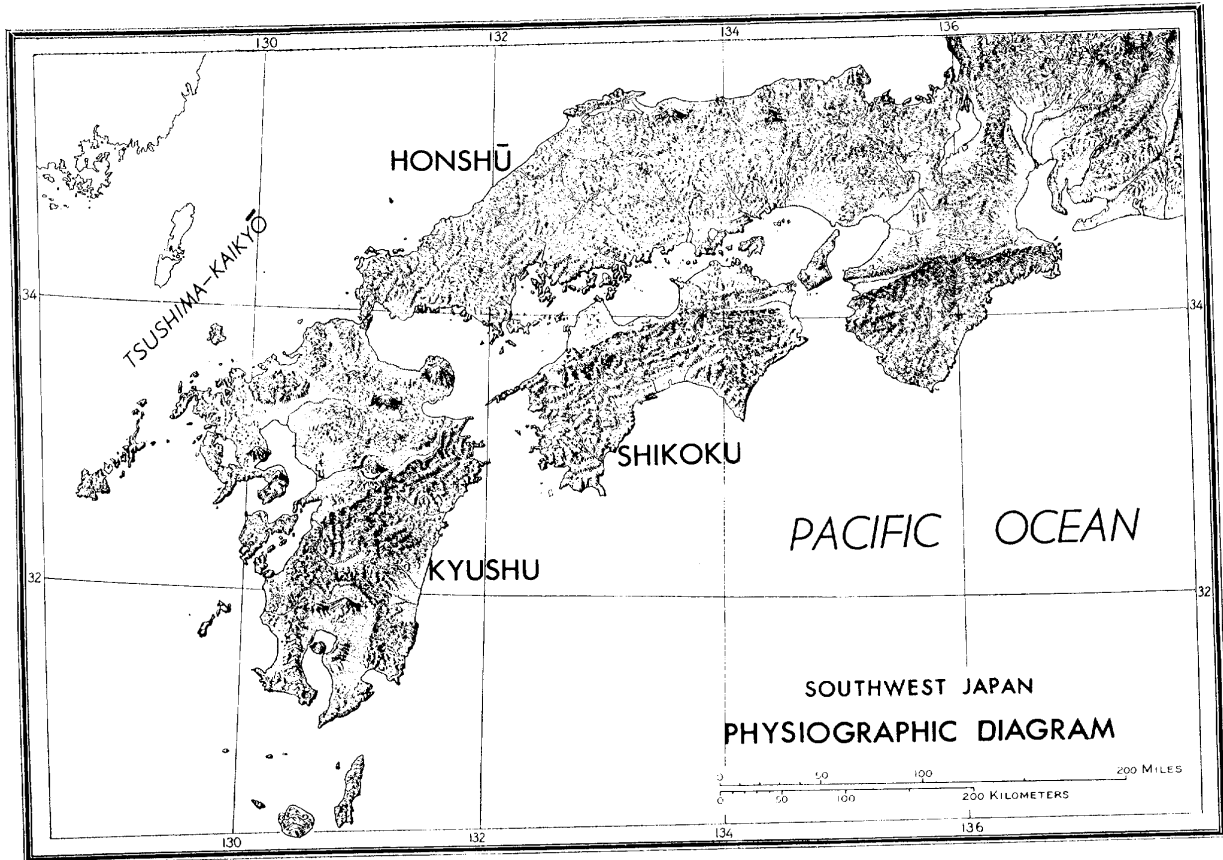


FIGURE I - 3.

1. Introduction

Southwest Japan as delimited in this study includes that portion of Japan proper between 31° and 36° N, 128° and 138° E. The latitude and climate are similar to those of the coastal plain of North and South Carolina in the United States, but the terrain is much rougher. The area may be divided for convenience into 3 sectors: 2 of the main Japanese islands and part of a third—Shikoku (7,244 square miles), slightly smaller than the state of New Jersey; Kyūshū (16,591 square miles), more than twice as large; and the southwestern part of Honshū, larger than Shikoku and Kyūshū combined.

The sectors are grouped about the Inland Sea, a narrow, island-studded body of water 260 miles long which forms the industrial, commercial, and military heart of Southwest Japan. Honshū forms the north and east shore of the Inland Sea, Shikoku the south shore, and Kyūshū the west shore. Access to the Inland Sea by water is possible only through the 3 narrow, heavily fortified straits which separate the 3 major islands. The 2 most vital industrial districts of Southwest Japan lie at the opposite extremities of the Inland Sea; the Ōsaka-Kōbe district, at the east end; and the northern Kyūshū district, at the west end. The naval base of Kure and lesser military centers also lie on the Inland Sea. The principal industrial centers

are interconnected by a well-developed steamship system, and by a well-developed but highly vulnerable railroad system.

Outside the Inland Sea, the principal nuclei include the naval base of Maizuru, north of Kōbe on the shore of the Japan Sea; the Sasebo naval base and the port of Nagasaki, in northwestern Kyūshū, facing the East China Sea; and the industrial center of Nagoya, in the eastern part of the Honshū sector, facing the Pacific and 160 miles westward from Tōkyō.

Southwest Japan is approached by outside land masses or island chains only at 3 places (aside from the adjoining Central Honshū). From the south, a line of islands extends from Guam through the Marianas and Nampō-shotō (including the Ogasawara-guntō or Bonin Islands) to within 70 miles of the eastern edge of Southwest Japan. Another strip of islands, Nansai-shotō (including Ryūkyū-rettō), leads northward from Formosa to the southern end of Kyūshū. From the Asiatic mainland, Korea projects to within 110 miles of Kyūshū and Honshū, and the intervening strait is broken midway by islands. More distant are such centers as Shanghai (490 miles to Sasebo) and Vladivostok (530 miles to Maizuru). Northeastern and eastern islands and land masses—Hawaiian Islands, Alaska, Kamchatka—are much more distant from Southwest Japan than are western and southern bases.

The following list gives approximate airline distances of various outlying localities from places in Southwest Japan:

<i>Scatth</i>	STATUTE MILES
Guam to S Kyūshū	1510
Manila to S Kyūshū	1290
N end Luzon to S Kyūshū	1020
Chichi-shima, Ogasawara-guntō (Bonin Islands), to S Kyūshū	710
Chichi-shima to S Honshū	600
Chichi-shima to Kōbe	680
Formosa to S Kyūshū	670
<i>West</i>	
Chungking to Sasebo naval base, NW Kyūshū	1380
Shanghai to Sasebo	490
Shanghai to Kōbe	850
Korea to Honshū and Kyūshū	110
<i>North</i>	
Petropavlovsk, Kamchatka, to Kōbe	1700
Vladivostok to Kōbe	580
Vladivostok to Maizuru naval base, N coast Honshū	530
<i>East</i>	
Honolulu to Kōbe	4150
Dutch Harbor to Kōbe	3130
Wake Island to Kōbe	1650

There may be some differences between spellings of place names in the text and on maps. Correct spellings are given in the Gazetteer, CHAPTER XV.

2. Military Geography

A. Relief.

Most of Southwest Japan is mountainous, but there are many small isolated basins scattered among the uplands, and small disconnected plains fringe the coasts (PLAN 38). The strategic military objectives in Southwest Japan are in the lowlands, the most important of which lie along a line extending from northern Kyūshū through the Inland Sea and on past Ōsaki to Nagoya. The over-all arrangement of relief makes this central zone of lowlands difficult to reach. At most points it is protected from assault from either north or south by rugged highlands which extend southwestward from a mountain knot lying northeast of Nagoya (FIGURE I-5, and PLAN 38).

The highlands diverge into 2 arms, enclosing the Nagoya and Biwa - Ōsaka lowlands and the Inland Sea. The few overland routes through the encircling highland arms are very difficult, and although the southern arm is broken by 3 water passages, Ise-wan (bay), Kii-suidō (channel), and Bungo-suidō (Hoyo-kaikyō) all 3 are narrow and easily defended.

(1) Mountains.

The mountain knot from which the 2 highland arms extend is a part of the great barrier of central Honshū lying between the Noto-hantō (peninsula) and the Hamamatsu coast. The Hida-sannmyaku (mountains), north of the Nagoya Plain, contain some of the highest peaks, 10,000 feet, in Japan proper, and the rugged Kiso-sannmyaku, 9,000 to 10,000 feet, constitute an almost equally effective barrier east of Nagoya.

The southern arm leaves the central Honshū knot north of Hamamatsu, is broken by Ise-wan (bay), and reappears on Honshū in the southern Kii-hantō (peninsula). Thence it continues through southern Shikoku and southern Kyūshū, with

interruptions at the Kii-suidō (channel) and Bungo-suidō. Most of these mountains are high and rugged, but elevations decrease westward. Ridges and valleys are oriented northeast-southwest across any line of advance from the Pacific. Volcanic cones, ash plateaus, and lava flows create additional terrain difficulties in the southeastern Kyūshū highlands. There are only a few plains associated with the southern arm, the outstanding ones being the Miyazaki Lowland of Kyūshū, the Kōchi Plain of Shikoku, and the Hamamatsu Coastal Lowland of Honshū.

The northern highland arm extends almost due west from the central Honshū knot, and includes all the mountains north of the central lowland zone from Nagoya westward. Some parts of this area are genuinely mountainous, more are rough hill country, but the entire area is marked by extreme variety. It is a region of disconnected rugged plateaus, many parts of which have been subjected to intense volcanic activity which has added ash, lava, and volcanic cones to an already complex topography. In general there are more land routes through this relief barrier than through the one bordering the Pacific, but these routes are by no means easy. As on the southern arm, elevations decrease westward; but the terrain differs somewhat in that there are several large coastal and interior plains (Biwa, Kyōto, Nara, Ōsaka), and a large number of smaller ones in or bordering this area. On the northern or Japan Sea side of this mountain barrier, however, there is only 1 coastal plain large enough to accommodate large forces and airfields—the plain west of Shinji-ko (lake).

(2) Lowlands.

The lowlands of Southwest Japan are of 2 types: interior basins and coastal plains. Although the largest lowlands are distributed roughly along a line between the northern and southern highland belts, they are actually imbedded within or adjacent to the highland arms. Both basins and coastal plains have at least one common feature, isolation. The basins may be entered overland only through narrow valleys of varying number and size. The coastal plains may be entered by similar valleys on their landward side, or directly from the sea. From neighboring coastal plains, they are approachable at best by narrow coastal routes which are backed by hills and mountains.

The lowlands of this part of Japan are small, even the Nagoya Plain measuring only 32 by 24 miles. The largest lowlands are coastal (Nagoya, Ōsaka, Saga, Kumamoto), but the Nara, Kyōto, and Biwa basins are among the larger of the interior basins of Japan.

The typical coastal lowland consists of a nearly flat alluvial floor, covered mostly with rice paddy fields, but in places having low flat mounds with dry crops or villages. Elevated footpaths and roads lace the plain, providing means of deployment among the ever-muddy rice fields. The levees of the rivers and the elevated banks of irrigation ponds and canals also provide comparatively dry roadways and a certain amount of concealment and cover on the plains. Foot troops can move in almost any direction, but with difficulty, across the plains. There are adequate roads and paths for bicycles and small motor vehicles; tracked vehicles can probably be deployed, but the larger wheeled machines will be confined to the main roads throughout the year in most of the rice areas.

The seaward side of coastal plains is bordered in many places by rolling beach ridges, often dune-capped, along the immedi-

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ate coast. Dune and beach ridge areas are best developed along the Japan Sea on Honshū. The sandy beach ridges are devoted to dry crops and forests, usually black pine. The depressions between ridges are often used for rice cultivation, although sometimes natural marsh or lagoon occupies the hollows. These ridges lie across the line of advance inland, but they also provide considerable cover from flat-trajectory fire.

On their landward sides many of the level plains terminate abruptly at the base of steep hills and mountains. In other places, the change from plains to hills is made transitional by either a sloping, fan-like accumulation of sand, gravel, and boulders, or by a series of intermediate steps consisting of sand and gravel terraces. These terraces are at several levels, ranging from a few feet to hundreds of feet above the plain. Streams have cut deeply into them and flow through shallow canyon-like valleys which separate the gently sloping or rolling surfaces of terrace remnants of varying sizes. The higher terraces are usually much rougher than the lower, and in many areas are rugged forested hills through which movement is difficult. Limited deployment for all types of vehicles is easy on the lower terraces and fans. These terraces are generally utilized for dry crops such as vegetables, tea, mulberry, and grains. The ground is relatively firm under these crops. Bamboo and other patches of woodland provide concealment. Many of the villages of Japan, and therefore much of the transportation system, particularly rail, are concentrated on the terraces and fans rather than on the lowlands themselves. Cross-country or continuous movement along the edges of the basins on these terraces and fans is not easy, because it requires the crossing of many steep-sided valleys.

The interior basins have essentially the same general characteristics as the coastal plains. Flat terrace remnants surround the basins and are carved into forms similar to those on the landward sides of the coastal plains. Several of the interior basins have fresh water lakes.

B. Drainage.

In Southwest Japan, water and mud are nearly as serious a problem in military operations as is the rugged terrain. In most areas flat enough to be used effectively in mechanized warfare, the presence of excessive amounts of water limits such activity. No plan for operations in this area can be made without consideration of the fact that rice fields occupy nearly all areas of low slope and are virtual swamps during the summer months. In fact, most of them are wet and muddy throughout the year. The ground does not freeze deeply in the winter; therefore, except in the limited areas where dry crops predominate (PLANS 41 and 42), wheeled vehicles will be confined to the roads throughout the year. Tracked vehicles, however, will probably be able to move through rice fields, at least during the winter after the paddies have been drained.

The natural drainage pattern of Southwest Japan is very dense, and on the plains is augmented by a close network of drainage and irrigation canals and water storage ponds. Cold springs are numerous along the margins of the lowlands and there are several areas of hot springs. Wells are common.

In the mountains most of the streams are short, swift, and shallow; on the plains the streams slow down and flow in wider, flatter channels. Because of the diversion of water for irrigation, many of the streams on the lowlands are shallow, 1 to 5 feet, for much of the year, and divide into many rivulets

which flow in broad channels choked with boulders and gravel. The stream beds are bordered on either side by natural and man-built levees. Artificial levees are necessary because of flash floods occasioned by typhoon rains, most likely in late summer, and because many of the streams flow above the level of the surrounding plains. Except during short periods of high water, such streams are navigable only near their mouths, and even there only by small boats. The rivers of Southwest Japan are of value chiefly for hydroelectric power, irrigation, and transportation of logs.

Biwa-ko is by far the largest lake of Japan. Most of the lowland lakes are shrinking in size; many of them are bordered by narrow reed-choked marshes. Other natural marshes are not generally important in the area, because most of them have been converted into rice fields.

Except when in flood most of the rivers would not be a serious obstacle to movement. A few of the larger streams which cross the coastal plains are barriers, especially where the stream channels have been canalized and deepened. River levees, from 10 to 20 feet high, form continuous bunkers. These levees could be breached easily, and when the rivers are in flood large areas could be inundated. The drainage and irrigation canals, except the very largest, would be only minor obstacles.

Except during droughts, water supply is adequate in Southwest Japan. Irrigation storage ponds, springs, wells, rivers, lakes, and reservoirs supply large quantities of water. The hot springs are highly mineralized. All water must be considered contaminated and should not be used for any purpose until it has been adequately treated.

C. Soil trafficability. (FIGURE I-6).

Soil trafficability is the capacity of soils to support the movement of military vehicles. It refers especially to movement across country and on unimproved roads made of local soil, rather than to traffic on improved or surfaced roads. Soil trafficability is determined by the type of soil (texture, organic matter content, and other profile features), topography, vegetation, and weather factors. In general, soil trafficability is moderately unfavorable in Southwest Japan.

(1) *Weather and trafficability.*

The weather factors result in poor trafficability, at least seasonally, in this area. The important weather factors are: precipitation (duration, intensity, and character); temperature as it affects evaporation, plant growth, and the freezing and thawing of soil; and wind, cloud cover, and humidity, which affect evaporation of soil moisture. Weather information used in this section was obtained from Chapter V. See also Topic 5 in this chapter.

At most places the precipitation is high, ranging from 50 to 190 inches annually, with the greater part of the area experiencing between 60 and 80 inches. That part of the area south of the central mountain ranges of Honshū experiences a distinct dry period during November through February; during the remaining months, precipitation results in periods of poor trafficability. In Honshū north of the central mountain range, the terrain is generally less favorable than south of the range, and nontrafficable conditions during the winter months are more common because of greater total winter precipitation and snowfall.

The poorest trafficability conditions throughout the area accompany the torrential rains associated with typhoons, especially during September. During this period, lowlands are often flooded by stream overflow, and coastal lands may be swept by extremely high tides which follow in the wake of typhoons. Rainfall of 8 to 30 inches in 24 hours may occur during the passage of a typhoon, and vehicular movement is halted.

In most parts of the area, precipitation falls on 140 to 220 days a year. There is little time for the soil to regain normal trafficability between successive periods of precipitation.

Moderately high humidity is characteristic of this region in all seasons, and impedes the rapid evaporation of soil moisture. Relative humidity at all coastal stations ordinarily averages more than 70% for the months with the lowest humidities; south of the central mountain ranges of Honshū, humidity is particularly high during summer.

Snow on the ground is seldom an obstacle to the movement of vehicles, except in, and north, of the central mountain ranges of Honshū, where snow may restrict movement of vehicles for short periods in January and February.

The occasional soil freezing that occurs in most of the area should not affect trafficability except insofar as it disrupts normal soil drainage. If shallow freezing occurs when the soil is already saturated, vehicles will break through the crust, and trafficability will be poor.

(2) *Terrain and trafficability.*

Terrain, like weather, is relatively unfavorable to cross-country movement in Southwest Japan. A large part of the interior of the area consists of rough mountain ranges where trafficability is poor regardless of soil or weather conditions, and where vehicular movements are restricted to discontinuous coastal plains separated by mountainous headlands or to the usually narrow valleys extending into the interior. Furthermore, extensive cultivation of wet rice on terrain which otherwise would be favorable for vehicular movement results in poor trafficability across large areas. The general distribution of rice land is shown on the accompanying soil trafficability map (FIGURE I-6). Detailed distribution of rice land is shown on the vegetation maps (PLANS 41 and 42).

(3) *Soil type and trafficability.*

The soil trafficability map shows that soil types vary considerably in areas of favorable terrain where soil conditions are important in determining general routes of movement. In such areas, fine-textured and medium-textured soils cover approxi-

mately equal areas. Clay constituents predominate in the fine-textured soils, which are slippery and muddy whenever wet. The fairly even division of sand, silt, and clay constituents in the medium-textured soils gives them better drainage. Coarse-textured soils, which are generally trafficable except during heavy precipitation or when flooded in river valleys, cover less area than the other types. The map legend is self-explanatory insofar as it indicates the relative trafficability of the different soil types in their natural state. Caution is urged in the use of the map, since it gives generalized rather than detailed information.

D. *Vegetation.*

About 50% of Southwest Japan is in forest, 17% under cultivation, and the remainder in scrub land, waste land, barrens, cities, villages, rural dwellings, lakes, and streams. Generally, all non-urban land areas too steep for cultivation are in forest, much of it planted, or in second growth mixed with grass and scrub (PLANS 41 and 42). The forests are of 4 types: broadleaf evergreen, broadleaf deciduous, coniferous (needleleaf), and mixed broadleaf and coniferous. Undergrowth is generally dense in the broadleaf and mixed forests and sparse in the coniferous forest. Clumps of bamboo fringe the forests in places, providing excellent concealment. The forests are somewhat similar to those in southeastern United States, but there are many more species of trees and plants. Cultivated crops consist of wet-field rice, small amounts of dry-field rice, and other dry-field crops such as tea, mulberry, wheat, soybeans, barley, fruits, and sweet potatoes.

The vegetation of this area, particularly the forest on the steep lands and the rice fields on the lowlands, will tend to restrict movement to the established lines of communication. Some concealment from horizontal observation is obtainable in the rice fields, especially in late summer when the grain is high. Concealment from horizontal and oblique observation may be expected in the tea and mulberry groves; and concealment from aerial observation may be had in some of the fruit orchards and in the forest and bamboo thickets at certain seasons. On the plains, concealment from air observation may be taken in the clumps of trees which ordinarily mark villages and temples. Except in limited areas, there are few dispersed farmsteads in Japan; the agricultural population generally lives in innumerable small villages which are $\frac{3}{4}$ to 1 mile apart. Fields of fire are not greatly limited by vegetation except in the forests. There is adequate wood for construction and fuel.

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E. Regional summary.

The relief, drainage, and vegetation of Southwest Japan are summarized by terrain regions in TABLE I - 1 below.

TABLE I - 1.
REGIONAL SUMMARY

REGION	RELIEF	DRAINAGE	PREDOMINANT VEGETATION
<i>Kyūshū</i> (1) Southern Kyūshū Lowlands and Highlands	Three coastal lowland areas among rugged uplands of moderate height; narrow passageways between lowlands; some rice on larger lowlands. Deployment and cross-country movement is fair in lowlands, poor in passageways, very poor in uplands.	<i>Highlands:</i> Stream gradients steep, with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats. <i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Rice on irrigable lowlands and narrow valley floors. Mulberry groves, fruit orchards, and other dry crops on many lower slopes. Forests, broadleaf evergreen and coniferous, cover most of uplands. Patches of grassland and scrub scattered through forests.
(2) Central Kyūshū Mountains.	Southern highland belt has rugged blocks with scattered higher volcanoes, narrow deep valleys, few passageways; rice in most valleys. Northern highland arm does not reach coast; has lower blocks and peaks, some hills, wider valleys, a few narrow valley routes. In both areas deployment almost impossible, cross-country movement very difficult.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Rice on coastal plains and narrow strips along streams. Dry crops on lower slopes above rice. Grasslands and scrub occupy wide belt across northern part of region; scattered patches elsewhere. Forests cover most of region; deciduous and coniferous trees above about 2800 feet; broadleaf evergreen and coniferous trees lower down.
(3) Northern Kyūshū Lowlands and Highlands.	Low rugged mountain areas rimmed by hills and separated by flattish lowlands which face enclosed bays. Narrow corridors connect lowlands; many heights dominate corridors; rice fields on lowlands. Deployment and cross-country movement possible on lowlands, restricted in corridors, difficult in uplands.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats. <i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Much rice on Saga and lesser plains. Terraced paddy fields bordering Saga Plain. Dry crops on hillsides, especially northeast of Kumamoto. Grass on western uplands, and scattered patches elsewhere. Broadleaf and coniferous forests on other uplands. Less forest area, proportionately, in this region than in most regions.
(4) Northwest Kyūshū Broken Lands.	Series of long narrow irregular peninsulas and offshore islands; rugged hills and low mountains; few high volcanoes; narrow winding valleys; no corridors; some rice in valleys. Deployment and cross-country movement difficult.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Narrow strips of paddy fields along streams. Dry crops on many slopes in southeast. Grass over wide areas in west and north. Forests over most of region; broadleaf evergreen and coniferous except in high elevations; deciduous and coniferous there.
<i>Shikoku</i> (1) Southwestern Shikoku Broken Lands.	Rugged mountains, moderate heights; many long, narrow, deep, winding, valleys form fair passageways, are not corridors; rice fields in most valleys. Deployment and cross-country movement very difficult.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Most of region covered with broadleaf evergreen and coniferous forests. Camphor trees relatively numerous in Tosa-wan area. Grass and scrub patches mainly in northeast. Paddy fields in strips along streams. Dry-crop fields, many mulberry groves, on slopes of northwest and west. Orchards on south coastal and valley slopes.
(2) Central Shikoku Mountains.	Rugged, steep, 3500-6000 ft. ridges; long deep, narrow, valleys; winding streams and some rice fields in valleys; no low passes; no corridors. Deployment and cross-country movement very difficult.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Forests, conifers with deciduous trees in high mountains and broadleaf evergreen over most of region. Extensive grass and scrub areas in west, lesser ones in east. Paddy areas few; mostly in valleys of extreme northwest and tributary to east coast. Dry crops on many interior slopes. Paper mulberry in southwest.
(3) Kōchi Plain.	Small coastal plain where several valleys converge; largest clear flat areas 6 by 8 miles; rice fields on flats; ridges between valleys form commanding heights. Deployment and cross-country movement possible.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Extensive paddy fields over most of lowlands; two crops annually. Mulberry important dry crop of low slopes and gravelly borders of streams. Broadleaf evergreen forests on hills and unirrigable lowlands.

TABLE U-1. (Continued).

REGION	RELIEF	DRAINAGE	PREDOMINANT VEGETATION
(4) Eastern Shikoku Lowlands.	Narrow wedge-shaped lowland and coast strip; low flat-topped terraces in wedge; small flat deltas on coast; much rice; all exits over high ridges; commanding heights on ridges. Deployment and cross-country movement possible.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields cover more than half of region. Dry crops, chiefly mulberry, on higher lands along river and on delta. Forests, mainly conifers, on the few hills.
(5) Northern Shikoku Lowlands.	Series of lowlands along coast for 130 miles; narrow, flat connections between most lowlands; scattered hills on lowlands and on rugged highland rim form commanding heights; rice fields on lowlands. Deployment and cross-country movement possible.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields cover greater part of region, 2/3 also used for winter grain or vegetables. Mulberry, fruit, and vegetables on lower slopes and unirrigable lowlands. Conifers, broadleaf evergreens, and grassy patches on hills.
West Central Honshū (1) Kii-harū Mountain Land.	Large triangular peninsula; high rugged mountains; narrow winding valleys with many commanding heights; no corridors; two small coastal lowlands; rice in lowlands and some valleys. Deployment and cross-country movement very difficult in mountains, possible in small lowlands.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Forests cover most of region; coniferous and broadleaf deciduous on highest parts, coniferous and broadleaf evergreen at lower elevations. Paddy fields on irrigable land of lowlands, and in strips along some valleys and small deltas. Fruit orchards and other dry crops on south-facing hills of one small lowland.
(2) Kinki Region Lowlands and Highlands.	Four large flat-floored basins separated by low steep-sided ridges; higher blocks and ridges along eastern boundary; many passageways and a few good corridors between basins; long narrow valleys and one short passageway through eastern highlands; commanding heights above all passageways and corridors. Deployment and cross-country movement possible in basins and corridors, difficult in passageways, very difficult on ridges.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats. <i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields on irrigable parts of basins, narrow valleys, and terraces. Dry crops on small, raised "islands" in paddy areas, and on hillsides above paddy fields. Fruit orchards, flowering trees numerous. Tea on some slopes in basins. Forests cover uplands and most slopes; coniferous and broadleaf deciduous widespread. Small areas of grass and scrub scattered through forests.
(3) Ise-wan Lowlands.	Large horseshoe-shaped lowland around bay; marginal terraces and rugged hills on east and west; square 24- by 32-mile Nagoya Plain on north; rice on plain and in small valleys among hills. Deployment and cross-country movement is possible on plain and in valleys, moderately difficult in hill and terrace areas.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields cover the irrigable coastal plains and many narrow valleys. Dry crops on unirrigable lowlands and lower slopes. Mulberries on "islands" of plain and eastern and western hills. Fruit orchards on hills in east part. Forests on higher hills and upland rim. Grass patches scattered through forests.
(4) Hamamatsu-Toyohashi Coastal Lowlands.	Long, narrow coastal lowland; series of river plains separated by large high terraces and rugged hilly areas; hills and terrace margins form commanding heights. Much rice on plains and between hills. Deployment and cross-country movement possible on river plains and terrace flats; difficult on terrace margins and hills.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields on irrigable lowlands. Winter grain and legumes on 1/3 of paddy area. Tea gardens on many terrace slopes in eastern part of region. Mulberries predominant on lower slopes of hills in western part. Other dry crops on some slopes. Open, coniferous forest on terraces and hills above tea and mulberries.
(5) Central Honshū Rugged Highlands.	High rugged mountain ranges on the east, rugged ranges and dissected blocks of lesser height on west; long, narrow, winding, deep, valleys and narrow basins; many commanding heights. Rice in basins and in few sections of valleys. Deployment and cross-country movement difficult in valleys and basins; very difficult in highlands.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Forests cover large part of region; mostly conifers and mixed broadleaf deciduous; broadleaf evergreen at low elevations; alpine flora on some high mountain tops, other tops bare. Grass and scrub areas usually on very steep slopes. Paddy fields on irrigable parts of Iida Valley; in narrow strips along other streams. Dry crops on slopes above these strips. Mulberries on unirrigable parts of Iida Valley and on bordering low slopes.
Western Honshū (1) Tanba Broken Plateau.	Low but steep-sided blocks and ridges, separated by long narrow valleys and interior basins which form passageways but not true corridors; many commanding heights above passageways. Rice fields in many valleys. Deployment and cross-country movement possible in valleys, very difficult in highlands.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Forests, mixed coniferous and deciduous, on hills bordering Japan Sea. Mixed broadleaf (mainly evergreen) and coniferous over most of region. Much scattered grass and scrub. Strips of paddy fields along many streams. Mulberry groves on unirrigable borders of streams in northwest. Small areas of fruit orchards and dry crops on scattered slopes.

TABLE I - 1. (Continued).

REGION	RELIEF	DRAINAGE	PREDOMINANT VEGETATION
(2) Matsue-Tottori Coastal Lowlands.	Series of small deltas and one large sand spit; some deltas are connected by narrow coastal flats. Lakes and rock ridges separate larger flat areas. Many rice fields. No corridors or easy passageways inland. Commanding heights above most of deltas and all coastal flats. Deployment and cross-country movement possible on deltas and sand spit, difficult elsewhere.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields on irrigable lowlands. Dry crops, largely mulberry, on unirrigable lowlands and lower slopes. Forests, deciduous and coniferous, on hills. Windbreaks of trees protect farmsteads. Scant grass areas.
(3) Western Honshū Rugged Highlands.	Rugged ridges and flat-topped blocks with steep sides; these decline in west to form rugged hills; many long narrow valleys; no corridors; commanding heights above all valleys; rice in larger valleys.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats.	Forests cover most of region: coniferous and deciduous along Japan Sea north of about 34° 30' N, and at high elevations; coniferous and various broadleaf mixed elsewhere. Extensive areas of coarse grass and scrub in eastern and western thirds of region. Strips of paddy fields along many streams. Dry crops on slopes around villages.
(4) Western Honshū Broken Lands.	Rugged highland blocks and isolated ridges separated by nets of narrow valleys and basins. Several small hill-dotted coastal plains with tributary valley nets; commanding heights above all valleys and most plains. Rice in coastal uplands and in larger valleys. Deployment and cross-country movement possible on coastal plains; difficult in uplands.	<i>Highlands:</i> Stream gradient steep with many falls and rapids except in scattered tiny basin flats; streams fill narrow valleys and meander from side to side in basins; some water storage and power dams; danger of flash floods even on basin flats. <i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields on coastal lowlands and in valleys, also on lower slopes above some valleys. Cultivated reeds in some flooded fields. Dry crops on many slopes, river levees, and "islands" in paddy areas. Thin forest of coniferous and mixed broadleaf covers uplands between valleys.
(5) Himeji-Yashiro Lowland.	Small irregular hill-dotted coastal lowland with tributary valley net penetrating Tamba Plateau to north. Commanding heights above valleys and most of plain. Much rice in coastal plain and larger valleys. Deployment and cross-country movement possible in plain, difficult in valleys and on hills.	<i>Lowlands:</i> Streams elevated slightly; dikes common; barren flats exposed between dikes and stream at low water; muddy banks and bottom unusual; streams canalized in urban areas; numerous irrigation ponds and canals on many larger lowlands; natural swamps rare; rice field swamps in all lowlands.	Paddy fields cover extensive areas near coast and in basins behind low hills. Dry crops on some slopes. Forests, mainly conifers (partly scrub pine), including deciduous and evergreen broadleaf, cover hills and unirrigable lowlands.

F. Natural critical areas.

There are 2 natural critical areas in Southwest Japan: Northern Kyūshū at the western end of the Inland Sea; and the group of plains and basins in the Kinki Region of Honshū, at the eastern end of the Inland Sea. Northern Kyūshū is one of the chief centers of heavy industry of Japan proper; and the Ōsaka-Kyōto-Nara-Nagoya group of lowlands in the Kinki Region contains not only a large number of industries, but also has the largest aggregate of level land available for the construction of air and depot facilities.

G. Routes to natural critical areas.

Routes to natural critical areas from usable landing places are available in Southwest Japan, but the routes are difficult. (FIGURE I-7 and PLANS 39 and 40). The lowlands which form the hearts of the critical areas are largely isolated from each other and from the ocean by mountains, rugged hills, or constricted water bodies. Connections between the lowlands consist of narrow, steep-sided valleys some of which open into broader basins. The railways, roads, and trails that follow the valleys cling precariously to the valley sides in many places or tunnel through projecting spurs. Such railways and roads can be blocked or destroyed easily.

3. Oceanography

A. Tides.

The mean diurnal ranges of the tides in this area vary from about 0.3 foot on the coast of Honshū bordering on the Japan Sea, to 11.5 feet in Shimabara-kaiwan, a gulf in western Kyūshū, and the average ranges at times of spring tides are as much as 15 feet. The ranges vary considerably during the month. At some places there is an appreciable inequality between the heights of morning and afternoon tides; at places referred to Kōbe and Hong Kong, the inequality is so great that, for a few days during the month, there is only 1 tide a day.

B. General circulation.

The Kuroshio (Japan Current) flows east-northeastward off the south coasts of Kyūshū, Shikoku, and Honshū throughout the year. Off the northwest and north coasts of Kyūshū and Honshū the Tsushima Current also flows northeastward. Off the west coast of Kyūshū a branch of the Tsushima Current flows southward throughout the year, joining the Kuroshio south of Kyūshū.

Near shore and in the channels between the islands, the tidal currents are often much stronger than the non-tidal currents and so mask the effect of the latter. The tidal currents in many of the passages of the Inland Sea are strong, and the diurnal inequality, in general, is large in the eastern part of the Inland Sea and comparatively small in the western part.

C. Sea and swell.

High sea and swell are frequent in this region. The 4 areas used for summarizing vary somewhat in the monthly distribution of the amounts of sea and swell, but in general the sea is least disturbed from May through July and roughest from October through March. Sea and swell are predominantly from northeast through northwest from October through March; they are more variable during the rest of the year, but in most areas southerly sea and swell predominate.

D. Sea water characteristics.

The temperature extremes of the surface water range from 29.5° to 90° F. Extreme salinity values of 26.20 to 38.82 parts per thousand have been recorded at the surface; but salinities below 32.00 or above 35.00 parts per thousand are uncommon.

The mean transparency of the water varies from about 40 feet to over 80 feet. The water in the open sea in the southern part of this area is very blue, but it becomes greener toward the northern part.

E. Sonar and diving conditions.

Average echo ranges at the surface vary from 2,700 to 2,750 yards in winter and from 700 to 2,100 yards in summer. In winter, the ranges will frequently be the same at all depths, but in summer the ranges will usually be appreciably shortened at some particular depth. In both winter and summer, ranges in shallow water will be reduced by the high background noise level.

It will rarely be possible for a submarine to maintain trim or to run quietly in balance during the winter, but in summer balancing is probable at average depths of 90 to 150 feet.

F. Bottom sediments.

The bottom sediments within the 100-fathom contour in this area are, in general, *sand* with numerous patches of *rock*, except in the deeper parts of the bays and in the Inland Sea where the bottom is chiefly *mud* (PLANS 31 to 37).

4. Coasts and Landing Beaches

The coasts of Southwest Japan are in general much indented, with numerous rocky promontories separated by bays or small bights (FIGURE 1-8). Many islets and detached rocks and reefs fringe the shore. The coast is backed by rugged, rocky hills and mountains, which rise either directly from the water's edge or a short distance inland. In places the mountains are interrupted by small alluvial plains which extend inland up the river valleys, and are bordered by beaches. The upper mountain slopes are largely clothed with oak and pine forests, while the lower slopes are cultivated or in grassland. The alluvial flats are intensively cultivated, with irrigated rice paddies adjacent to the streams. Immediately behind the beaches a belt of scattered pines and grass is commonly present.

Hundreds of beaches line the shores of Southwest Japan, but the great majority of them are either relatively small, inconvenient of approach, or removed from existing objectives. Some 40 of the more extensive beaches are well-situated with

respect to approach, inland terrain, and accessibility of objectives, including airfields. These most important beaches are mainly along the Pacific and China Sea shores of Kyūshū, Shikoku, and southwestern Honshū; a few lie along the shores of the Inland Sea. Most of the small beaches are in bights or are scattered pocket beaches on the many small islands which fringe the major islands, especially in the Inland Sea. Many of these small beaches are composed of pebbles or sand and pebbles; the longer beaches, especially those near the mouths of large rivers flowing into the larger bays, are predominantly sand. There are no coral beaches along the shores of Japan as far as is known, but areas of live coral are present on the near-shore bottom at a number of places along the southern shores of the main islands, especially along Kyūshū and Shikoku (FIGURE 1-8).

A. Kyūshū.

Along most of the deeply indented coasts of Kyūshū rugged hills and mountains rise directly from the water's edge, or a short distance behind the shore. The coastal mountains are cut by numerous short, narrow, deep, steep-walled ravines and by a few larger river valleys. Alluvium forms small coastal plains around the river mouths, extends inland up the valleys, and in places forms narrow isolated strips between the mountains and the shore. The largest alluvial plains are on the northwest coast, on the west coast, at the head of Ariakeno-umi, and on the east coast around Takanabe. Approaches range from gently shelving off the alluvial flats to steep to off some of the mountainous sections of the coast. Detached rocks and reefs are common along the more deeply indented stretches, but except for sand and mud banks around the river mouths, dangers are rare off the coastal plains. The hills and mountains are largely covered with subtropical oak and pine forests, alternating with patches of grassland. Along the lower hill slopes are small groves of bamboo. Bordering the coasts and rivers many of these slopes are terraced and planted to dry crops. The alluvial flats are covered with a patchwork of dry crops, truck gardens, irrigated rice fields, and mulberry groves. Immediately behind the beaches a strip of grass and scattered pines is commonly present.

The best beaches on Kyūshū are along the southern half of the island, although there are also good beaches along the northwestern shore and in the bays on the northeast. Most of the beaches along the western part of the island are small. In general, the large beaches are backed by extensive coastal plains with good communications and the approaches to them are clear; some of the beaches are at the heads of bays. Most of the small beaches are along the more rugged parts of the coast, where both inland terrain and communications are unfavorable for operations.

B. Shikoku.

The coasts of Shikoku bear close relation to the inland terrain of the island. The most prominent feature of Shikoku is a range of mountains trending southwest - northeast, and consisting in part of alternating, roughly parallel ridges and valleys. Where these mountains meet the shore approximately at right angles, on parts of the southwestern, southern and eastern sides of the island, the coast is deeply indented and fringed by islets. A number of small, disconnected alluvial flats and plains,

many of which are bordered by landing beaches, are present on the northern and eastern sides of the island and around the shores of Tosa-wan, a large bay on the southern side of Shikoku. The bottom ranges from gently shelving off the alluvial flats to steeply shelving where mountains parallel the shore. Detached reefs and shoals are numerous except off the northwest coast bordering the Inland Sea, off the north and east shores of Tosa-wan, and off the southeast coast of the island. The vegetation is in general similar to that on Kyūshū.

The best beach area on Shikoku is along the eastern part of the southern shore; good beaches are also found in the north-eastern and northwestern parts (FIGURE I-8). Except for the southern shore, however, the beach approaches are by way of relatively narrow channels which lead to the inner seaways among the islands. On Shikoku the large beaches are backed by plains and the small beaches by rugged terrain.

C. Southwestern Honshū: North Coast.

The seaward approach to this sector is relatively clear. The bottom ranges from steeply shelving off the straighter parts of the coast to very gently sloping, as around Miho-wan. Detached rocks and islets fringe the shore in places but are less numerous than along the coasts of other sectors of this region (FIGURE I-8).

Except for Wakasa-wan, at the eastern end of this coast, Miho-wan, near the center of the coast, and several smaller bays to the southwest, the coast is not greatly indented. The entire coast is backed by hills and mountains. In places these rise steeply from the water's edge, but where large streams reach the coast, the shore is fronted by alluvial flats, which extend inland up the valleys. The most important of these flats are in the vicinities of Tottori, Yura, Tsunozu, Takatsu, and Hagi, and along the south shore of Miho-wan. The major alluvial areas, including the large plain west of Miho-wan are bordered by landing beaches.

The vegetation is similar to that of Kyūshū and Shikoku but contains fewer subtropical varieties.

D. Southwestern Honshū: South Coast.

More than half of the south coast of southwestern Honshū borders the Inland Sea, lying between Honshū on the north and east and Kyūshū and Shikoku on the south (FIGURE I-8). This sea is about 240 miles long east-west and about 10 to 30 miles wide. It is entered from the west through Shimonoseki-kaikyō, between Honshū and Kyūshū; from the south through Bungo-kaikyō between Kyūshū and Shikoku; or from the east through Kii-suidō, between Honshū and Shikoku.

The Inland Sea coast of Honshū is deeply indented with many inlets and promontories and is fronted by numerous small islands. Smoothly rounded pine-covered hills characterize the coast. The only large alluvial areas are in the vicinity of Hiroshima, between Fukuyama and Ogushi, along the northeastern shore of Harima-nada, and at the head of Ōsaka-wan. Along the southeastern shore of Ōsaka-wan flat-topped sand-and-gravel terraces terminate in steep bluffs. There are landing beaches east of Shimonoseki and south of Ōsaka. The bottom, in general, has moderate slopes and the central and larger part of the Inland Sea is studded with numerous rocks, reefs, and islets.

The shores of the Kii-hantō, eastward of the Inland Sea, are

similar to those of Shikoku. Ise-wan is a long inlet bordered by alluvial flats, flat-topped terraces, and low but rugged hills. An extensive alluvial plain, on which is the city of Nagoya, lies at the head of the bay. Landing beaches are present along the eastern and western sides, and there are very few dangers. East of Ise-wan to the eastern boundary of the area, the coast is nearly straight. Areas of sand and gravel terraces, rising from the water's edge, alternate with alluvial flats extending several miles inland. Both are backed by rugged hills and mountains and the flats are bordered by landing beaches. The bottom is gently sloping and practically free of dangers.

The vegetation on the southern coast of Honshū is in general similar to that of Kyūshū.

5. Climate and Weather

A. Regional differences.

Kyūshū, Shikoku, and Southwestern Honshū may be conveniently divided into 2 principal regions for the discussion of climate. The first, and larger, region lies to the south of the main mountain ranges of Honshū and includes all coastal sections and mountain slopes facing the Pacific Ocean. The climate of this region is characterized by summers with heavy rainfall and much cloudiness, and by winters that are relatively dry and sunny (FIGURE I-4). The second, and smaller, of the 2 regions lies to the north of the main mountain ranges of Honshū and includes all coasts and mountain slopes facing the Japan Sea. This region is characterized by frequent precipitation and much cloudiness in the winter months and a secondary maximum of precipitation and cloudiness in the summer months.

B. Weather and operations.

In the region facing the Pacific Ocean, the cooler months of the year (November through February) appear to offer the most favorable conditions for military operations, with August having the most favorable conditions in the summer season. In the region facing the Japan Sea, August appears to be the most favorable for operations, with favorable periods also probable in the late spring months. The weather over only the Japanese Islands has been here considered, not the weather over the open ocean or over the adjacent Asiatic mainland.

TABLE I-2 gives detailed implications of climate and weather for Kōbe.

C. The weather elements.

Precipitation is heaviest in June over the region facing the Pacific, with a secondary maximum in September; the monthly amounts usually vary between 8 and 12 inches. The heaviest falls are recorded on the slopes of the higher mountains of Shikoku and of the Kii-hantō (peninsula). The least rainfall occurs over the Inland Sea (Seto-naikai) region. The season of moderate to heavy rains lasts from April through October, while the relatively "dry" season lasts from November through March. Some years have a midsummer drought, which is most likely to occur in August. In the region facing the Japan Sea, the precipitation is very frequent and very heavy during the winter months. Over the higher elevations, considerable snow

FIGURE I-4.
GRAPHIC SUMMARY OF CLIMATE, KÖBE

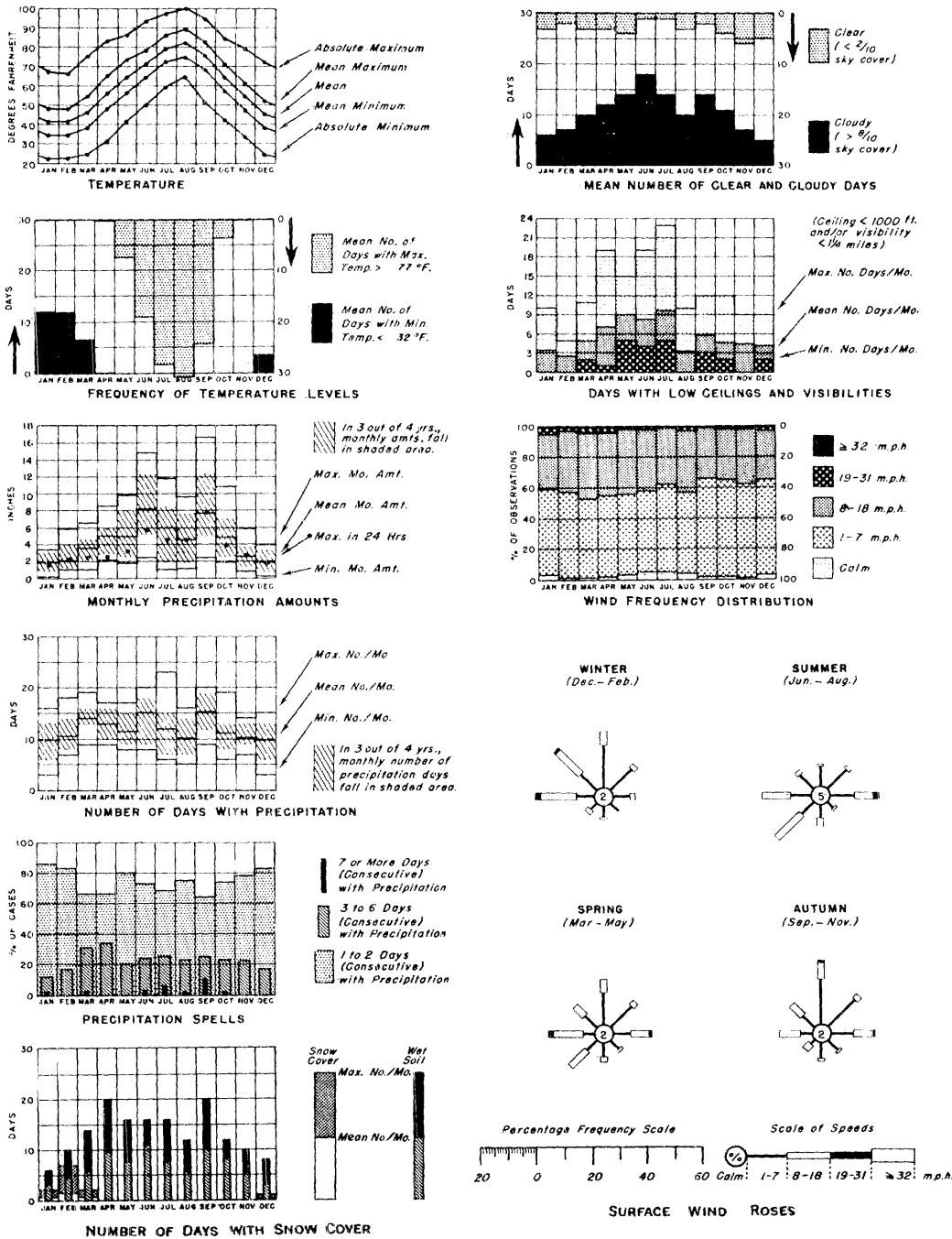


TABLE I - 2.
MILITARY IMPLICATIONS OF CLIMATIC CONDITIONS, KÖBE

MILITARY FACTOR	WEATHER FACTOR	MONTHS OF MOST FREQUENT OCCURRENCE*	MONTHS OF LEAST FREQUENT OCCURRENCE*
AIR OPERATIONS			
General	Thunderstorms	May-Oct. (1-3 days/mo.)	Nov.-Apr. (1 day/mo. in occasional yrs.)
	Severe icing	Dec.-Mar. (3-7 days/mo.)	May-Oct. (Rare)
High Level Bombing	Ceiling < 1,000 ft. and/or visibility < 1 1/4 mi.	Apr.-July (7-10 days/mo.) **	Jan.-Feb.; Aug. (3 days/mo.) **
	Gales	All months (0-1/2 of obs.)	
Incendiary Bombing	Sky > 8/10 cloud covered	May-July; Sept. (14-15 days/mo.)	Nov.-Feb. (5-7 days/mo.)
	Visibility < 6 mi.	May; July-Aug. (26-26 days/mo.) **	Jan.-Feb. (21 days/mo.) **
Observation & Photography	Wind velocity < 18 m.p.h.	Feb.; May-Dec. (97-99% of obs.)	Jan.; Mar.-Apr. (95-96% of obs.)
	Rainfall	June, Sept. (9*/mo.)	Dec.-Feb. (2*/mo.)
Air-Ground Support	Sky > 8/10 cloud covered	May-July; Sept. (14-18 days/mo.)	Nov.-Feb. (5-7 days/mo.)
	Visibility < 6 mi.	May; July-Aug. (26-26 days/mo.) **	Jan.-Feb. (21 days/mo.) **
Parachute Operations	Ceiling < 1,000 ft.	Apr.-July (6-9 days/mo.) **	Jan.-Feb.; Aug. (2-3 days/mo.) **
	Wind velocity > 16 m.p.h.	All months (0-1 day/mo.)	
Barrage Balloons	Visibility < 8 mi.	Jan.; Mar.-Apr. (6-7% of obs.)	Feb.; May-Dec. (3-5% of obs.)
	Thunderstorms	January (10 days/mo.) **	May, July (5 days/mo.) **
GROUND OPERATIONS	Thunderstorms	May-Oct. (1-3 days/mo.)	Nov.-Apr. (1 day/mo. in occasional yrs.)
	Wind velocity > 30 m.p.h., surface to 10,000 ft.	Winter (24% of obs.)	Summer (16% of obs.)
General	Rain frequency	All months (10-15 days/mo.)	
	Temperature > 90° F.	June-Sept. (17-29 days/mo.)	Nov.-Mar. (None)
Artillery Fire Control	Temperature < 32° F.	Jan.-Feb. (12 days/mo.)	May-Nov. (None)
	Wind velocity > 30 m.p.h., surface to 10,000 ft.	Winter (24% of obs.)	Summer (16% of obs.)
Chemical Warfare	Visibility < 2 1/2 mi.	Apr.-June; Sept.-Oct. (5-7 days/mo.) **	Jan.-Feb.; Aug. (3 days/mo.) **
	Temperature > 75° F.	June-Sept. (21-31 days/mo.)	Dec.-Mar. (None)
Mechanized Operations	Temperature < 32° F.	Jan.-Feb. (12 days/mo.)	May-Nov. (None)
	Wind velocity > 16 m.p.h.	Jan.; Mar.-Apr. (6-7% of obs.)	Feb.; May-Dec. (3-5% of obs.)
Vehicle Maintenance	Instability and turbulence	June-Sept. (Steep daytime lapse rates)	Dec.-Mar. (Frequent night inversions)
	Low humidity	Dec.-May (56-57% r.h., afternoon)	June-July; Sept. (32% r.h., morning)
Infantry	Rainfall	June, Sept. (9*/mo.)	Dec.-Feb. (2*/mo.)
	Snow cover	Jan.-Mar. (1 day/mo.)	Apr.-Nov. (None)
Engineering Construction	Temperature < 32° F.	Jan.-Feb. (12 days/mo.)	May-Nov. (None)
	High temperature	July-Aug. (Abs. max., 97-100°)	Jan.-Feb. (Abs. max., 65-67°)
Supplies and Storage	Sand and duststorms	None	
	Rain frequency	All months (10-15 days/mo.)	
Road Communications	Temperature < 32° F.	Jan.-Feb. (12 days/mo.)	May-Nov. (None)
	High humidity	June-July; Sept. (52% r.h., morning)	Dec.-May (56-57% r.h., afternoon)
Road Communications	Rain frequency	All months (10-15 days/mo.)	
	Snow cover	Jan.-Mar. (1 day/mo.)	Apr.-Nov. (None)

* Numbers in parentheses are normal expectancies. Unless otherwise noted, ranges within the group of months given are based on the means of the month of most and least frequent occurrence.
** Estimated. > means "more than" < means "less than"

must be expected, although the amounts are small along the immediate coast of southwestern Honshū. A secondary maximum occurs in June, and the September rainfall is very heavy.

Typhoons can occur during any month of the year but are most likely to affect the Japanese Islands in September. They are attended by widespread areas of low-level, overcast, torrential rains, and winds exceeding 75 m.p.h. Much damage is caused by extremely high tides which follow in the wake of the storm. Operations of all types are interrupted by the passage of a typhoon.

Temperatures are moderately high in the summer months, and the weather is mild in winter. The most frequent maximum temperatures in midsummer, are in the high 80's and low 90's, while minimum temperatures average above the freezing level in all winter months even along the north coast. Extremes between 95° and 100° F. in summer and between 10° and 20° F. in winter must be taken into consideration. For the most part, temperatures will not interfere with operations in this area.

Cloudiness is at a maximum in June at the height of the rainy season in the region facing the Pacific Ocean. In this region, especially in well-protected localities, there are a great many clear days each month from November through February when the cloudiness is least. In the region facing the Japan Sea, the maximum cloudiness occurs in December and January, concurrent with the period of maximum precipitation. Ceilings are lowest in the moist, mT air masses of the summer, particularly in June.

Humidity is moderate to high along the coastal areas at all seasons of the year. The high humidity of the south coastal areas in summer is almost unbearable when coupled with the high temperatures of that season, and all who can afford to do so plan to spend at least a portion of the summer at inland mountain resorts. The high humidities of the north coast in winter are more bearable because of the lower temperatures.

Surface winds show considerable variability in both direction and speed because of the wide variation in the local topography. The strongest and most persistent winds are found at exposed coastal points. The weakest and least persistent winds are found near the Inland Sea. Extreme velocities may occur at any time of the year but are most likely to occur in September in connection with the passage of a typhoon. Winds are stronger in winter than in summer and are stronger in the afternoon hours than in the early morning hours.

Visibility may be limited by precipitation, fog, dust, or haze. Fog is not very important in Kyūshū, Shikoku, and southwestern Honshū, except where the high mountains are enshrouded in cloud. Haze in the lower levels may be quite important in the occasional dry periods of the summer season, rendering surface objects indistinct at relatively short distances.

6. Port Facilities

Japan has the most important ports in the Pacific Ocean. With the exception of Tōkyō and Yokohama, they are in Southwest Japan, concentrated at either end of the Inland Sea, on the west coast of Kyūshū, and on the northwest coast of Honshū along the Japan Sea. The large number of secondary ports on the Inland Sea—the north coast of Shikoku and the southwest coast of Honshū—are intermediate coastal shipping

points that feed traffic to the concentrations of principal ports at either end of the sea.

In all, Southwest Japan has 19 principal ports, 41 secondary ports, and 81 other landings (FIGURE I-9) distributed as follows:

Kyūshū—8 principal ports, 11 secondary ports, and 27 other landings.

Shikoku—1 principal port, 13 secondary ports, and 18 other landings.

Southwest Honshū—10 principal ports, 17 secondary ports, and 36 other landings.

The division of ports into the categories of principal, secondary, and other landings is relative; certain ports are artificially equipped, or naturally endowed, with greater advantages than others, and for a specific region are considered principal while others are considered secondary. In addition, there are some points where shipping is carried on, but limited facilities or lack of data result in the classification of these points as other landings. In general, the principal ports have anchorage and landing, cargo handling, storage, and clearance facilities capable of accommodating deep-draft ocean-going vessels; secondary ports have anchorage and facilities for handling coastal traffic.

The coastlines of the Japanese Islands provide many deep natural harbors. Extensive development of these harbors and the construction of port facilities has been underway since the early 1900's; this development program was intensified in the 1930's and has been in progress to date. A large proportion of Japanese ports have artificially improved inner harbors in addition to adjacent natural anchorage areas. Some secondary ports can provide anchorage for whole fleets in the waters off their harbors. Harbor improvements include construction of breakwaters, dredging of channels and water areas, and reclamation of shore land. Concurrent with the construction of landing facilities, the Japanese provide adequate mechanical cargo handling, storage, clearance, and repair facilities. Several of the principal and secondary ports are important for shipbuilding and repair as well as anchorage and landing facilities.

Where possible, the Japanese take advantage of rivers flowing into harbors to assist in clearing cargo. At several principal ports, canal networks have been constructed to clear cargo from the harbors to the industrial plants on the banks of the rivers and canals, which are quayed for extensive lengths. Rivers and canals are particularly significant at Ōsaka and Nagoya. All the important ports, and virtually all of the secondary ports, are linked to the Japanese highway and railroad systems (FIGURES I-10 and I-11).

At the eastern end of the Inland Sea, Kōbe, the largest port in Japan, and Ōsaka and Amagasaki handle the port traffic for the important Kyōto-Kōbe-Ōsaka triangle, the leading industrial center of Japan.

At the western end of the Inland Sea, Shimonoseki-Moji and Wakamatsu-Yawata-Kokura handle the traffic for important coal, steel, shipbuilding, and other industrial installations.

On the west coast of Kyūshū are the shipbuilding center of Nagasaki, and 6 principal ports—Fukuoka, Karatsu, Sakito, Ōmura-Miike, Misumi, and Kagoshima.

On the northwest coast of Honshū along the Japan Sea are 4 principal ports—Tsuruga, Miyazu, Sakai, and Hagi, which handle traffic with the Asiatic mainland. Yokkaichi and Nagoya, 2 principal ports, are on the southwest coast of Honshū,

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eastward from Ōsaka and Kōbe. Nagoya is an important aircraft production center.

Kōchi, the only principal port on Shikoku, is on the southern coast of the island.

The secondary southwest Honshū ports—Habu, Onomichi, and Uno—are shipbuilding and repair centers. Uno, its adjacent Tama shipyards, and Hibi are often considered parts of Tamano, a city southward from Okayama.

Two closed naval ports, Sasebo on the west coast of Kyūshū and Kure on Honshū, are not discussed in this topic. Maizuru, a secondary Honshū port, is used for both naval and commercial purposes. Kudamatsu, another secondary Honshū port, is a short distance eastward from the Tokuyama Minor Naval Station. Ujina, the port of Hiroshima, and Uno, both southwest Honshū secondary ports, are military embarkation points.

In most ports, the unloading capacity estimates given in CHAPTER VI apply only to the described portions of the facilities, which generally are the deep-draft, relatively well-known quays, wharves, and piers. In some ports where sufficient quantitative data is available in Washington, these estimates come close to approximating the total capacities of the ports. They are based on short tons (2,000 pounds) of general cargo handled at known deep-draft vessel berths, assuming an 8-hour day.

Another set of unloading capacity estimates, given in CHAPTER XII, and prepared by the Army Service Forces, is based on the use of all facilities for handling military supplies in terms of short tons (2,000 pounds), assuming a 10-hour day. TABLE I-3 gives a tabulation of the unloading capacity estimated as given in CHAPTERS VI and XII.

A. Kyūshū.

(1) Principal ports.

(a) *Wakamatsu-Yawata-Kokura.* Wakamatsu and the adjacent port towns of Tobata, Yawata, Kokura, and Akasaka are at the northern tip of Kyūshū on the strip of water separating this island from the southwestern tip of Honshū. Shimonoseki-kaikyō, the strait which provides entrance to Wakamatsu and Kokura harbors, also leads into Kammon-kō, the harbor for Shimonoseki-Moji. Wakamatsu, essentially a coal port, is on the northwestern side of the harbor; Yawata, site of the Imperial Steel Works, reported to be one of the largest in the world, is on the southeastern side of the harbor; and Tobata, a fishing port, is across the main harbor from Wakamatsu. Kokura is eastward from Wakamatsu and Tobata; Akasaka is 1¼ miles east-northeastward from Kokura.

Wakamatsu-kō, an artificial harbor, consists of an outer harbor, a main harbor, and inner harbor. The entrance has a controlling depth of 3¼ fathoms. Depths in the outer harbor range from 1 to 5 fathoms. The 196-acre water area of the main harbor has charted depths from 17 to 25 feet. The 2,515-acre water area of the inner harbor has dredged channels along the northern and southern sides, with depths of 3 to 16 feet and 10½ to 15½ feet, respectively. The middle is shallow. Kokura-kō consists of 2 river mouth basins. The entrances to both basins are clear. The channel to one has a controlling depth of 9 feet. The second basin, Gawa Basin, has been dredged to 29½ feet and in 1935 there were plans for dredging a channel. The artificial harbor at Akasaka has charted depths of 4½ to 9 feet. There are about 230 third-class anchorage berths in the outer harbor.

TABLE I-3.
ESTIMATES OF UNLOADING CAPACITIES AT PORTS
OF SOUTHWEST JAPAN

NAME	CATEGORY	CHAPTER XII ESTIMATE	CHAPTER VI ESTIMATE
<i>Kyūshū:</i>			
Wakamatsu-Yawata-Kokura	Principal port	11,000 (?) *	No estimate; specialized coal and ore facilities.
Fukuoka	Principal port	4,600	1,000
Karatsu	Principal port	2,000	1,330
Sasebo	Naval port	11,000 (?)	Not covered.
Nagasaki	Principal port	5,000	2,200
Ōmura-Miike	Principal port	2,850	1,200
Misumi	Principal port	1,850	960
Kagoshima	Principal port	1,300	No estimate.
Shibushi	Secondary port	650	No estimate.
Aburatsu	Secondary port	650	No estimate.
Hososhima	Secondary port	650	No estimate.
Oita	Secondary port	650	No estimate.
Beppu	Secondary port	650	No estimate.
Makurazaki	Other landing	650	No estimate.
<i>Shikoku:</i>			
Kōchi	Principal port	No estimate.	1,000
Komatsushima (Listed in Chapter XII as Tokushima)	Secondary port	2,950	1,000
Takamatsu	Secondary port	4,600	No estimate.
Sakaide	Secondary port	No estimate.	700
Niihama	Secondary port	650	No estimate.
Imabari	Secondary port	1,300	No estimate.
Yawatahama	Secondary port	3,300	No estimate.
Uwajima	Secondary port	3,650	No estimate.
Sukumo	Other landing	350	No estimate.
Nagahama	Other landing	3,950	No estimate.
Marugame	Other landing	350	No estimate.
<i>Honshū:</i>			
Tsuruga	Principal port	4,300	3,400
Miyazu	Principal port	No estimate.	2,600
Sakai	Principal port	2,300	1,080
Hagi	Principal port	No estimate.	400
Shimonoseki-Moji	Principal port	17,850	15,120
Kure	Naval port	3,300 (?)	Not covered.
Kōbe	Principal port	33,000	50,000
Ōsaka	Principal port	50,500	16,250
Yokkaichi	Principal port	2,300	3,500
Nagoya	Principal port	18,500	8,800
Maizuru	Secondary port	4,950 (?) **	600
Ezumi	Secondary port	No estimate.	575
Hamada	Secondary port	No estimate.	530
Ube	Secondary port	3,300 (?)	No estimate.
Tokuyama	Naval port	4,400 (?)	Not covered.
Hiroshima	Secondary port	5,300	No estimate.
Onomichi	Secondary port	350	No estimate.
Uno	Secondary port	3,300	No estimate.
Toba	Other landing	2,000	No estimate.

* Question mark indicates unloading capacity was based on incomplete information at time estimate was made.

** May include naval as well as commercial facilities.

The principal and secondary ports of Kyūshū, Shikoku, and southwest Honshū are briefly described in this topic in the order of their geographic locations moving counter-clockwise around each island.

Quays front most of the main harbor and the steel works area. Practically all of the waterfront has been improved, but details are not available. In 1941, 4 piers were reported under construction in the outer harbor. Of 96,790 feet of faced or quayed landing facilities, only a few of the reported depths alongside are over 20 feet. Tugs are available. Cargo handling facilities are primarily designed for coal and ore.

(b) *Fukuoka.* Fukuoka, with the adjoining community of Hakata and other towns on the shores of Hakata-kō, is developed principally as a coal exporting center. An artificial harbor, protected by breakwaters, fronts Fukuoka, Hakata, and Hakozaki. A 175-yard wide approach channel, with depths of 24 to 25½ feet, was being dredged in 1938 for about 1 mile northwestward of the entrance to the artificial harbor between

2 main breakwaters. The entrance channel through Fukuokawan is wide, clear, and has 9 fathoms in the fairway. Hakata-kō can provide 16 first-, 41 second-, and 420 third-class anchorage berths.

The main wharf, north of Hakata Municipal Basin, provides the only accommodations for ocean vessels. Specialized facilities for handling bulk cargoes of coal and oil are at Saitozaki and Neihama. Extensive reclamation work was in progress in 1938 and other improvement plans were projected. Numerous lighters are available. Minor repairs can be made and a drydock is available for shallow-draft vessels.

(c) *Karatsu*. Karatsu, on the northwest coast, was a coal-ing port prior to depletion of the coal deposits in the vicinity. Nishi-kō, the western arm of Karatsu-kō, has general depths of 24 to 30 feet; a 24-foot depth is maintained alongside the principal quay and in its approach channel. The fairway leading into Nishi-kō, about 1,000 yards wide, has depths of 40 to 48 feet. Higashi-kō, the eastern arm of the harbor, is used mostly by small craft with local knowledge; depths of 24 to 33 feet prevail in its outer part. The entrance to Higashi-kō, about 1,450 yards wide, has depths of 30 to 34 feet. Two first-, 3 second-, and 14 third-class anchorage berths are available in Nishi-kō; in favorable weather there are 2 first-, 6 second-, and 5 third-class berths in Higashi-kō.

The principal landing facilities, in the artificial harbor in the southeastern corner of Nishi-kō, provide berthage for one 350-foot vessel drawing 20 feet, and four 200-foot vessels drawing 12 feet. Only light-draft vessels can be accommodated at other facilities. Sixty coal lighters and 1 small tug are available.

(d) *Sakito*. Sakito is on the western side of Kakinourashima and the eastern side of Sakito-shima; both islands lie off the northwestern coast of Kyūshū. The town is occupied entirely by the Sakito Mining Company, which has extensive coal mining operations in the area and exports the coal at the port. Depths in the outer harbor diminish from about 78 feet in the entrance to about 37 feet at the entrance to the inner harbor. General depths of 27 feet or more are charted over most of the inner harbor. There are 2 first-, 1 second-, and 6 third-class anchorage berths in the outer harbor. In the inner harbor, vessels usually berth alongside the quays or at mooring buoys.

There are a number of wharves at which vessels can berth, but details are not available. Most berths are equipped with coal loading machinery. Vessels at mooring berths load from lighters, the largest of which is equipped with loading machinery.

(e) *Nagasaki*. On the west coast of Kyūshū, Nagasaki is one of the 3 major Japanese shipbuilding centers. It has a large, well-sheltered harbor that provides extensive, good anchorage in both inner and outer harbors. Virtually the entire inner harbor is lined with piers, wharves, quays, shipyards, drydocks, cranes, and other port facilities, but only one 1,380-foot commercial wharf with a 29½-foot depth is reported to be able to handle ocean-going vessels. Two shipyard wharves have depths ranging from 16½ to 33 feet and extensive crane installations. Seventeen other landing facilities are listed for Nagasaki, but depths alongside are unknown. A number of mooring buoys, 500 lighters, towboats, water, coal, and oil barges are in the harbor.

The principal entrance to the harbor, from the west, is free of dangers and has a least width of 600 yards between the 60-foot contours; depths of 132 to 138 feet on the entrance range

decrease to 96 feet at the entrance to the inner harbor. The entrance from the southwestward is divided into 3 narrow, tortuous channels by numerous islets, reefs, and shoals. Central depths in the inner harbor range from 96 feet at the entrance to 18 feet near the head. There are six 200-yard anchorage berths in the inner harbor, exclusive of berths at mooring buoys. In the outer harbor, there are 5 first-class and numerous 150- and 200-yard anchorage berths.

Repair work on some of the largest vessels afloat can be made at Nagasaki. The Nagasaki shipyards of the Mitsubishi Company occupy 2 miles of waterfront, and the Kawaminani interests have extensive ship repair and building facilities on Koyagi-shima. Oil installations around the harbor have a capacity of more than 550,000 barrels; the coal supply and handling facilities are abundant. B-29 Superfortresses of the 20th Bomber Command attacked Nagasaki 10 August 1944.

(f) *Ōmuta-Miike*. The mining and manufacturing city of Ōmuta and the adjacent coal port of Miike are on the middle of the eastern shore of Shimabara-kaiwan, a body of water which indents the west coast of Kyūshū. This industrial section, virtually a company town of the Mitsui interests, has 2 of the largest zinc refineries in Japan, a synthetic oil and coal tar derivative plant, sulphuric acid and cotton industries, and coal mines. Ōmuta-kō and Miike-kō are adjoining harbors on the eastern side of Shimabara-kaiwan. Ōmuta-kō is entered through a dredged channel, with a depth of 2 feet at lowest low water, that leads across the drying mud flats off the mouth of Ōmutakawa. Miike-kō consists of an outer harbor, an inner harbor, and a wet dock. The inner harbor is approached through a dredged channel between 2 parallel jetties. It is about 1 mile long and has a width of 150 feet in the dredged area, where there are charted depths of 24 feet at lowest low water. The 124-acre water area inner harbor has depths of 31 to 36 feet at lowest low water. The wet dock is entered from the inner harbor through a channel 120 feet wide, with a navigable width of 62 feet at the dock gate and a depth of 27.2 feet over the sill at mean sea level. The dock has an area of about 32 acres and the depth inside is maintained at 28 feet below mean sea level. Fifteen first-class anchorage berths are available in the outer harbor. Safe anchorage is afforded, even during gales, in the inner harbor and the wet dock.

The quay in Ōmuta-kō, used primarily by small sailing vessels, is equipped with a coal conveyor and has direct rail connections with the mines. The ocean terminals at Miike-kō provide five 350-foot berths for vessels drawing 20 feet, and two 450-foot berths for vessels drawing 26 feet. On the northeastern side of the inner harbor, a coaling quay has a coal conveyor for loading large vessels that are unable to enter the wet dock. A general cargo quay, with berths for deep-draft vessels, was under construction (1940). In the wet dock there are 2 general cargo wharves and a coaling quay. The latter is equipped with coal loaders and traveling cranes, and all are served by railroad trackage. Tugs are available.

(g) *Misumi*. Misumi, on the west coast, ships considerable lumber and cement. The northern entrance to Misumi-kō is divided into 2 channels; the eastern one is foul. The western channel, about 120 yards wide outside the 3-fathom contours, has central depths of 10 to 19 fathoms. The southern entrance is also divided into 2 main channels; one has a least width of 240 yards outside the 3-fathom contours, depths of 9 to 15 fathoms in mid-channel and except for a shoal near the south-

ern end of the fairway, is clear. The other, with a controlling depth of $3\frac{1}{4}$ fathoms, is tortuous and is not recommended. The eastern entrance to the harbor through Motareno-seto is about 300 yards wide outside the 1-fathom contours and has a least depth of $1\frac{1}{4}$ fathoms. There are 2 first- and 2 third-class anchorage berths outside the buoyed area in the harbor. Limited anchorage is available off Misumi.

The landing facilities are at Sagari Matsu, about $1\frac{1}{2}$ miles south of Misumi, where quays, piers, and warehouses are reported to have recently been constructed. The general cargo wharf can accommodate two 450-foot vessels in depths of 24 to 48 feet. Lighters are available.

(b) *Kagoshima*. Kagoshima, on the south coast, is a distributing center and has considerable trade with other Japanese ports. The least navigable width in the outer harbor main channel is about 1,600 yards and its shoalest depths are 9 to 13 fathoms. The general depths are from 10 to 25 fathoms, free of dangers. The shores are bordered by foul ground. The inner harbor is entered through 2 narrow passages at either end of the detached breakwater. The principal entrance at the southern end of the breakwater has depths of 5 to 6 fathoms. There are general depths of about 3 to $4\frac{3}{4}$ fathoms in the middle of the inner harbor. Anchorage is available in the outer harbor where the bottom is mostly sand and the depths are ample for large vessels.

The principal facilities are a quay with a depth of 24 feet alongside, and 2 floating piers, one of which can accommodate fairly large vessels; only small craft can use the other. Large vessels work cargo at the anchorage.

(2) Secondary ports.

(a) *Shibushi*. Shibushi, on the east coast near the southern extremity of Kyūshū, has an artificial harbor formed by 2 breakwaters. Depths in the harbor range from 4 to 15 feet. Harbor works completed in 1943 consist of 2 quays, but data on berthing space and depths alongside are not available.

(b) *Aburatsu*. Aburatsu, on the east coast near the southern end of Kyūshū, has a natural harbor with the added protection of 2 breakwaters. The entrance depth is 15 fathoms, decreasing to $3\frac{1}{2}$ and $4\frac{1}{2}$ fathoms in the center. The 3-fathom curve is 500 feet from the head of the harbor. Aburatsu is a shipping point for lumber and is the headquarters of a deep-sea fishing fleet. A mole, about 600 feet long, and about 1,300 feet of quays are at the head of the harbor, which was dredged in 1940. However, dredged depths are not known.

(c) *Hososhima*. Hososhima has a natural harbor on the eastern coast. Entrance into the outer harbor is in 11 fathoms, decreasing to 5 fathoms at the entrance to the inner harbor. Depths of $3\frac{1}{4}$ to $4\frac{3}{4}$ fathoms are in the inner harbor. The outer harbor provides 1 first- and 1 second-class anchorage berths. Small vessels anchor in the inner harbor. The landing facilities in the inner harbor consist of 3,150 feet of quays with depths alongside ranging from 12 to 25 feet. There are also 2 off-shore wharves; one has a frontage of 325 feet and depths of 21 to 28 feet, and the other has a frontage of 250 feet and depths of 17 feet.

(d) *Totoro*. Totoro, on the east coast, is the headquarters of a fishing fleet. The harbor is a naturally sheltered body of water; the eastern section has depths of $3\frac{1}{2}$ to 4 fathoms and the western section has depths from $1\frac{3}{4}$ to $2\frac{1}{2}$ fathoms. Outside the harbor there are 3 second- and 8 third-class anchorage

berths. There is a 59-foot pier with depths of 12 feet at the head of the town of Totoro in the western section of the harbor. There is a 225-foot quay with $19\frac{1}{2}$ feet of water alongside in the eastern section at the village of Akami.

(e) *Tsukumi*. Tsukumi, on the northeast coast, provides 24 first-, 3 second-, and 6 third-class anchorage berths. A shipping point for cement, there are wharf facilities at Tsukumi in the southern section of the harbor and at Tokoura in the northern section, but details are not available.

(f) *Ōita*. Ōita's artificial harbor on the northeastern coast is protected by 2 breakwaters with an entrance 150 yards wide between them. The western part of the harbor has depths of 16 to 25 feet. Ōita and Beppu are on Beppu-wan, a bay which provides as many as 170 first-class anchorage berths. A pontoon wharf, about 240 feet long with 18 to 20 feet of water alongside, is on the south shore of the harbor opposite the entrance. A 325-foot pier extends over shallow water to depths of 19 feet in the western section of the harbor. Other quays have depths of 7 to 15 feet alongside, but details are lacking.

(g) *Beppu*. Beppu, on the northeastern coast, has an artificial harbor with an entrance about 50 yards wide and 5 feet deep. The 4.6-acre water area in the harbor has depths of from 3 to 13 feet. A 325-foot pier has depths ranging from 3 to 7 feet on the northern side, and 12 feet on the southern side.

(h) *Unoshima*. Unoshima, on the northern end of Kyūshū, has an artificial harbor with depths of 4 to 16.4 feet. A coal handling pier in the eastern end of the harbor is about 300 feet long, but has no water alongside at low tide. A pier, about 100 feet long with $11\frac{1}{2}$ feet of water on all sides, is in the northern part of the harbor. There are 2 quay-side berths, 508 feet and 410 feet, in the eastern part of the harbor which has been dredged to 7.2 feet.

(i) *Usunoura-kō*. Usunoura-kō, a coal-shipping port on the western coast, has a natural harbor, over 1 mile long, about 300 yards wide at the entrance, and with an average width of about 200 yards. A 500-foot quay has 18 to 20 feet of water alongside and is served with railroad trackage. A frontage of 1,900 feet of filled-in land has 9 to 15 feet of water alongside and may be used as wharfage.

(j) *Matsushima-kō*. Matsushima-kō, on the island of Matsu-shima off the west coast of Kyūshū, is a coal-shipping port. The natural harbor has depths of 8 fathoms in the entrance and 5 to 11 fathoms inside where there is 1 second- and 1 third-class anchorage berth. A coal pier, with depths of 32 feet near its head, is equipped with a coal-handling conveyor. A basin to the west of the coal pier has depths of 5 to 13 feet, and contains a number of small piers or landings. The shore at the head of the harbor appears to be quayed, and may be available for berthage of vessels. The depths alongside range from 0 to 24 feet.

(k) *Minamata-kō*. Minamata-kō, on the southwest coast, has a natural harbor protected by off-lying islands and a jetty. Depths in the entrance are about 10 fathoms, decreasing to $4\frac{1}{2}$ fathoms inside the harbor, which provides 2 first- and 3 second-class anchorage berths. A quay 980 feet long has depths of 20 to 21 feet alongside.

B. Shikoku.

(1) Principal port.

(a) *Kōchi*. Kōchi, on the south coast, has a basin harbor on the western side of the estuary of Kagami-kawa. The estuary

dries over large areas, but the basin has been dredged in part to depths of $5\frac{1}{2}$ to 21 feet. The entrance is only about 250 yards wide; a controlling depth of $18\frac{3}{4}$ feet is maintained in the dredged approach channel. Dredging was under way in 1941 to increase the depth to 20 feet. Anchorage is limited to light-draft vessels, except in the open roadstead off the entrance. The main wharves on the northern side of the basin provide about 1,150 feet of berthage in a dredged depth of 21 feet, and 910 feet in a dredged depth of 9 feet. Two 450-foot vessels drawing 20 feet can be accommodated at the main wharf.

(2) *Secondary ports.*

(a) *Susaki.* Susaki, on the southeast coast, has a harbor with a $\frac{1}{2}$ -mile wide entrance. Depths in the central part of the harbor from the entrance to about 800 yards from the head are 5 to 8 fathoms. Anchorage is available in $5\frac{1}{2}$ to $6\frac{1}{2}$ fathoms, over mud, off the reclaimed land at the northeastern end of the town. A pier, about 150 feet long, with less than 6 feet of water alongside, is at the southeastern side of the town. At the eastern end of the town there are 2 wharves, each about 280 feet.

(b) *Komatsushima.* Komatsushima, on the east coast, has a harbor protected by 3 breakwaters; the entrance is between the north breakwater and the northern end of the detached breakwater. A part of the harbor has been dredged to 20 feet. A quay, about 1,125 feet long with depths of 13 to 17 feet alongside, can accommodate one 250-foot vessel drawing 16 feet, and three 200-foot vessels drawing 12 feet. Three floating piers are reported, but their locations are not known.

(c) *Sumoto.* Sumoto, on the east coast of Awaji, off the northeastern coast of Shikoku, has a harbor protected by 2 breakwaters. The entrance between the breakwaters, about 50 yards wide, has a controlling depth of $11\frac{3}{4}$ feet. The harbor is divided into 2 basins; the northwestern one has depths of $12\frac{1}{2}$ to 18 feet, and the southeastern one, 13 to 14 feet. Two T-head piers in the northwestern basin have depths of $14\frac{3}{4}$ and 15 feet, respectively, at their heads. Six small piers along the southeastern side of this basin have depths of $6\frac{1}{4}$ to $12\frac{3}{4}$ feet. Vessels can berth at the quays on the southwestern side in depths of 4 to $6\frac{1}{2}$ feet. In the southeastern basin, a T-head pier has a depth of 13 feet along its face. Quays on the southwestern side of this basin have depths of 5 to $12\frac{1}{4}$ feet alongside.

(d) *Takamatsu.* Takamatsu, on the north coast, has a harbor protected by 3 breakwaters. The principal entrance, at the western end of the detached breakwater, has a dredged depth of 20 feet, with shoal patches charted in mid-channel and on the eastern side. Most of the western part of the harbor has been dredged to 20 feet; the remainder has been dredged to 14 feet, except at the basin near the root of the western breakwater, where the dredged depth is 12 feet. The eastern part of the harbor has been dredged to 12 feet almost to the eastern breakwater; a basin extending southward has a dredged depth of 7 feet. Two floating piers in the western part of the harbor have depths of 20 feet alongside. Small boats can berth at the quay east of these piers where the 20-foot dredged depth approaches to within about 50 feet of the quay wall. Other piers, quays, and boat basins are available, but depths do not exceed 12 feet.

(e) *Sakaide.* Sakaide, on the north coast, has a narrow inlet harbor protected by a breakwater. Depths in the entrance

channel vary from $4\frac{1}{2}$ to $5\frac{1}{2}$ fathoms, with general depths of 20 feet inside. An 800-foot quay on the eastern side of reclaimed land can berth two 350-foot vessels in a depth of 20 feet.

(f) *Tadotsu.* Tadotsu, on the north coast, has a harbor enclosed by breakwaters. Depths in the approach are less than 3 fathoms. The 32-acre water area in the outer harbor has depths of $16\frac{1}{2}$ feet in 1939. The $17\frac{1}{4}$ -acre water area in the inner harbor has depths of about 6 feet. In the outer harbor, a floating pier, 250 feet long, can accommodate two 250-foot vessels in depths of $16\frac{1}{2}$ feet. Vessels can berth alongside the east breakwater, but the $16\frac{1}{2}$ -foot dredged depth is from 60 to 100 feet from quayside. Wharves equipped with cranes are in the inner harbor.

(g) *Kannonji.* Kannonji, on the north coast, has a harbor protected by breakwaters. The approach is in 10 to 13 fathoms; the 10-fathom curve is about 1 mile offshore. A wide shoal borders the shoreline. The entrance, between the breakwaters, is about 125 feet wide and has depths of 26 feet just outside. A channel, 165 feet wide, has been dredged to a depth of 6 feet to the quays at the town. In the northeastern part of the harbor there is a basin with a dredged depth of 6 feet. Quays on 3 sides of the basin provide about 1,300 feet of berthage in depths of 6 feet. An additional 600 feet of berthage, in depths of 6 feet, is available at the inner end of the southern breakwater.

(h) *Niihama.* Niihama, on the north coast, has an artificial harbor protected by 2 breakwaters. The 900-foot entrance between the breakwaters has depths of about 5 fathoms. In 1938, a channel, 350 feet wide, had a dredged depth of 28 feet from the entrance to the principal wharf. East of this channel there are general depths of 12 to 15 feet. Other dredged areas in the harbor have depths ranging from 10 to 22 feet. Anchorage inside the harbor is suitable only for small craft. A quay, about 2,300 feet long and believed to have depths of 18 to 22 feet alongside, fronts the eastern side of the reclaimed area in the western part of the harbor. It is served by the railroad and is equipped with mechanical handling facilities. A floating pier is at the head of the harbor. Other quays in the southeastern part of the harbor provide about 3,100 feet of berthage with depths of 10 to 13 feet.

(i) *Imabari.* Imabari, on the north coast at the southeastern entrance to Kurushima-kaikyō, has a harbor protected by a breakwater; inside are depths of $18\frac{1}{2}$ to $25\frac{1}{2}$ feet in the principal part of the harbor. There is a basin with a depth of 9 feet at the head of the harbor. Three floating piers and a quay with depths of 18 to 25 feet alongside are reported, but their locations cannot be definitely determined from data available. There is a landing in the basin at the head of the harbor.

(j) *Takahama.* Takahama, on the west coast, has a small cove harbor inside the southeastern entrance point of Takahama-seto, which has a least width of 900 yards and deep water in mid-channel. Depths in the harbor vary from $1\frac{1}{2}$ to 6 fathoms. Anchorage is available west of the fairway in Takahama-seto. Two floating piers project from the shore to charted depths of 14 to 16 feet. The entire waterfront is quayed, but depths alongside are shallow. The quay is equipped with a crane, and the southern part is served by railroad trackage.

(k) *Mitsubama.* Mitsubama, on the west coast near the southeastern entrance point of Takahama-seto, has a harbor

protected by a breakwater. General depths in the outer harbor are 13 to 17 feet. The inner harbor, east of the piers, has a dredged depth of 6 feet, except along the northern side. Anchorage is available in 8 fathoms, over sand, west-northwest of the head of the breakwater. Two floating piers project into dredged depths of about 13 feet from the quay east of the root of the breakwater. About 3,100 feet of berthage, with depths of 6 feet, are available at quays in the inner harbor.

(l) *Yawatahama*. Yawatahama, on the west coast, has a small harbor at the head of an inlet. The entrance, about 1 mile wide, is free of dangers and has charted depths of 20 to 23 fathoms; central depths are from 11 to 19 fathoms. The old harbor at the head of the inlet has depths of 6 feet. Adjoining it on the south, the new harbor has depths of 15 to 36 feet. Eight first-, 2 second-, and 3 third-class anchorage berths are available. A reclaimed area, separating the old and new harbors, has quays on 3 sides, each about 400 feet long. Depths alongside are shallow, except at the quay on the northwestern side, a part of which has a depth of 19 feet. A floating pier, with depths of 16½ feet, projects from the northwestern corner of the reclaimed area.

(m) *Uwajima*. Uwajima, on the southwest coast, has a harbor in the eastern part of Uwajima-wan. The entrance, about ½ mile wide, has charted depths of 17 to 21 fathoms. Inside the entrance, depths decrease gradually to the head of the harbor. South of a reclaimed area on the eastern side of the harbor are dredged depths of 8¼ to 14¾ feet (1941). The recommended anchorage is in 7 fathoms, over mud, west of the head of the northern pier. Two floating piers, each having 13 feet at its head, are north of the reclaimed land on the eastern side of the harbor. About 3,500 feet of quays around the reclaimed area have depths of 4½ to 16½ feet; the latter depth is charted in front of about 900 feet of this quayside. Other quays are adjacent to the dredged areas south of the reclaimed land.

C. Southwest Honshū.

(1) *Principal ports.*

(a) *Tsuruga*. Tsuruga, near a mid-point of the northwest coast, has a 3,000-acre water area in a harbor well protected from all but northerly winds. Jōgū-wan, a 550-acre water area in the northwest corner of the harbor, gives some protection from all weather. The 5-fathom contour is near shore; central depths range up to 16 fathoms. A water area of more than 1,800 acres provides first-class anchorage. The approach and entrance through Tsuruga-wan has a least width of 1¾ miles and is free of obstructions.

A basin formed and protected by breakwaters in front of Tsuruga has about 3,800 linear feet of quays that provide berthing space for two 450-foot ships drawing 20 feet and nine 250-foot vessels drawing 16 feet. In addition, about 720 linear feet of quays provide space for barges and lighters drawing up to 14 feet. Piers provide landings for launches. Warehouses and supply dumps are available. Fresh water is available by water boat.

(b) *Miyazu*. Miyazu, a shipping port for grain and textiles on the northwest coast at the southwest corner of Wakasa-wan, has a natural bay harbor that provides about 35 first-class anchorage berths, well-sheltered and over good holding ground. The depths range from 6 to 13 fathoms.

The facilities consist of the following: a floating pontoon pier with a berthing space of about 108 feet on each side and a depth alongside of 28 to 30 feet; about 420 linear feet of wharves with depths alongside of 15 to 18 feet, providing 2 berths for 200-foot vessels; and about 2,230 linear feet of wharves with depths alongside ranging from 18 to 30 feet, providing 3 berths for vessels 250 feet long, 2 berths for vessels 400 to 450 feet long, and 1 berth for a vessel 600 feet long.

(c) *Sakai*. Sakai is on an improved natural roadstead at the western end of Miho-wan on the northwest coast. The long narrow harbor, subject to strong tidal currents, has a controlling depth of 19 feet. Anchorage in the outer harbor, subject to northeasterly winds and to backwash by waves from the Japan Sea, is available for about 20 capital ships and 20 auxiliaries. A large area with a controlling depth of 12 feet is available for small craft anchorage. The approach and entrance from the Japan Sea is wide and free of obstructions.

Two quays in the inner harbor at the west end of town provide berthing space for one 350-foot vessel drawing 20 feet and three 250-foot vessels drawing 16 feet. A number of small piers provide landings for launches. Water is available by water boat. Supply dumps are available.

(d) *Hagi*. Hagi, a shipping point for lumber on the northwest coast near the southwestern corner of Honshū, has a main harbor, a recession in the shore about 1.7 miles wide and 1 mile deep, with the 10-fathom contour from 300 to 600 yards from shore and with central depths of 8 to 13 fathoms. Anchorage in the bay is exposed to winds and seas from the Japan Sea to the northwestward, but Obata-ura in the northern part of the bay, with depths of 6 to 8 fathoms over mud, provides moderate protection against all weather except westerly winds. The approach and entrance from the Japan Sea is more than a mile wide with no hidden dangers. The entrance to the inner harbor, Kato-kō, through Obata-ura, at the northern end of the bay, is about 500 yards wide, 48 feet deep, and free of obstructions.

Wharf facilities for small boats only are on the Matsumoto-kawa in the town of Hagi at the south end of the bay. A quay in 2 sections of 350 and 170 feet, respectively, with a 24-foot depth alongside, is on the south shore of Kato-kō, the main harbor. Berthing space is available for barges and one 350-foot ship drawing 20 feet. Warehouses and storage dumps are near the waterfront. Water is available on the wharf.

(e) *Shimonoseki-Moji*. Shimonoseki is on the southern tip of Honshū; Moji is on the northern tip of Kyūshū. They are separated by the narrow strait, Shimonoseki-kaikyō, the western entrance to Japan's Inland Sea. The harbor and port facilities on the waterfronts of both cities on each side of the strait are treated as a single port. Both are connected by ferries and a railroad tunnel.

Together with the Kyūshū Island ports of the Wakamatsu-Yawata-Kokura area to the southwestward, Shimonoseki-Moji constitutes one of the most important transportation and industrial regions in Japan. Shimonoseki-Moji is the focal point of Japanese imports from China, Korea, and Manchuria. The 1,700-acre water area in the harbor is about 6 miles long and from 400 yards to 1 mile wide. There are 12 second-class anchorage berths in front of Moji and 6 first-class berths in front of Shimonoseki. The holding ground is poor and all berths are subject to the effect of strong tidal currents that pre-

vail in the strait. The eastern entrance, Hayatomo-seto, is slightly more than 400 yards wide and has depths of $5\frac{1}{4}$ to 13 fathoms. The western entrance is about $\frac{3}{4}$ mile wide with depths of $5\frac{1}{2}$ to 8 fathoms.

Quays and wharves in the port provide berthing space for eleven 450-foot ships drawing 26 feet; four 450-foot vessels drawing 20 feet; four 350-foot ships drawing 20 feet; one 250-foot ship drawing 16 feet, and nineteen 200-foot craft drawing 12 feet. The principal landing facilities include approximately 15,625 feet of quays and wharves; 8,960 feet have depths of 22 to 33 feet alongside and the remainder have depths of 12 to 22 feet to take care of coastal steamers and small freighters. An additional 12,800 feet of shallow water berths are available in depths of 6 to 12 feet to handle small craft, lighters, and barges. A number of small jetties, piers, ferry landings, and slipways are scattered throughout the harbor and an adequate number of lighters and tugs are based at the 2 ports. Coal, oil, storage, and repair facilities also are available.

(f) *Kōbe*. The most important port and sixth largest city of Japan, Kōbe is one of the 3 ports at the head of Ōsaka-wan, the eastern end of the Inland Sea. Kōbe is about $14\frac{1}{2}$ miles eastward from Ōsaka. Together with Ōsaka, the second city of Japan, and Amagasaki, a smaller port between the 2 larger cities, Kōbe forms part of the industrial heart of Japan—the Ōsaka-Kōbe-Kyōto triangle. In 1941, it was reported that the Japanese were developing Kōbe and Ōsaka as a single port.

The artificial harbor has a water area of about 2,500 acres inside the breakwaters with depths of 27 to 44 feet. In the inner harbor outside the fairways, there are 12 first-, 28 second-, and 50 third-class anchorage berths; and there were 28 mooring buoys for large ships—five were for capital ships. The main entrances between breakwaters have a least width of 250 yards and a depth of 42 feet. The approach through Ōsaka-wan, free of obstructions, has a width of about 700 yards in Kata-seto and 3,500 yards in Kitan-kaikyō. Outside the breakwaters, there is unlimited anchorage for all types of ships in depths up to 7 fathoms.

Since 1906, the harbor at Kōbe has undergone extensive development, including the reclamation of land and the construction of landing facilities; since 1935 this development work has been intensified and was still in progress during 1941. In addition to the miles of quayed waterfront for use by lighters and smaller vessels, there are 147 vessel berths at the main piers, wharves and quays as follows: thirteen for 600-foot vessels drawing 30 feet; twenty-eight for 450-foot vessels drawing 26 feet; thirteen for 450-foot vessels drawing 20 feet; ten for 350-foot vessels drawing 20 feet; twenty-eight for 250-foot ships drawing 16 feet; and fifty-five for 200-foot craft drawing 12 feet.

A large number of cranes and other mechanical handling facilities are available at the wharves, including electrically operated $1\frac{1}{2}$ - to 5-ton traveling cranes and $\frac{1}{2}$ - to 30-ton stationary cranes. A 1936 census showed that there were more than 2,000 lighters and about 80 tugs at Kōbe. In addition, there were water boats and oil barges. A conservative estimate places the available warehouse and transit shed storage space at 5,700,000 square feet; 2,600,000 square feet of this estimate is in warehouse space. Extensive facilities are available

for storing and handling coal, gasoline and oil, and other ships supplies. Drydocks and repair facilities also are available.

(g) *Amagasaki*. Amagasaki has an artificial harbor in a river mouth. Anchorage, exposed to southwesterly winds, is available to capital ships in the open waters outside the harbor. The approach and entrance have no hidden dangers.

Quays under construction in 1940 would provide berthing space for four 450-foot ships drawing 26 feet and a number of 200-foot vessels drawing 12 feet. Open area on reclaimed land is available for supply dumps.

(h) *Ōsaka*. Ōsaka, the third largest port of Japan, is built on the delta of the Yodo-gawa. Three rivers which flow into the harbor, together with a network of connecting canals, are the transportation arteries for the city's waterborne commerce. Many of the city's industrial plants are located on the banks of these rivers and canals. The lighters, junks, and sampans plying these waterways are said to handle a volume of commerce almost equal to that carried by the harbor railway system.

An extensive program of harbor improvement, started in 1934, is in large part completed. Unlimited anchorage for all types of vessels is available outside the inner harbor in depths up to 7 fathoms. Within the inner harbor, there were 28 mooring berths, including four for 20,000-ton ships, eight for 15,000-ton ships, and five for 10,000-ton ships. Including berths at wharves, it is estimated that the inner harbor can handle 50 ships of over 5,000 tons. The harbor, which was being enlarged in 1940, had a water area of about 1,620 acres; 1,200 acres were dredged to a depth of 29 feet and 125 acres to a depth of 32 feet. Seven third-class anchorage berths were available in the inner harbor. Several square miles of area are available for first-class berths over mud in Ōsaka-wan. The main entrance channel between breakwaters has depths of 26 to 28 feet over a width of about 190 yards.

Exclusive of certain recent north and south harbor developments, on which detailed information is not available, 38 vessel berths are available at the piers, wharves, and quays at Ōsaka, as follows: two for 600-foot vessels drawing 30 feet; sixteen for 450-foot vessels drawing 26 feet; four for 450-foot vessels drawing 20 feet; five for 350-foot vessels drawing 20-feet; eight for 250-foot vessels drawing 16 feet; and, three for 200-foot vessels drawing 12 feet. In addition there are numerous landing facilities on the river-canal interior waterway system; many of these can accommodate large-size vessels and have warehousing and mechanical cargo handling facilities.

Virtually all the landing facilities on the inner harbor have mechanical handling facilities, including traveling and stationary cranes. A fleet of 500 tugs operate in the harbor and between Ōsaka and Kōbe. In addition, there were over 3,000 lighters and 30 or 40 other motor communication boats at Ōsaka. Other harbor craft included floating cranes, oil tank vessels, and water boats.

Over 300 sheds and warehouses have been reported for the area adjoining the inner harbor. The total storage space is close to 3,000,000 square feet. The extensive land reclamation in progress in recent years is believed to have provided large open storage areas. In addition to the waterways system, adequate railroads and roads are available for clearing cargo. Water, coal, oil, gasoline, and extensive repair facilities also are available. Sixty-six tanks having a capacity of 666,000

barrels are reported. As a shipbuilding center, Ōsaka has at least 17 drydocks and a number of marine industrial plants.

(i) *Yokkaichi*. Yokkaichi, in the northwestern part of Ise-wan on the southern coast of Honshū, has an artificial harbor protected by a breakwater. The depths in the dredged area off the piers and wharves, and in the entrance channel, are about 30 feet. Anchorage is available northward of the breakwater in about 5 fathoms, and off the lighthouse at the end of the breakwaters in about 6 fathoms, soft mud bottom. There is room off Yokkaichi in the northern part of Ise-wan, in depths of 5 to 13 fathoms, to accommodate an entire fleet.

The facilities consist of a pier in the southern part of the harbor, which is 300 feet wide and about 825 feet long, with depths alongside of 18 to 27 feet; and a quay about 500 feet long with depths alongside of less than 18 feet. The pier has 2,475 feet of berthing space. The construction of 3 new piers on the eastern side of the reclaimed land and northward of the existing pier, has been proposed, but data regarding their present status is not available.

(j) *Nagoya*. Nagoya, on the southern coast, has an outer harbor, a long entrance channel protected by jetties, and an inner harbor formed by breakwaters. There are 1- to 6-fathom depths in the outer harbor, and general depths of 24 to 33 feet in the inner harbor. The controlling depth in the entrance channel is 27 feet. The outer harbor affords anchorage for 260 third-class anchorage berths; 32 mooring-buoys were in the inner harbor.

The principal terminals in the port are 3 piers at the head of the inner harbor. They are equipped with warehouses and railroad trackage, and provide berthing space for two 450-foot vessels drawing 26 feet, six 450-foot vessels drawing 20 feet, two 350-foot vessels drawing 20 feet, one 250-foot with 16 feet of water, and five 200-footers with 12 feet of water.

(2) Secondary ports.

(a) *Maizuru*. Maizuru, on the west coast, has a natural harbor with depths of 7 fathoms at the entrance, decreasing to 3½ fathoms at the head of the bay. Of the 2 arms in Maizuru-wan, the western one is the commercial port of Maizuru, and the eastern one is the naval port of Higashi-Maizuru and the commercial port of Shin-Maizuru. The latter is of little importance. Maizuru-kō provides 12 first-, 5 second-, and 14 third-class anchorage berths. A coal pier has 520 feet of berthing space with 22 feet of water alongside, 420 feet with 11 to 21 feet of water, and 1,200 feet with 6 to 21 feet of water. A general cargo wharf has a frontage of 550 feet with 12 to 14 feet of water.

(b) *Matsue*. Matsue is on the northwest coast of southwestern Honshū. The harbor consists of the western end of Ōhashi-kawa and the eastern end of Shinji-ko, a lake which is the source of the river. The principal part of the harbor is in the river where a channel has been dredged to 15 feet. Abreast the town, Shinji-ko is shallow, but central depths in the lake are 2 to 3½ fathoms. A quay, with 6 feet of water alongside, extends about 1,330 feet along the southern bank of the river. A drydock is reported, but its location cannot be determined from data available.

(c) *Ezumi (Yezumi)*. Ezumi, on the northwest coast, has a harbor formed by breakwaters, with depths of about 30 feet in the entrance. General depths in most of the harbor area are not more than 10½ feet. The bay, outside the harbor, can

provide 2 first- and 3 second-class anchorage berths. There are 2 piers in the harbor; one is 230 feet long, with 8 to 10 feet of water alongside, and the other 170 feet with 9½ feet of water. Both are 120 feet wide. There are also several quays with depths of 5½ to 9 feet alongside.

(d) *Hamada*. Hamada, a fishing port, is on the northwest coast of southwestern Honshū. Hamada-kō consists of the artificial fishing harbor in front of the town; Seto-wan, a channel, and Tono-ura, an inlet, form the northern part of the harbor. The principal entrance, from the westward, is about 1½ miles wide and has a shoal in mid-channel. South of the reef, the entrance is 800 yards wide, with depths of 13 to 19 fathoms. The entrance channel north of the shoal is about 1,000 yards wide, with charted depths of 12 to 17 fathoms. Depths decrease gradually inside. General depths are 12 to 16 fathoms, with a least swept depth of 18 feet over the shoals. There are 2 first-class anchorage berths available off the artificial harbor and 1 first- and 2 second-class anchorage berths in Nagahama-kō, at the southern end of the harbor. There are no facilities for berthing deep-draft vessels. Of 3,860 feet of quays and wharves in the harbor, only 610 feet have depths of over 10 feet alongside; the remainder have depths of 3 to 9 feet. The fish pier in the inner harbor has 9 to 11 feet alongside. A small drydock is in Tono-ura.

(e) *Senzaki*. Senzaki, on the northwest coast of southwestern Honshū, exports coal and timber. Senzaki-kō has general depths of 5 to 8 fathoms, but off the town depths are under 5 fathoms. A 12-acre water area in the inner harbor, protected by breakwaters, has central depths of 3¼ to 5 fathoms. The entrance is about 100 yards wide, with mid-channel depths of 3½ fathoms. The approach from eastward, through Senzaki-wan, is about ¾ mile wide between entrance points of the bay and has general depths of 8 to 11 fathoms. The western approach, through Senzaki-seto, has a least width of about 150 yards and general depths of 3½ to 8 fathoms. There are probably 18 to 20 first- and 12 to 15 second-class anchorage berths in the bay and harbor. The principal facilities include a pier, with a depth of 18 feet at its head, at the southern entrance to the inner harbor; 3 piers at the coal storage areas, at the southern end of the town; and 3 fueling piers at the oil tank installation.

(f) *Ube*. Ube, on the southwest coast, is a coal exporting port. The outer harbor has general depths of less than 3 fathoms, except in the central part where depths range between 3 and 4 fathoms. A drying mud bank occupies the northern and northwestern parts of the outer harbor. The inner harbor, enclosed by breakwaters, is on the eastern side of Ube-kō and has depths of 10 to 14 feet in its outer part, but the inner part is shallow. About 104 third-class anchorage berths are available in the outer harbor. There are a number of piers and wharves at the port, but generally they are in depths of 10 feet or less in the inner harbor and the small boat basins on either side of it. The principal facilities appear to be a quay and a pier, with 18 and 13 feet alongside, respectively, at a colliery in the western part of the outer harbor.

(g) *Kudamatsu*. Kudamatsu, on the southwestern coast at the head of Kasado-wan, a part of the Inland Sea, is a short distance eastward of the Tokuyama Minor Naval Station; Kasado-ura, the small bay that fronts Kudamatsu, lies within the limits of the naval port. The naval facilities at Tokuyama, include several commercial piers. Kudamatsu is fronted by a

series of walled salt pans. Miyanosu-hana, a narrow tongue of land extending west-southward from the southern end of the town, is the site of an oil refinery and storage installation. Thirty first-class and 30 second-class anchorage berths are available in Kasado-wan and 8 first-class anchorage berths are available southward of Miyanosu-hana. It is reported that several large wharves, with depths alongside sufficient to accommodate large vessels, have been built recently, but details are not available. The known landing facilities at Kudamatsu have depths of 12½ and 15 feet alongside, but an oil pier at Miyanosu-hana is believed to have 23 feet of water at the head. Two drydocks are in the harbor.

(b) *Murotsu-Kaminoseki*. Murotsu is on the mainland; Kaminoseki is on Naga-shima, close to the southwest coast of Honshū. The harbors are on opposite sides of Kaminoseki-kaikyō. The narrow part of this channel is about 400 yards long and has depths of 5 to 6½ fathoms, but does not exceed 100 yards in width. The width of the navigable channel is reduced to about 50 yards by shoal water on both sides. Anchorage is available in depths of 1½ to 12 fathoms off the towns, and in 8 fathoms in Fuku-ura, northwest of Kaminoseki. Two piers at Murotsu have charted depths of 30 and 14½ feet, respectively, off their heads. The T-head pier at Kaminoseki has a charted depth of 4½ feet across its face, but the pier at the northern end of the town dries at low water. There are 2 piers on the western side of Fuku-ura; one has a charted depth of 11 feet at its head, and the other dries at low water.

(i) *Hiroshima*. Hiroshima, a military embarkation point in the northern section of Iyo-nada, part of the Inland Sea, has an improved natural harbor, divided into eastern and western sections by Ujina-shima. The depths in either section range from about 7 fathoms to drying depths. Good sheltered anchorage is in depths of 4½ to 6 fathoms, over mud bottom. There are about 12 second-class anchorage berths in Kaitawan. Three piers, in the western part of the eastern section of the harbor, fronting on Ujina, have pontoons at their extremities. These piers are 600, 775, and 340 feet long, with floating pontoon sections of 300, 300, and 200 feet in length, respectively. The charted depths alongside the pontoon sections are 18 to 32, 9 to 18, and 3 feet, respectively. The root of the shortest or eastern pier is served by railroad. An embarkation wharf, about 1,200 feet long, with depths alongside sufficient for transports, is reported, but the location is unknown.

(j) *Itosaki*. Itosaki, an oil center, is on the southeast coast. Itosaki-ko is at the eastern entrance to Mihara-wan, which indents the northern side of Mihara-seto. There is a small basin at Itosaki with central depths of about 8 feet, but the quays dry at low water. A mud bank dries for a distance of about 1 mile at the head of Mihara-wan. A channel with a depth of 13 feet has been dredged through the bank to a basin at the town of Mihara. The basin has a dredged depth of about 9½ feet. There are 7 first-, 2 second-, and possibly 2 third-class anchorage berths in Itosaki-ko. Vessels berth in about 22 feet alongside barges moored at the heads of 2 oil piers. The northern pier is equipped with pipe lines. About 900 feet of quays in the Mihara basin have dredged depths of 9.8 feet and there is a quay 1,100 feet long on the southern side of the 13-foot dredged channel to the Mihara basin.

(k) *Habu*. Habu is a shipbuilding and repair center, on Inno-shima off the south coast of Honshū. The harbor is in the southern end of Nagasaki-seto, a narrow channel. The main

approach is from Mihara-seto, through Yuge-seto, to the southern entrance to Nagasaki-seto. Nagasaki-seto is about 880 yards wide at the southern entrance, narrowing to about 290 yards abreast Habu. The controlling depth in the strait to Habu is 5 fathoms. Three T-head piers at Habu have charted depths of 7 to 22 feet. Depths at other quays and basins in front of the town are shallow. About 600 feet of quays at the Mitsuno Shipyard have 10 to 11 feet alongside. There are several drydocks at the port, the largest of which is capable of handling the heaviest naval units.

(l) *Onomichi*. Onomichi, on the south coast, is a shipping point and a boat repair center. The harbor is not accessible to larger vessels; medium-size vessels can enter only from westward. The eastern channel is shallow and varies in width from 200 to 500 yards between the zero tide line. Central depths are from 1¼ to 6 fathoms. Small craft can anchor in the channel. Seven piers front the town. One dries at low water, and the others have depths alongside varying from less than 3 feet to a maximum of 15 feet. There are also 6 ferry terminals with charted depths of less than 3 feet. Four drydocks are available.

(m) *Hibi*. Hibi, on the south coast, is a salt-shipping port. The 130-acre water area in the harbor, an indentation in the coast, is open to the south. Depths range from about 2 fathoms at the entrance to drying flats at the head. Small craft anchor in the harbor in depths of 1 to 2 fathoms, over sand. About 30 first-class anchorage berths are available outside the harbor, in depths of 7 to 26 fathoms, over sand and shells, unsheltered. The facilities consist of a quay about 450 feet long, with shallow depths alongside of about 4 to 6 feet, and a mole about 375 feet long, at the western entrance, with charted depths along the north face of 6 to 9 feet.

(n) *Uno*. Uno, on the south coast, is a shipbuilding center and an important point of military embarkation. The passenger and cargo terminals are at Uno, and the shipyard facilities are at Tama. Uno, Tama, and Hibi are often considered ports of Tamono, a city southward from Okayama. The outer harbor has central depths of 9 to 28 fathoms. The southern entrance has a least width of 1,000 yards between the 10-fathom contours, while the eastern entrance is only about 600 yards wide. The inner harbor has depths of 1½ to 3 fathoms. Eight first-class anchorage berths are available. There are several landings at Uno, with depths of 6 to 12 feet, but the most important are the railroad and military piers. An extension of the railroad pier to depths of 33 feet was planned for completion in 1941. The military pier and a railroad car-ferry slip are east of the railroad pier. The waterfront at Tama is occupied exclusively by a shipyard which has 3 drydocks.

(o) *Ō*. The town, on the south coast, near the eastern end of the Inland Sea, has an improved natural harbor used as a fishing port and as a shipbuilding and repair center. The harbor, about ½ mile long and from 250 to 1,500 yards wide, has depths of 2½ to 4 fathoms. Outside the harbor in Ō-wan are 20 third-class anchorage berths. The entrance is through Ō-wan with a minimum width of 700 yards and depths of 3½ to 4½ fathoms. A rocky island and shoal is at a midpoint of the eastern side. About 3,300 linear feet of quayed seawall in the shipyard provides berthing space for one 450-foot ship drawing 20 feet; one 250-foot ship drawing 16 feet; and four 200-foot craft drawing 12 feet. Other space in town at the north end of the harbor is available to ferries and probably to other

small craft drawing less than 9 feet. Buildings that could be used as warehouses, space for supply dumps, and cargo handling cranes are available at the shipyard. Extensive hull and some machinery repairs can be made.

(p) *Shimotsu*. Shimotsu, on the southwestern coast, has a natural harbor providing shelter from all winds and good anchorage. The depths in the entrance channel are 6 fathoms decreasing to $3\frac{1}{4}$ fathoms near the head of the bay. An oil wharf has berthing in 22 to 26 feet of water for about 430 feet of quay, and a general cargo quay, about 600 feet in length, has about 6 feet of water alongside.

(q) *Taketoyo*. Taketoyo, on the south coast, has a small artificial harbor about 9 miles northward of the entrance to Chita-wan. Depths in the bay decrease from 10 fathoms in the southern part to 4 fathoms at Taketoyo. The entrance to the artificial harbor is about 125 yards wide and encumbered with sea weeds. The basin dries at low water. Chita-wan affords ample room to accommodate an entire fleet. A pier forming the southern side of the artificial harbor is about 1,500 feet long and has less than 18 feet at its head. The railroad serves the pier. Two piers, south of the artificial harbor, dry at low water. A drydock is reported, but its location is not known.

7. Transportation and Communications

A. Transportation.

The area defined in this study as Southwest Japan includes most of the nation's great transportation and communications corridor, as well as 3 of its 4 major transportation centers: Nagoya, Ōsaka - Kōbe - Kyōto, and Moji-Shimonoseki. The major transportation corridor extends westward from Tōkyō and Nagoya to Shimonoseki and is most highly developed along the Inland Sea and its immediate littoral. Throughout the area, rugged terrain restricts both roads and railroads largely to coastal and valley routes and requires numerous tunnels, bridges, and defiles. As a result, there are many vulnerable bottlenecks. In the entire complex of land transportation, railroads far exceed roads in importance.

(1) Railroads.

The railroad system of Japan includes about 16,000 miles of line, about half of which are in Southwest Japan (FIGURE I - 10). The pattern consists essentially of main lines along the coasts of the islands, with transverse connections across the interior highlands. On Honshū and Kyūshū, the coastal lines form complete circuits. Owing to the mountainous character of Japan, close networks of lines are found only in the 3 small, densely populated plains bordering the southeast coast. On or adjacent to these plains are the 6 largest cities of Japan—Tōkyō, Yokohama, Nagoya, Kyōto, Ōsaka, and Kōbe; the last 4 of these are included in the area of this study.

The railroad connecting these cities—the Tōkaidō line—is the most important in Japan. Its extension west to Shimonoseki, the Sanyō line, is only slightly less important. The other major routes of Southwest Japan are the northwest (Sanin) line from Kyōto to Shimonoseki and the shorter lines running from Shimonoseki to Kagoshima and Nagasaki on Kyūshū. The recently completed Kammon tunnel under the narrow strait separating Honshū and Kyūshū now permits through

rail traffic between these islands. The Sanin line and the short connection between Tsuruga and Maibara, on the Tōkaidō line, carry heavy traffic between Korea and Manchuria and the Ōsaka-Kōbe and Nagoya industrial districts. Between Tsuruga and Maibara, this traffic has become so heavy that a new line has been built to relieve the congestion. Alternative routes, some of which are of considerable importance, connect various main line points; most of them, however, traverse rugged country and have much smaller traffic capacity than the main routes.

Average capacity on main double-track lines in Japan is 60 or even 100 trains daily in each direction; the average on the best single-track lines may be 25 to 45 trains daily. The prevailing narrow-gauge limits speed by necessitating an overhang on cars, and, together with the grades and curves resulting from irregular terrain, reduces capacity by requiring the use of short trains and light equipment.

All railroad lines in Japan that carry general traffic, particularly through traffic, are owned and operated by the state. Private ownership is restricted to local, interurban, and special purpose lines. The number of private lines is steadily decreasing as a result of the government's purchasing program.

The Imperial Government Railways were until recently a separate department of state, presided over by the Minister of Railways. Wartime conditions have led to a consolidation of all transportation and communications under a new Ministry of Transport and Communications, but the railway administration has been little affected by the new arrangement. While general administration is concentrated in a Central Office in Tōkyō, direct management is decentralized in 8 regions which have a large degree of local autonomy. Officials and other employees are classified according to rank in typically Japanese manner. Financially, the Government Railways are independent and self-supporting; special provisions are made for capital expenditure.

The state railway system has been efficiently managed and operated, without political interference. It has achieved and maintained high technical standards, and some of its techniques, notably in shop practice, have been extensively adopted in other countries.

The standard gauge of the Government Railways, and of most other Japanese lines, is 3' 6", although a considerable number of private electric lines have a gauge of 4' 8½", and there are a few lines of 2' 6" gauge. Most lines are single-track; the main line from Tōkyō to Shimonoseki, part of the Kagoshima line on Kyūshū, and some other lines, principally in metropolitan areas, are double-track. There is a small mileage of quadruple-track in the Tōkyō and Kyōto - Ōsaka - Kōbe districts.

Nearly $\frac{1}{3}$ the total length of the Government Railways is on curves, and about $\frac{2}{3}$ is on grades. The maximum gradient is ordinarily, but not invariably, 2.5%. The minimum radius for curves is 300 meters (984 feet), but a few curves are even sharper.

Bridges and tunnels are extraordinarily numerous. Bridges average nearly 4 per mile, and there are about 1,200 tunnels with an aggregate length of 435 miles. The frequent small earthquakes are a special hazard in tunnels, as they develop latent weaknesses which produce slides and cave-ins when stronger earthquakes occur.

Rights-of-way are carefully maintained, but rails and track construction are light by American standards. Rails are usually spiked directly to ties, without tie plates. Gravel ballast is used on main lines. Trains are operated by the block system, but automatic signals have been installed on only a portion of the lines.

The direct motive power is steam. Many local lines, especially in metropolitan areas, are electric, and some 250 miles of government lines have been electrified. These are found chiefly in the Tōkyō and Kyōto - Ōsaka - Kōbe region and in sections with numerous or long tunnels or heavy grades.

Locomotives in Japan probably total about 5,000, passenger cars about 15,000, and freight cars about 85,000, with some 3,500 additional units of rolling stock of all kinds on local railways. Passenger engines are mostly 4-6-2 types, weighing, with tender, 115 tons, although newer types weigh 130 tons; freight engines are 2-8-2 types weighing 124 tons, or 138 tons in the case of newer types. Tractive effort averages about 40% less than for American locomotives.

Most passenger cars have 4-wheel trucks; some have 6-wheel trucks. The usual length is 66 feet, and the standard width is 9.5 feet. Freight cars are still mostly of the 4-wheel variety, with a capacity ranging from 10 to 15 tons; the latter is the most common size. Many larger cars with 4-wheel bogie trucks and capacities of 25 to 30 tons have recently been built. In addition, many older cars have been equipped with a third axle to facilitate an increase in their carrying capacity.

The largest and most important repair shops in Southwest Japan are at Kokura, Wakamatsu, and Nishikagoshima in Kyūshū; Hatabu, Takatori (Kōbe), Suita (Ōsaka), Nagoya, and Hamamatsu in Honshū. Roundhouses and engine sheds are spaced at comparatively short distances.

There are 3 known classification yards of the hump gravity type in Southwest Japan, at Tosu (near Karuma, on Kyūshū), Hiroshima (on Honshū), and Suita (near Ōsaka). Other classification yards, of the flat switching type, are at Dairi (Mōji), Wakamatsu, Nogata, Higashi-nada (Kōbe), Suita (near Ōsaka), Umekoji (Kyōto), Maibara, Inazawa (near Nagoya), Nagoya, and Hirano (near Ōsaka).

Japanese railroads are highly vulnerable, chiefly because of their many bridges and tunnels and the close proximity of main lines to coasts. In addition, there are numerous congested areas and bottlenecks at important junctions. Some of these are Ōrio (Kyūshū), Okayama, the Kyōto-Ōtsu region, Maibara, Tsuruga, and Nagoya.

(2) Roads.

Roadbuilding received little attention in Japan until the coming of high-speed motor transport during the last 2 decades. Most Japanese roads are still not "motorable" by western standards; only about 1/6 of the 600,000 miles of roads can be used by motor vehicles during all seasons. Good paved highways are found chiefly in the vicinities of large urban areas. Prefectural and municipal roads which were intended to connect the national highways are still in the planning stage.

Natural elements have a marked effect on the pattern and trafficability of Japanese roads. Rugged terrain has restricted roadbuilding and makes deployment off the road difficult. Heavy monsoon rains, typhoons, and earthquakes frequently render stretches of road entirely impassable. Extensive areas of forested land furnish good cover for motor transport, but tea

gardens and orchards offer little. There are adequate supplies of roadbuilding materials, except bitumen and tar.

Construction and maintenance of Japanese roads have been under the administration of the National Highways Bureau of the Home Affairs Ministry, and part of the cost of construction has customarily been defrayed by the national treasury. Efforts have been made during the war to coordinate all transportation and accelerate roadbuilding. The road law of 1919 set the minimum width of newly constructed national highways at 24 feet and that of prefectural roads at 18 feet, but older roads do not necessarily meet these specifications. As the law set no further standards, there is little uniformity in either the surfacing or condition of Japanese roads. Japanese bridges are of good construction, similar in design to common types found in the United States. Steel girder types prevail because they best withstand earthquake shocks. Pedestrians, carts, bicycles, motorcycles, and small cars make up the bulk of road traffic. The 7,000,000 bicycles form an important part of the transportation system. Use of small vehicles accounts in part for the lack of improvement of roads; increased use of trucks, however, is promoting road development.

In general, the pattern of roads in Southwest Japan is one of main coastal or circum-island routes linked by less important cross-island roads (FIGURE I-11). There are noticeably fewer roads in the Pacific folded mountain zone of southern Kyūshū and Shikoku than in the less rugged, hilly sections of Honshū and the northern parts of Kyūshū and Shikoku. The principal highway on Kyūshū circles the island, with numerous spurs in the populous northern industrial area. The main roads on Shikoku run across the northern part of the island and south across the mountains to Kōchi. On Honshū, 2 main highways lead from Tōkyō to the Kyōto area, one through the mountains, and one along the coast. The Kyōto - Ōsaka - Kōbe area, the industrial center of Southwest Japan, is well served by a good transportation network. From this center, 2 main highways lead westward to Shimonoseki, one following the north coast for much of the way and the other the south coast. Secondary roads on Honshū form the cross-island connections between the main highways.

(3) Water transport.

Coastal and interisland waterways are a vital and integral part of the Japanese transportation system. The Inland Sea, a large, relatively well-protected stretch of water with many deep harbors and large cities surrounding it, has one of the most highly developed coastal trades in the world. Wartime demands have seriously limited the number of ships engaged in the coastal and interisland trade. The Japanese Government is attempting to alleviate this shortage by increasing shipbuilding and by shifting some of the coastal waterway traffic to the railroads. Several major and many minor shipping routes which connect the numerous ports of call parallel the entire coast of southwestern Honshū, Kyūshū, and Shikoku. Among the more important ports are Kōbe, Ōsaka, Nagoya, Mōji, Shimonoseki, and Nagasaki (FIGURE I-11).

Railroad ferries and passenger and goods ferries are also important in interisland shipping. They link the transportation networks of Honshū, Kyūshū, and Shikoku (FIGURE I-11).

Transportation on the inland waterways is relatively unimportant. Few of the rivers are navigable even by shallow-draft vessels, and little freight is transported on the canals

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B. Communications.

Japan's communications network is well planned and uses good equipment (FIGURE I - 12). Maintenance is poor, and all communications services are operating far above their normal capacity.

(1) Radio.

The Japanese Government has shown great interest in radio; facilities have been expanded in the past 20 years and administration has been concentrated under the direct control of the Ministry of Transportation and Communications.

Radio equipment is manufactured in Japan, frequently patterned after American or German models. Broadcasting equipment is adequate. Cheap home receivers of poor quality are readily available. Only officials are permitted to hear short-wave broadcasts.

The Middle Japan Radio Central, which handles most of Japan's communications with Europe, maintains 2 complete groups of stations. The Yosami transmitter and the Yokkaichi receiver, with controlling stations at Nagoya and Ōsaka, handle radiotelegraph, while the Semayama transmitter and the Ono receiver, with the controlling station at Ōsaka, send and receive both radiotelegraph and radiotelephone. Many offlying islands are dependent on radiotelegraph for rapid communication with Japan proper.

Broadcasting stations are widely scattered and so located that reception is possible throughout the country. Stations of 10,000 watts are located at Nagoya, Ōsaka, Hiroshima, and Kumamoto, and all stations are connected by land line to permit simultaneous broadcasting.

(2) Land telegraph.

Government-operated telegraph service ties together the chief industrial centers and such out-of-the-way points as light-houses, and is connected with radiotelegraph and submarine cables for overseas communication. All messages are funnelled through the district telegraph bureaus, 4 of which are at Nagoya, Ōsaka, Hiroshima, and Kumamoto. Most routes parallel railways or highways; telegraph stations, except in the largest cities, are in post offices. Maintenance is poor and the number of faults (interruptions of service) is increasing.

(3) Telephone.

Through telephone circuits are well planned but inadequate in number. The 1,100,000 telephone instruments available to civilians do not nearly meet the demand, although calls may be placed at more than 10,000 public stations. The entire system is dependent on the proper functioning of exchanges, while long-distance circuits rely on repeater stations. Lines are overcrowded, and women workers have replaced men wherever possible. Maintenance is poor.

(4) Submarine cable.

An extensive network of submarine cables connects the various islands of Japan proper and provides through telegraph and telephone service to islands to the north and south and to the mainland (FIGURE I - 12). Chief concentration of facilities is along the Inland Sea, at Yobuko (on Kyūshū), at Nagasaki, and on the coast of southwest Honshū just north of Shimonoseki. Lines are operated by the International Telecommunications Company under direct control of the Ministry of Transportation and Communications. Time lost because of mechanical

faults totalled 124,772 hours in 1938, an increase of 62% over the preceding year.

8. Cities and Towns**A. General characteristics.**

Southwest Japan is the most highly urbanized section of the Japanese Empire. Its cities are focal points of Japanese military strength, as they include the major naval bases and the principal industries manufacturing war supplies. Although virtually every city and town can theoretically be shelled from the sea, scarcely a single town is actually exposed to direct attack from the open sea, for the urban settlements are concentrated around the shores of the Inland Sea and at the heads of bays which reach far inland (FIGURE I - 13). The 100 *shi* (chartered municipalities) of Southwest Japan are classified into 8 functional types, of which manufacturing, government, transportation, and mining centers are of greatest strategic importance.

Except for the downtown business and industrial districts of Ōsaka, Kōbe, Kyōto, and Nagoya which have a Western appearance, the cities and towns in Southwest Japan have the traditional Japanese aspect. Unpainted frame buildings with slate-colored tile roofs of nearly uniform height face directly on narrow streets surfaced with stone. Open gutters carry drainage and refuse water from the houses on each side.

In many of the smaller towns there are no well-marked residential and commercial sections; throughout these towns, many streets are lined with shops operated by a family living either to the rear or in the second story. The street pattern is commonly rectangular in the center of the town or city but often becomes irregular on the outer expanding edges of urban growth. Rivers, canals, and, consequently, bridges are found in most towns.

Fire is a hazard in most Japanese cities. Although most Japanese houses have tile roofs, which are much safer than American shingle roofs, the wooden framework and walls are inflammable. Inflammability is usually highest in the poor residential areas, where wooden houses are built solidly along the street, adjacent to one another. In such districts, many of the streets are mere lanes too narrow to form good firebreaks or routes of entry for large fire-fighting equipment. Two-story wooden buildings, such as schools, post offices, bathhouses, and police or telegraph offices are important fire hazards, but such of these buildings as are of recent construction are largely fire-resistant. Many of the large industrial, governmental, and commercial buildings which are obvious targets are of western-style reinforced concrete construction, both fire- and earthquake-resistant.

Canals, one or several wide streets, and parks, which act as firebreaks, divide most cities into several fire districts, each relatively well protected against the spread of fire from another district. Fires are most common in winter, when the houses are heated. Winds, which often make the difference between a small fire and a major conflagration, are particularly strong from December to March. Japanese homes destroyed by fire can be replaced at a relatively small cost in money and man-hours.

All the 100 *shi* of Southwest Japan are served by railroads. Water transportation is available in most towns either by vir-

tue of seacice location or through short river or canal connections. Bicycles and rickshas are major means of transportation in most cities and towns. Telegraph and telephone facilities, as well as gas and piped water, are available in all cities and towns of any consequence; few residences, however, have telephones. Nearly all urban homes are lighted by electricity.

The cities and towns of Southwest Japan are treated within their regions in the following order: Nagoya area, Ōsaka area, Inland Sea area (excluding Ōsaka), northern coast of Honshū (Sanindō), Shimonoseki-kaikyō (straits) area, west central Kyūshū, and eastern Kyūshū, and southern Shikoku (FIGURE I-13).

B. Nagoya area.

The Nagoya area, at the head of Ise-wan (bay), is one of the 3 largest plains of Japan, a major center of rice production, and an important nucleus of manufacturing cities. The 3 principal cities are Nagoya, Gifu, and Toyohashi.

(1) Nagoya (1940 population: 1,328,084).

Nagoya is the third city of Japan, both in population and in industrial production. It lies at the southern margin of Nōbi-heiya (plain), a short distance inland from the northeastern extremity of shallow Ise-wan. The principal products are normally textiles, pottery, processed foods, and machinery, but its factories have switched to the production of military equipment. The Mitsubishi Aircraft plant on Nagoya harbor and its affiliated plants in the area are reported to produce 20% of Japanese aircraft. The Aichi Aircraft Works is also located there. The Tōkaidō railroad gives direct access to Tōkyō on the east and Ōsaka on the west. Other railroads provide access to both sides of Ise-wan and the hilly interior. Repair facilities are available for a wide range of types of machinery. Warehouses are located in the harbor area and along the Naka-gawa canal. Principal vulnerable points are the Mitsubishi Aircraft Works, the Aichi Aircraft Works, locks of the Naka-gawa canal, and Nagoya and Atsuta railroad stations and yards.

(2) Gifu (1940 population: 172,340).

Within one of the major hydroelectric power regions of Japan, Gifu is an industrial city producing silk and woolen textiles, porcelain, and paper products. The city lies on the northern margin of Nōbi-heiya (plain), 18 miles northwest of Nagoya. Its main rail connections are with Nagoya, but a line also runs to the Japan Sea at Tsuruga. Repair facilities are adequate for small machinery. There are storage facilities in the textile mills. A vulnerable point within the city is the railroad station and yards. Five miles east of the city is a large plant of the Mitsubishi Aircraft Company.

(3) Toyohashi (1940 population: 242,716).

Toyohashi, 40 miles southeast of Nagoya on the easternmost branch of Ise-wan, is the seat of several military schools and of silk manufacturing. The Tōkaidō railroad provides direct access to Tōkyō on the east and to Nagoya and Ōsaka on the west. Electric lines run in other directions. The barracks of the military schools provide billeting facilities. Garages have equipment for the repair of internal combustion engines. The Standard Oil Company maintained limited facilities for the storage of oil and other commodities. Vulnerable points are the railroad station, an armaments factory, and an explosives factory.

C. Ōsaka area.

The Ōsaka area lies at the eastern end of the Inland Sea. The heart of the area, the Ōsaka - Kōbe - Kyōto triangle, with a population of more than 8,000,000, is the principal industrial district of Japan. The larger cities of this area are Ōsaka with its industrial suburbs of Wakayama, Sakai, and Amagasaki; Kōbe; and Kyōto.

(1) Ōsaka (1940 population: 3,252,340).

Ōsaka, the second city of Japan, is the leading industrial center of Japan and the Orient. Although noted as the center of cotton spinning, it is a city of diversified manufacturing and serves as a commercial center for numerous industrial suburbs. Ōsaka is a major railroad center. The Tōkaidō line provides service to Tōkyō on the east and connects at Kōbe with rail lines serving the Inland Sea cities on the west. Other lines radiate from the city and cross Honshū to the Japan Sea. First-class roads lead to Kōbe, Kyōto, and Wakayama. Regular passenger air service from Ōsaka is maintained by several air lines. Ōsaka castle and its barracks provide billeting facilities. There are many hospitals and large hotels in the city. Extensive repair facilities are associated with the several shipyards, the railroad repair shops, and the machinery manufacturing plants. There are numerous warehouses in the harbor area and along canals in the industrial section. Many sections of Ōsaka may be highly inflammable because of the city's congestion and wooden buildings. The Sumitomo Metal Industry and Aluminum Company, the Fujinagata Shipbuilding Company, the Amatsumi Steel Ball Manufacturing Company, the Sumitomo Electric Industries, the Japan Dyestuff Manufacturing Company, and the Ōsaka arsenal are vulnerable points.

(2) Kōbe (1940 population: 967,234).

Kōbe, on the north shore of Ōsaka-wan, is the principal foreign-trade port and the sixth largest city of Japan. It is also a major industrial center, specializing in shipbuilding and in the related production of steel and machinery. Kōbe is the junction between the Tōkaidō Main Line Railroad east to Tōkyō and the Sanyō line west to Shimonoseki and Kyūshū. There is road access east and west. More than 200 hotels and inns might be used for billeting, but most of them are small. The large shipbuilding yards and the railway shops maintain repair facilities. Many new warehouses of reinforced concrete are located on the waterfront. Vulnerable points are the Mitsubishi dockyards, the Hawasaki dockyards, the Kōbe steel works, the Kōbe railway station, and the telephone exchange. The central part of the city along the Tōkaidō Main Line contains many government and commercial buildings and an inflammable, congested residential district.

(3) Kyōto (1940 population: 1,089,726).

Kyōto, 20 miles northeast of Ōsaka, is a cultural and religious center and a focal point of railroads running east-west and north-south. There are many small handicraft industries in the city. The Tōkaidō Main Line leads east to Tōkyō and southwest to Ōsaka. Other lines, some electrified, lead to the Japan Sea and to nearby points in the Ōsaka area. The Tōkaidō highway provides access east to Tōkyō and south and west to Ōsaka and Himeji. Several large hotels and barracks for 5 regiments are available for billeting. Water is obtained from Biwa-ko (lake). The airplane factory southeast of the city and the Kyōto railroad station and yards are vulnerable points.

D. Inland Sea area.

The Inland Sea area includes cities bordering on that body of water in southern Honshū and northern Shikoku. Many of the cities are important both for manufacturing and as training centers for the army. The 2 principal urban concentrations, near Ōsaka at the eastern end and near Shimonoseki-kaikyō (strait) at the western end are treated separately (Topics 8B and 8E). The next most important cities of the Inland Sea area are Okayama, Kure, and Hiroshima on the southern coast of Honshū; and Matsuyama, Niihama, and Takamatsu on the northern coast of Shikoku.

(1) Okayama (1940 population: 163,552).

Okayama is a training center for troops and an industrial city manufacturing a wide variety of products. It is about 100 miles west of Ōsaka. The Sanyō rail line runs east to Kōbe and west to Shimonoseki. Other lines lead inland and to the Japan Sea. By a line to the south, the city is connected with its port town of Tomano (formerly Uno). An army airport with underground hangars is located near the city. Barracks for workers and for the cavalry and infantry troops provide billeting facilities. Light machinery can be repaired. Warehouses are in the railroad yards. Vulnerable points are the railroad freight yards, electric-railroad power plant, and the powder storehouse.

(2) Kure (1940 population: 276,085).

Kure, about 200 miles west of Ōsaka, is the site of the largest naval base in Japan and of the Naval Academy. A shipbuilding yard, naval industrial plant, aircraft factory, and steel mill add to the strategic importance of the city. A single-track branch line runs north to connect with the main line of the Sanyō railroad. A highway connects with Hiroshima on the northwest. The naval air station is 3 miles east of the city. Barracks in the naval station and at the Naval Academy on nearby Eda-jima (island) afford billeting facilities. Kure is well equipped for machinery repairs of all types. Warehouses lie near the piers and wharves of the waterfront. Naval oil storage is reported to consist of 16 tanks with a total capacity of 632,000 tons. There are extensive coal-bunkerage facilities. Ondo-seto (canal), which provides access to the Kure naval base, is the most vulnerable point. The rail connection to the north and the numerous buildings associated with the naval base and arsenal are also vulnerable.

(3) Hiroshima (1940 population: 343,968).

Hiroshima, about 200 miles west of Ōsaka, is the largest city and an administrative center of western Honshū. It is also the headquarters for the 5th Army Division and an industrial center manufacturing a variety of products. The Sanyō rail line provides access east to Kōbe and west to Shimonoseki. A large civilian landing field is located in the city. Billeting facilities are available in the brick barracks (3,000 men) on the harbor and in the barracks of the military compound in the northern part of the city. Repair facilities for virtually all types of machinery are located here. Water is supplied from Ōta-gawa (river). Warehouse facilities are available in the port area. Bridges connecting the various parts of the city constitute vulnerable points.

(4) Matsuyama (1940 population: 117,534).

Matsuyama, dominating Iyo-nada (open bay), is the most

important city and port in western Shikoku and the headquarters of the 9th Infantry Brigade. It is connected by rail with the other cities of Shikoku. Short lines run inland. There are 2 airports near the city. Billeting facilities are available in the infantry barracks. The vulnerable points are a munitions magazine and the port works.

(5) Niihama (1940 population: 42,392).

Niihama, in the central part of the northern coast of Shikoku, is strategically important for its copper and aluminum reduction plants, and is also a fishing center. It is connected by a short spur with the railroad which skirts the north coast of Shikoku. A secondary road connects with the primary highway which parallels the coast. The metallurgical plants have repair facilities. The principal target is the Sumitomo aluminum reduction plant.

(6) Takamatsu (1940 population: 111,207).

Takamatsu, the northernmost city of Shikoku, has a commanding position on Bisan-seto (straits), separating 2 parts of the Inland Sea. Railroads and roads connect it with other cities on Shikoku. A seaplane station, a military landing field, and a civilian landing field are near the city. Warehouses are located along the docks.

E. Sanindō area.

Sanindō, as the northern side of southern Honshū is called, is a comparatively unproductive, isolated, hilly area. It has few cities of consequence; the most important is the twin city of Maizuru and Higashi-Maizuru, whose populations in 1940 were, respectively, 29,903 and 49,810. Tsuruga, about 50 miles farther east, is the chief commercial port on the northwestern coast of Honshū and a point on the passenger route from Tōkyō to Vladivostok.

The largest naval base on the Honshū coast of the Japan Sea is at Higashi-Maizuru. Maizuru is a commercial port carrying on trade with other ports on the Japan Sea. There are rail connections with other points along the Japan Sea and with Ōsaka on the other side of Honshū. The naval station has barracks for more than 3,000 men, shipbuilding and repair facilities, and large depots for fuel and other supplies. It is the most vulnerable point.

F. Shimonoseki-kaikyō (strait) industrial area.

The Shimonoseki-kaikyō industrial area, located astride the strait at the western entrance to the Inland Sea, lies in extreme southern Honshū and northern Kyushū. Through this narrow strait passes the shortest sea route from the cities of southern Honshū to the continent of Asia, and under it lies the Kammon tunnel connecting Honshū and Kyūshū. The area contains many industrial cities, including the major center of the iron and steel industry of Japan. The principal cities are Shimonoseki and Moji, on the 2 sides of the strait; Ube, on a nearby coalfield of southern Honshū; the 4 closely grouped cities of Yawata, Wakamatsu, Kokura, and Tobata; and the regional capital, Fukuoka.

(1) Shimonoseki (1940 population: 196,022).

Shimonoseki is primarily a transportation center, with manufacturing as a secondary function. With Moji, it controls the western entrance of the Inland Sea, and rail traffic between Honshū and Kyūshū is funnelled through the Kammon tun-

nel between the 2 cities. Shimonoseki has served as an embarkation point for troops and supplies for Korea and North China. It is a junction point of rail lines from Kyūshū through the Kammon tunnel, from the south coast of Honshū by the Sanyō line, and from the northwestern coast of Honshū by the railroad which joins the Sanyō line east of the city. It is also connected with the coastal roads on both sides of Japan. An army airfield lies near the city. Billeting facilities are available in the barracks of the Shimonoseki Fortification Command. The railroad shops provide repair facilities. Vulnerable points are the railroad yards in Shimonoseki and the tunnel entrance, shipyards, and oil storage facilities on nearby Hiko-shima (island).

(2) *Moji* (1940 population: 138,997).

Moji lies at the extreme northern tip of Kyūshū at the western entrance of the Inland Sea. It ranks fifth among Japanese ports in tonnage of foreign vessels handled and is an important coal-shipping port. Moji is the northern terminus of the Kyūshū railroad net and is now connected with the railroads of Honshū by the Kammon tunnel. Good highways lead south to the principal points on the island. Two military landing fields are near the city. Oil-storage tanks, a granary, and warehouses along the waterfront provide storage. Vulnerable points are the railroad yards, tunnel entrance, and the Asano cement plant.

(3) *Ube* (1940 population: 100,680).

Ube is a coal-mining and industrial city on the southern shore of Honshū, about 25 miles east of Shimonoseki. It contains the largest magnesium plant and the third largest nitrogen-fixation plant in Japan proper, and the largest steam-power plant in western Honshū. A branch of the Sanyō railroad reaches Ube. A seaplane base and an emergency landing field are located near the city. The Ube Cement Company is equipped with large storehouses. Vulnerable points are the Riken Metal Company magnesium plant, steam-power plant, cement factory, Ube Coal Liquefaction Company synthetic oil plant, and the Ube Nitrogen Fertilizer Company plant.

(4) *Yawata* (1940 population: 261,309).

Yawata is the site of the great Imperial Iron and Steel Works, the largest producer of pig iron and steel in the Japanese Empire. A suburb, Kurosaki, contains a plant of the Japan Aluminum Company. A double-track portion of the main Kyūshū line, which extends from Moji to Tosu, passes through the city, providing easy access from Honshū via Moji, from the southeast via Kokura, and from the south and west via Fukuoka. There is a network of roads throughout the area south of Shimonoseki-kaikyō (strait). The water supply comes from a reservoir on the Onga-kawa, 4 miles south of the city. The steel works constitute a major vulnerable point.

(5) *Tobata* (1940 population: 84,260).

Tobata lies a short distance northeast of Yawata and is likewise dominated by heavy industries. Its facilities are for the most part identical with those of Yawata.

(6) *Wakamatsu* (1940 population: 88,901).

Wakamatsu is the chief coal-exporting port of Japan and shares in the heavy industry of the Yawata area. It contains the headquarters of mining companies operating in the Chikuhō-tanden (coal field) to the south. Large rail yards be-

hind the docks are linked with the coal field and with the main-line railway from Moji to Fukuoka.

(7) *Kokura* (1940 population: 178,604).

Kokura, between Moji and Yawata, is a rail center and an army town, but it is mainly dominated by heavy industry. Its factories include a large army arsenal, a steel plant, and railroad-construction shops. Double-track main-line railways provide access to Moji on the northeast and to Yawata and Fukuoka on the southwest. Other lines lead south to the coal fields and southeast along the east coast of Kyūshū. A road network joins Kokura and adjacent cities of the industrial area. A landing field is nearby. Barracks of the infantry and field artillery regiments furnish billeting facilities. The railroad shops have repair facilities. Water comes from Kiyotaki-gawa (river) Hara-gawa, and from dug wells. The rail line, nearby industries along the water front, and the arsenal are vulnerable.

(8) *Fukuoka* (1940 population: 323,217).

Fukuoka, 40 miles southwestward of Moji, is the largest city on Kyūshū, the capital of the industrial and mining prefecture of Fukuoka, and an industrial center of increasing importance. A double-track railroad leads to Moji. Other lines run southwest along the coast and south via Kurume to the principal west coast cities and towns of Kyūshū. National highways lead northeast to Moji, east to Iizuka, and south to Kurume. A civil airport, a naval air station, and a seaplane base are near the city. The barracks in the fortress area provide billeting facilities. Water comes from reservoirs on the Muromi-gawa. Well water is brackish. Warehouses adjoin the wharves, and oil and coal-storage facilities are located across the bay. Rail lines are vulnerable, as Fukuoka is a transportation bottleneck.

G. West-central Kyūshū.

West-central Kyūshū consists of 2 parts: a rugged western peninsula, with the naval base of Sasebo and the port of Nagasaki, backed by poor hinterlands and dependent on good harbors; and the plain-bordered twin bays of Shimabara-kaiwan and Yatsushiro-wan, with the military centers of Kurume and Kumamoto and the coal-mining industrial city of Ōmuta - Miike.

(1) *Sasebo* (1940 population: 205,989).

Sasebo, the westernmost city of Japan proper, lies on Tsushima-kaikyō (strait) at the northwestern tip of Kyūshū. One of the 4 principal naval bases of Japan, it guards the important narrows between the Japan Sea and the East China Sea, and the western entrance to the Inland Sea. It contains a naval arsenal, dockyard, and aircraft factory; 2 miles southeast of the city is an aircraft assembly plant. One rail line leads southeast to a junction with the Nagasaki - Saga - Moji line. A national highway follows the same route. A naval airport accommodates both land and sea planes. The naval base contains extensive barracks. Complete marine repair facilities are available at the base. There is also an aircraft repair depot. Oil tanks, coal storage facilities, and warehouses are located along the waterfront. There is a large naval hospital. Vulnerable points are the naval base itself, oil and coal storage facilities, the naval aircraft factory, the aircraft assembly plant southeast of the city, and the railroad station.

(2) *Nagasaki* (1940 population: 252,630).

Nagasaki, in spite of a poor local hinterland and its remote-

ness from the rest of Japan, has been a major port because of its excellent natural harbor, its accessibility to southeast Asia, and its historical priority in foreign trade. Its relative importance among Japanese ports has been declining, but it has become one of the 3 major shipbuilding centers of the Empire. A single rail line leads east and north from the city to join the main Moji - Kagoshima route, and a single road connects the city with the highway network of the island. A civil airfield accommodates both land and sea planes. Billeting facilities are available in the fortress area of the city. Marine repair facilities are provided at the shipyards, and other types of repairs can be made in the city. Warehouses line the shore. Vulnerable points are the Mitsubishi dockyard, the Tategami shipyard, the Koyagishima shipyard, Akunoura engine works, the highway and railroad out of the city, and the steam power plant.

(3) *Kurume* (1940 population: 89,940).

Kurume, located centrally on a plain at the northeastern end of the Shimabara-kaiwan (gulf) is an army center, a rail hub, a rubber-manufacturing point, and the site of an arsenal. Railroads lead from Kurume north to Moji, south to Kagoshima, east to Ōita on the east coast, and west by way of a nearby connection to Sasebo and Nagasaki. Roads follow the same general routes. There are 2 army airfields near the city. The barracks of the 12th Army Division provide billeting facilities. There are warehouses near the railroad station. The Kurume medical school has a hospital. Vulnerable points are the Tosu marshalling yards, 5 miles north of the city, the largest marshalling yards on the island of Kyūshū; the railroad bridge across the Chikugo-gawa; headquarters of the 12th division; the arsenal; and the plant of the Nippon Rubber Company, which produces 23% of the tires and tubes of Japan.

(4) *Ōmuta-Miike* (1940 population: 177,034).

The mining and manufacturing city of Ōmuta, the adjacent coal port of Miike, and the underlying Miike coal fields form an industrial unit on the coast 20 miles south of Kurume. The community is virtually a company town of the Mitsui interests. Industrial plants include the 2 largest zinc refineries in Japan and a synthetic oil plant. A main-line railroad leads north to Moji and south to Kagoshima. Secondary roads to Saga and Kumamoto give access to national highways. There is an emergency landing ground near Ōmuta, and there is reported to be a seaplane alighting area nearby. The industrial plants have machine shops for making repairs. Coal yards are located along the harbor at Miike. Chemical plants have tanks for liquid fuel and industrial gases. Vulnerable points are the harbor installations between the sea locks and the inner and outer basins at Miike, the railroad yards, and the large Minuto generating station.

(5) *Kumamoto* (1940 population: 210,038).

Kumamoto, 20 miles southeastward of Ōmuta, is primarily a government center, serving as the headquarters of the 6th Army Division and the capital of a prefecture. It is also a commercial center for the lowland east of the Shimabara-kaiwan (gulf). A main-line railroad and a national highway run north to Moji and south to Kagoshima. Another rail line and a secondary highway lead east to Ōita on the east coast. There is a civil airfield south of the city. The permanent garrison provides billeting facilities. Kumamoto Medical College operates a hospital.

H. Southern Shikoku and southeastern Kyūshū.

Southern Shikoku and southeastern Kyūshū are hilly and contain few cities or towns. The principal centers are Kagoshima, Kōchi, and Tokushima.

(1) *Kagoshima* (1940 population: 181,736).

Kagoshima is the largest city and principal port of southern Kyūshū. Factories in the city produce explosives and submarines. A single-track railroad runs north to connect with the main system of Kyūshū. Roads run to both the east and west coasts and to the southern tip of Kyūshū. A fighter landing ground and a seaplane base are located near the city. The barracks on the outskirts provide billeting facilities. Railroad and machinery shops make repairs. Warehouses and oil tanks are in the port section. Filariasis, dengue, and schistosomosis are prevalent diseases. Vulnerable points are the railroad tunnel, railroad junction and shops, and the submarine dock (position unknown).

(2) *Kōchi* (1940 population: 106,644).

Kōchi is the principal commercial center of southern Shikoku. Railroads extend for short distances east and west from the city, but the main line runs northward across the island. There are roads eastward along the coast and northward along the railroad. A civil landing field and a seaplane anchorage are near the city. The infantry barracks provide billeting facilities. Warehouses and oil tanks are near the docks. The 2 railway bridges are vulnerable.

(3) *Tokushima* (1940 population: 119,581).

Tokushima, the largest city on Shikoku, is situated on the east coast of the island, on the principal alluvial area. Rail lines run northward near the coast and westward up the long valley of the Yoshino-gawa (river). Roads follow the same routes. There is a fighter landing field near the city. The infantry barracks provide billeting facilities. Plague has been reported. Vulnerable points are the railroad bridge over the Shimmachigawa, the military headquarters, and the port installations at Komatsushima.

9. Resources and Trade

A. Food resources.

(1) *Present food position.*

Imports from Korea, Manchuria, Formosa, and Indochina are necessary to maintain the present level of food consumption, which is slightly lower, on a per capita basis, than before the war.

(2) *General characteristics of agriculture.*

Despite the rapid industrialization of Japan in recent years, agriculture remains the basic industry of Japan. Agricultural areas are primarily coastal and extend as far inland as terrain permits. Farming is typically small-scale (farms average less than 3 acres), intensive, and chiefly by hand labor. Fertilizers are used extensively.

(3) *Food consumption and food balance.*

The average prewar diet of the Japanese supplied 2,150 calories per capita per day, of which 50% was derived from

rice, 11% from other grains, 8% each from potatoes and sugar, 6% from beans, 5% from fish, and 12% from other foods. Despite an increase in population, total consumption remains about the same as in the late 1930's. Domestic production of Japan proper, falling short of the best prewar years, now supplies only 4/5 of the calories consumed. Southwest Japan produces less than 3/4 of its total caloric consumption and must import rice, fish, sugar, and soybeans. Food deficits and surpluses in Southwest Japan are shown in FIGURE I-14.

(4) Food production.

Rice is grown in Southwest Japan wherever irrigation is possible, and a normal crop yields about 9,600,000,000 pounds or 46% of Japan's total annual production. Southwest Japan also has a normal annual production of 1,700,000,000 pounds of wheat (or more than 1/2 of Japan's total); about 1,800,000,000 pounds of barley; about 200,000,000 pounds of soybeans (1/4 of the country's total) and 200,000,000 pounds of other beans (more than 1/3 of the total); more than 4,000,000,000 pounds of sweet potatoes (more than 1/2 of the total); and 1,500,000,000 pounds of fruits (more than 1/2 of the total).

Livestock raising is minor. Southwest Japan annually produces only about 4 pounds of meat per capita and 4 pints of milk per capita.

(5) Fishing.

Before the war, Japan was the world's foremost fishing nation and had 1 1/2 million people engaged in the industry. The largest catch was sardine, most of which was salted and dried. About 71,500 of the 355,000 vessels engaged in fishing prior to the war were powered by internal combustion engines.

Half of Japan's fishing population lived in Southwest Japan and, in 1939, accounted for about 1/3 of Japan's total fish catch. Shimonoseki and Nagasaki were the chief fishing ports.

(6) Food products industry.

The food products industry accounted for 9% of the total value of factory output in 1938 and ranked fifth in importance among 10 major industrial groups. Canned food was Japan's third largest export item in prewar years; other food products industries served domestic needs. About 1/2 of Japan's total production came from Southwest Japan.

B. Water supply.

(1) Natural availability.

Southwest Japan is adequately supplied with water, although occasional droughts cause shortages. Urban areas are supplied principally by rivers. Even in these areas, however, the ground water is used extensively, and some cities rely entirely on this source. Other cities draw part or all of their water from springs or lakes. In rural areas, surface runoff is impounded for both irrigation and domestic use and augments the ground water supplies. Collected rain water and melted snow are relatively unimportant sources.

Hot springs are very numerous in the area, and many of them have therapeutic qualities. Most of the spring waters are used for bathing, but some are taken internally.

(2) Waterworks.

FIGURE I-15 shows the location of the communities known to have waterworks. Many of the waterworks are of modern design and include large dams and up-to-date purification

plants. The reservoirs, however, are generally small. Both drilled and dug wells are used to tap the ground water.

The purification plants compare favorably with those of American cities. The older installations employ slow sand filters; the more modern ones use the rapid sand type. Many filters are open. In some instances ozonization has supplanted chlorination in the sterilization of water; aeration is also used. The relatively high incidence of intestinal diseases, coupled with the recommended use of filter equipment in the home, suggests that the water supplies are not so safe as reports indicate. Some epidemics have been attributed to polluted water.

C. Construction materials.

Lumber is a relatively more important construction material in Japan than in the Western World, as almost all Japanese industrial, commercial, and residential buildings are made wholly or partially of wood. Most large industrial plants built in the last decade, however, are of modern reinforced concrete construction.

About 1/3 of Japan proper's 49,000,000 acres of widely-scattered timber reserves are in Southwest Japan, but reserves of the best construction lumber are limited in the area. Lumber production in 1939 was over 1/2 the country's total. Lumber production, timber stands, and sawmills are shown in FIGURE I-16.

Among Japan proper's other principal construction materials, Southwest Japan produced, in 1938, 66% of the cement, 80% of the bricks, 72% of the tiles, and 45% of structural steel (FIGURES I-17 and I-18).

D. Industrial raw materials and primary processing.

(1) Minerals.

Japan proper has a deficiency in domestic production of practically every metal, but stockpiles of bauxite and possibly aluminum ingots, and of ferro-alloys, copper, tin, and mercury are believed to be substantial. Japan relies heavily on production in Korea, Manchuria, or China for some of the metals, including iron, magnesium, copper, lead, and zinc. Locations of ferrous deposits in Southwest Japan are shown in FIGURE I-17. The only major source of iron in Southwest Japan is iron pyrites.

Copper mines at Besshiyama (Ehime prefecture) and Ikunomachi (Hyogo prefecture) are of some importance, as is the Kamioka lead and zinc mine in Gifu prefecture. The locations of non-ferrous metal smelters and refineries are given in FIGURE I-19, and the capacity or estimated production of plants in each prefecture and city is shown in TABLE I-4 as a percentage of the total for Japan proper.

Japan has deficiencies in most non-metallic minerals; the principal exception is sulfur. Non-metallic mineral production is shown in FIGURE I-18. In 1938, Southwest Japan produced 2/3 of Japan's total value of asbestos products, 3/5 of her abrasives, 7/10 of her glass, and probably a large part of her graphite products.

Almost all Japan's domestic salt is produced on the Inland Sea coast in Southwest Japan. Production in 1939 was about 630,000 metric tons, slightly less than the amount of salt used annually for food. Substantial imports of salt are required for making caustic soda used in synthetic fiber production.

(2) Fuel.

(a) *Coal.* The growth of war industry, particularly the expansion of steel, coke, and electric power output, has substantially increased Japan's coal requirements. A chronic coal deficiency has been a major factor in limiting expansion of industrial production, and in making the coal mines of northern Kyūshū of strategic importance to Japanese industry. Although current output in Southwest Japan is about 32,000,000 metric tons ($\frac{2}{3}$ of Japan's total), 10,000,000 to 15,000,000 metric tons must be imported annually, largely high-grade coking coal from North China, Korea, and Karafuto. The locations of coal fields are shown in FIGURE I-20.

(b) *Coke.* Capacity of by-product coke ovens in Southwest Japan, heavily concentrated in the Yawata-Tobata area, is estimated to be slightly more than 4,000,000 metric tons of furnace-grade coke, or $\frac{7}{10}$ of Japan's total capacity and $\frac{1}{3}$ of the combined capacity of Manchuria, Korea and Japan (TABLE I-4, FIGURE I-17). Under current conditions, it is likely that some excess capacity exists.

(c) *Petroleum.* Japan's petroleum supply is extremely dependent upon stockpiles and production in the East Indies. Total Empire production in 1944 is estimated at about 22,000,000 barrels of all products, including 12,000,000 barrels produced by hydrogenation of coal or tar and by Fischer-Tropsch synthesis. Southwest Japan has no oil wells but is responsible for between $\frac{1}{2}$ and $\frac{1}{4}$ of the synthetic oil production (TABLE I-4, FIGURE I-20).

(d) *Charcoal.* Charcoal is the principal household fuel in Japan. Production and distribution difficulties have been encountered during the war.

(3) Industrial crops.

Japan cultivates no cotton. Sericulture in Southwest Japan centers around Nagoya. Oilseed production is important in Fukuoka prefecture.

E. Manufacturing plants.

Locations of principal plants important in Japan's war economy are shown on a series of maps and are briefly summarized in TABLE I-4. This table gives information for all prefectures in Southwest Japan, but locations within prefectures are generally given only for cities of 30,000 population or more. Estimated percentages of capacity or production are shown for some products. These are based on totals for Japan proper only; percentages based on all Japanese-controlled production would be considerably lower in many cases. Industrial concentration in the area in 1943 is shown on FIGURE I-21.

(1) Iron and steel.

The steel production of the Japanese Empire is less than $\frac{1}{8}$ that of the United States. It depends very heavily on iron ore and coking coal mined on the continent. Southwest Japan has over $\frac{1}{3}$ of the Empire's blast furnace capacity, over $\frac{1}{2}$ of the steel-making capacity, and $\frac{2}{3}$ of the net capacity of rolling mills. Currently the Japanese are not obtaining enough iron ore to utilize, on the average, more than 60% of their pig iron capacity and 80% of their steel capacity. In Southwest Japan, production of pig iron is highly concentrated in northern Kyūshū; steel production, in northern Kyūshū and the Ōsaka-Kōbe district (FIGURE I-17).

(2) Chemicals.

Largely because of the coal fields in the area, Southwest Japan is most important in Japan's well-developed chemical industry. Large quantities of the chemicals necessary to war industry and for sustained agricultural production are produced in this area (TABLE I-4 and FIGURE I-22).

(3) Industrial machinery.

The machinery industry in general is characterized by many small plants. About $\frac{1}{3}$ of all production in Japan proper occurs in the Ōsaka-Kōbe district and $\frac{1}{6}$ in the Nagoya district. Kyūshū and the western end of Honshū are of growing importance (FIGURE I-23).

In view of large-scale prewar imports and the heavy equipment and great skill required to produce machine tools, existing facilities must be hard pressed to keep up with the heavy demand for tools for war industries. The production of precision gears and reduction gears for warships is highly concentrated at Tsukada in Ōsaka prefecture. Production of anti-friction bearings is a major bottleneck in war production; $\frac{1}{2}$ of Japan's total capacity and 90% of Southwest Japan's is in Kuwana (Mie prefecture) and Ryōgenmura (Hyōgo prefecture).

(4) Electrical machinery and equipment.

Southwest Japan does not produce a major part of Japan's electrical machinery and equipment but does produce some individual items in important proportions (FIGURE I-23).

(5) Ordnance.

Japan has probably been able to maintain an adequate supply of light weapons, but her position in heavy weapon production appears much less favorable and may be a weak spot. Ōsaka, Fukuoka, and Hiroshima prefectures, each containing large government arsenals and concentration of private plants manufacturing ordnance and ordnance components, are the most important munitions centers in Southwest Japan (FIGURE I-24).

(6) Shipbuilding and ship repair.

By the middle of 1944, Japan was faced with a serious shipping shortage causing curtailment of imports of industrial raw materials. It is estimated that Southwest Japan will build about 470,000 tons of merchant vessels in 1944 ($\frac{2}{3}$ of the Japanese total) and 325,000 tons of naval vessels ($\frac{1}{5}$ of the Japanese total). Most principal shipyards have their own engine building facilities (FIGURE I-25). There are 2 large marine engine builders at Ōsaka and Kōbe, not shown on FIGURE I-25.

The Japanese are expected to build 650,000 gross tons of wooden ships (the equivalent of 325,000 tons of steel bottoms) in 1944. Southwest Japan will contribute about $\frac{2}{3}$ of the total, or $\frac{2}{3}$ of the wooden shipbuilding in Japan proper.

(7) Railroad equipment.

Wartime traffic increases have placed a heavy strain upon Japanese railroad equipment, but additions to rolling stock have kept pace with minimum requirements. Southwest Japan is probably responsible for over $\frac{9}{10}$ of the locomotive production and more than $\frac{3}{4}$ of the freight car output of Japan proper (FIGURE I-25).

(8) Motor vehicles and tanks.

The Japanese motor vehicle industry, virtually non-existent

prior to 1936, by Western standards, is extremely small. Some of the facilities have been converted to tank production. Two plants, one near Nagoya and the other at Kōbe, account for $\frac{2}{3}$ to $\frac{1}{2}$ of the capacity of the Japanese motor vehicle industry.

(9) Aircraft.

Aircraft now commands top priority in the Japanese war production program. Despite rapidly increased production, current output is still small, compared with American production. Fighters and torpedo bombers constitute $\frac{3}{4}$ of new production. Production in Southwest Japan accounts for about 400 finished operational type aircraft per month ($\frac{1}{3}$ of the estimated total), and a proportionate share of aircraft engines. Mitsubishi Hikoki KK, one of the two largest aircraft builders in Japan, has a complex of plants in and around Nagoya, including the largest single aero-engine plant in all Japan. The Kawasaki Kokuki Kogyō KK has plants scattered between Nagoya and Ōsaka, including a large aero-engine works at Akashi and the Kagamiyama assembly plant at Sohara-mura (Gifu prefecture), which is the exclusive source of Japan's newest and best fighter planes (FIGURE I-24).

(10) Rubber tires.

Japan is believed to have stockpiles of rubber. Her minimum requirements for truck tires are well below productive capacity. Three plants in Southwest Japan have about $\frac{2}{3}$ of the tire making capacity of Japan proper.

(11) Textiles.

Japan's textile economy has shrunk to relatively small proportions. The staple fiber and rayon industry, located mainly in Southwest Japan (FIGURE I-26), now produces most of the clothing material for the civilian population. Some plants have been converted to war chemicals or to machinery and aircraft parts production. The military forces use all the available wool and much of the cotton. After military and industrial requirements are met the supply of all clothing fibers (including silk) left for civilians is only about $\frac{1}{3}$ of prewar consumption.

(12) Pulp and paper.

Paper pulp and paper industries in general are probably operating below capacity. Southwest Japan produced $\frac{1}{12}$ of Japanese-controlled pulp output in 1938 and $\frac{1}{6}$ (82,000 metric tons) of the newsprint made in Japan proper. The area produced nearly $\frac{1}{2}$ the cardboard and paper board (FIGURE I-16).

F. Electric power.

At the end of 1943, the electric power generating plants of Japan proper had a total capacity of 13,400,000 kilowatts, of which about $\frac{2}{3}$ was in Southwest Japan. Total output in Japan proper for 1943 is estimated at about 49,000,000,000 kilowatt hours.

In Southwest Japan there are 4 major "grids" or transmission networks into which several hundred generating plants send energy (FIGURES I-27 to I-29). These are the Chūgoku, Shikoku, Kyūshū, and Ōsaka-Nagoya supply areas. The latter is tied with the Tōkyō grid, and details of its operations and a figure showing the 2 grids will be included in JANIS 85. Most power is produced from hydroelectric plants scattered throughout the uplands and carrying the base load at all seasons. The principal exception is the Kokura-Tobata-Yawata sub-area at the western end of the Inland Sea, where steam

plants are used almost exclusively. This is true to a lesser extent in the Shimonoseki-Ube area also, but elsewhere steam capacity is used chiefly to supplement hydroelectric production during the dry season. About 90% of all coal used to operate steam plants in Japan in 1943 was consumed in Southwest Japan.

Principal electric power consumers in Southwest Japan are the iron and steel industry, aluminum and magnesium plants, coal mining, and certain chemical industries.

G. Commerce.

Japan's dependence on imports, primarily from the west and secondarily from the south, is very great. Imports from the west include large tonnages of coal, iron, and foodstuffs, as well as considerable quantities of non-ferrous metals, synthetic oil, and cotton. The most important imports from the south are petroleum, bauxite, iron ore, rice, and sugar. Chief ports in Southwest Japan are Moji, Wakamatsu, Yawata, Ōsaka, and Kōbe. Interisland commerce is dominated by the movement of coal from Kyūshū to Honshū. Pig iron, rolled steel products, cement, refined metals, and chemical products also flow from Kyūshū to Honshū.

H. Finance.

Japan's circulating currency, based on the *yen* which is divided into 100 *sen* or 1,000 *rin*, consists mainly of Bank of Japan notes in various denominations from 1 to 100 *yen* and a small amount of 200 *yen* notes. Although the Bank of Japan has exclusive right to issue legal tender in Japan proper, Bank of Chōsen and Bank of Taiwan notes are generally accepted and circulate freely at par.

Commercial banking is concentrated in 5 large banks known as the "Big Five." There are important semi-governmental institutions in the fields of industrial and agricultural credit.

10. People and Government

This topic is a brief coverage of People and Government of Japan proper. A map showing population distribution in Southwest Japan appears as FIGURE I-30 in this chapter.

A. People.

(1) Numbers and distribution.

As of 1 October 1940, the date of the last regular census, the population of Japan proper was 73,114,000. Estimates of the 1944 population variously place the number at 74,310,000 and 75,239,000, the latter being based on the acceptance of Premier Tojo's somewhat questionable figures on births for 1939 and 1940. The 1940 population represents an increase of about 13.4% since 1930 and about 30% since 1920. Prior to the war the average rate of increase was nearly 1,000,000 per year.

In addition to the Japanese, the above total includes an estimated 1,000,000 Koreans most of whom have been brought to Japan in recent years as laborers; a few thousand foreigners, mostly Chinese; and about 16,500 Ainu, living mainly in Hokkaidō. In 1940 there were 36,566,000 males, 36,548,000 females.

Honshū, the main island, contains 77% of the total population; Kyūshū, 14%; Shikoku, 5%; Hokkaidō, 4%; and

the Ryūkyū Islands less than 1%. The prefectures containing the great cities of Tōkyō, Ōsaka, Yokohama, Nagoya, Kyōto, and Kōbe had 24% of the total population in 1920; by 1940 they had 31%. In the period between 1935 and 1940 the centers containing war industries grew most rapidly, at the expense of the rural areas and of those cities important by virtue of light industry or commerce. The extent and growth of urbanization is shown by the fact that in 1920, 16,592,000 persons, or 29% of the total population, lived in cities; by 1940 these figures had increased to 28,392,000 or 38.8%. Around 1938, the Government adopted a decentralization program designed to maintain 40% of the population in agricultural districts. More recently the fear of air raids has brought about some dispersal of population from the large cities.

(2) Social structure.

(a) *Origin groups.* The inhabitants of the 4 main Japanese Islands, with the exception of a few small and scattered minorities, belong to the Yamato race, a mixture of Mongol, Malay, and other strains, with a culture by now remarkably homogeneous. One minority group, probably Japanese in origin, is that of the Eta or pariahs, who are usually depressed economically because of social discrimination against them and who in the recent past have attempted as a group to better their condition. Korean laborers have been imported into Japan in increasingly large numbers, but the Koreans do not constitute an organized minority although they are looked down upon by Japanese. The Ainu aborigines constitute another group, small and quite primitive, which is slowly dying out.

(b) *Social organization.* Japanese society is organized into a hierarchy, beginning with the Emperor and the Imperial Family and continuing downward through the nobility, army and navy leaders, civil service, industrial leaders, lower middle class, and rural and urban laboring groups. The basis of organization is the family, of which the eldest male is head; the Emperor is head of the Japanese Family. The groups have prestige according to their association with the Emperor and his government (the ranking derives from Tokugawa centralized feudalism modified by individual prosperity accruing from Japan's industrialization); in Japan the social superior is almost inevitably the leader.

Women are considered socially inferior to men and have been trained to accept this position, but their extensive use in wartime employment may have somewhat broken down this convention.

(3) Cultural characteristics.

(a) *Language.* The standard Japanese language is understood and spoken, with regional colloquialisms, throughout Japan. Two dialects exist, one in the Tohoku region (northern Honshū), and the other in Kyūshū around Kagoshima, but standard Japanese is also understood here. The written language, adapted from Chinese, is taught in elementary schools; but newspapers and magazines use a scribescript of *kana* (syllabic symbols) which obviates the necessity for knowledge of many characters.

(b) *Education and religion.* Formal education in Japan is universal for the first 6 years and is carefully regulated by the government, with a view to nationalistic indoctrination of youth and to elimination of sources of "dangerous thoughts," by which is meant any ideas advocating a social organization different from the existing one. Religion is almost equally well

controlled at present, and both Buddhists and Christians in Japan are heartily supporting the war. Shintoism, the third important religion, is the main channel of nationalism, preaching the divinity of the Emperor, of the land and people of Japan, and of Japan's conquering destiny. Everyone is required to participate in Shinto rituals regardless of his adherence to other faiths.

(c) *Temperament and customs.* Social training in Japan is designed to produce individuals who will fit well into Japanese society. Children are taught to be extremely sensitive to ridicule, so that public opinion becomes a powerful brake on unconventional tendencies. This sensitivity is the basis for "face-saving" practices, including an elaborate structure of appropriate polite formulæ and expedient polite fictions.

Hardly second to individual sensitivity is Japanese national pride, which is closely related to Shinto doctrines. A third facet of the national character is docility toward regimentation, resulting from Japan's long history of minute social organization from the top down.

Other important Japanese characteristics are respect for the Emperor and for religious monuments, cleanliness both of person and of the home, and chastity of women who are not licensed prostitutes.

B. Labor supply.

The 1930 census reported that 46% of the total Japanese population was gainfully occupied. Agriculture is the principal source of livelihood. In 1930, 48% of the labor force, totalling 29,000,000 workers, was engaged in agriculture, 20% in manufacturing and building, 17% in commerce, 6% in government and professional services, and the remaining 9% in communications, mining, fishing, domestic service, and miscellaneous occupations.

The past 14 years have witnessed significant changes in the industrial distribution of the labor force. It is estimated that, by 1944, agricultural employment has declined to 41% of the total; manufacturing has increased to 29%; commerce has decreased to 12%; and government and professional service has increased to 7%. Within the manufacturing category there have been tremendous employment increases in metals, machinery and tools, chemicals and other war industries, with declines in employment in textiles, ceramics, and other less essential industries. Meanwhile the total labor force has expanded to 33,000,000, or about 45% of the population in 1944.

The mobilization of Japanese labor for war has been governed by strict decrees promulgated under the National General Mobilization Law. Workers, both male and female, are under compulsory labor service. New reserves of labor, including women, juveniles, older workers, physically handicapped persons, and foreigners (particularly from Korea), have been added to the labor force. Intensive efforts to increase utilization and raise productivity include controls over wages and hours, training program in the schools and factories, and rationalization and simplification of industrial processes. Labor unions have been abolished and the labor force has been entirely regimented.

C. Government.

All political power in Japan stems from the Emperor, and the constitution, by which the country is governed, is the Em-

peror's gift to his people. Power is highly centralized and concentrated in the executive, in theory the Emperor but in practice his advisers, who include the Lord Privy Seal, the Imperial Household Minister, the Lord Chamberlain, the Privy Council, the various military advisers, and the Cabinet. Executive inter-relationships are highly complex, and the location of control varies with shifts in the political situation.

Popular representation is provided for in the lower house of the bicameral Diet. Although the Diet must approve all laws, its actual position is not one of great importance or influence because of the executive exercise of extensive ordinance power, the absence of cabinet responsibility, and the Diet's limited control of the budget.

For purposes of local administration Japan is divided into 9 regions and subdivided into prefectures which, in turn, contain cities, towns, and townships. Local government is controlled almost entirely by national authorities, chiefly through the Minister of Home Affairs. Local executives are either appointed or removed by the Home Minister, and elected assemblies, while they exist on all levels except the regional, have little power. Although units of local government lack autonomy in matters of policy, they have recently acquired extensively increased administrative functions as a result of the national government's program of decentralization.

On the lowest level of government, the Neighborhood Associations, to which all Japanese belong, provide the individual with the opportunity to participate in community affairs such as the rationing program, civilian defense, and the maintenance of public order.

D. Public order.

The police of Japan are of 2 general types: the civil police and the military police or gendarmerie. The civil police are organized on a national basis under the control of the Ministry of Home Affairs; in the local areas they are supervised by the nationally appointed prefectural governors and police chiefs. While the military police are part of the army and are under the jurisdiction of the Ministry of War, they also exercise extensive control over the activities of the civil population.

The functions of the Japanese police are unusually extensive, including not only traffic regulation, the apprehension of criminals, and the maintenance of public order, but also fire fighting, mediation of labor disputes, enforcement of sanitary and economic regulations, supervision of public entertainment, and organization and control of civilian defense activities. In addition the police, both civil and military, play a major part in the control of "dangerous thoughts," censorship of publications, and the apprehension of political offenders.

In the performance of their duties the police enjoy wide and relatively unrestricted powers. Searches are undertaken without warrant or explanation, suspects and their associates are arrested and held for questioning for indefinite periods, and, particularly in political cases, third degree methods are frequently used. Detailed registration of the entire population makes possible a constant check of the individual's movements and activities, such surveillance being reinforced by police supervision of the Neighborhood Associations. Possession of such wide powers has made the Japanese policeman arrogant and paternalistic in his attitude toward the people, who both fear and respect him as the symbol of Imperial power.

Japan has a national legal system under the jurisdiction of

the Minister of Justice. Both in legal codes and in prison administration the Japanese system is similar to that of Western Continental Europe, with certain modifications. Appointments to judicial office are made as the result of examination, and the judiciary has maintained a high standard of integrity and ability. The position of the bar, however, is less important than in most other countries.

E. Political factors.

During the last decade political power has passed increasingly into the hands of those groups favoring a policy of extreme nationalism both internally and externally, subordination of the parliamentary system, increasing military control of government and economy, and expansion abroad.

Widely varied political elements have played a part in this evolution and have willingly or unwillingly contributed to this general trend. The result has been to place the greatest influence in the hands of the military. In general the various military factions have agreed in favoring an intensification of state control and external expansion. Certain of the more radical military elements have sought by terrorism to force the adoption of these policies, while others have confined themselves to more subtle means of increasing the hold of the military on the government.

The Patriotic Society movement in Japan has been favored by the nationalism of the people and strives to foster chauvinism. These societies are devoted to the promotion of the Imperial principle and have supported militarism either directly or indirectly. They opposed the political parties, the growth of the parliamentary structure, and moderate internationalism. Some groups employed terrorism to further these aims, while others confined their activities to propagandizing the people along ultranationalistic lines.

Within the parliamentary structure the political parties were never able to attain complete development as dominant political groups or as representatives of popular opinion. In the fall of 1940 they were dissolved and amalgamated into the Imperial Rule Assistance Association, which was designed to unite all political elements and the people in the face of national crisis. This organization soon proved unwieldy as an instrument of political control, and the Imperial Rule Assistance Political Society was created in May, 1942, to supersede it. The old political parties, however, have not completely lost their identity; their leaders have played a prominent role in the IRAPS, and some were sufficiently influential to gain representation in the Koiso Government.

Of the class groups, the great industrial combines have been better organized and therefore have played a more dominant role. During the decade after the last war they worked through the political parties, but more recently they have turned to the military in order to assure protection of their interests. Labor and agricultural groups, while numerically strong, have always been prevented from becoming a potent political force by internal divisions, governmental restrictions, and popular suspicion. During the last decade, such of these groups as survived have been forced to subscribe to the doctrine of the dominant patriotic, nationalistic, and military groups. While the labor and agricultural groups are at present without influence or experience in government, they remain a potential force.

Last, there are certain individuals who tend more toward western forms of thought, a somewhat more international out-

look, and a preference for a more cautious and moderate pattern of action than that espoused by the military. These persons may be found among the nobility, the diplomatic and bureaucratic personnel, the university professors, and the business groups. They do not in any sense form a cohesive group, but certain of them hold positions of some influence and may come to the fore when a suitable opportunity arises.

Public opinion on political matters, kept under rigid supervision for many years, tends to approve the patriotic groups and admire the military as servants of the Emperor. It has tended, however, to be critical of the business groups as being self-interested, and of the old political parties as being corrupt.

11. Health and Sanitation

A. Water and sewerage.

Although water is found in abundant quantities in the region under discussion, there are likely to be shortages in a few areas during the latter part of the summer. Adequate filtering and chlorination facilities are found only in larger cities. In many instances the water purification may not be so efficient as the government record would seem to indicate (FIGURE I-15).

Most privies are provided with pits. Night-soil is removed and distributed for fertilization. There are very few flush toilets, and these are confined to larger cities.

Sewerage systems have been established only in large cities. Open sewers or gutters are used to carry off liquid wastes in all other settlements.

B. Harmful insects and rats.

The chief mosquitoes acting as vectors of disease are *Anopheles byrcanus sinensis* (malaria and filariasis), *A. lindesayi japonicus* (malaria), *Aedes flavopictus* (dengue, filariasis), *Aedes albopictus* (dengue), *Aedes abholateralis*, *Aedes togoi*, *Aedes koreicus*. The 4 last-named mosquitoes are probably suitable carriers for filariasis. The *Aedes* species are also considered vectors of B encephalitis. *Culex tipuliformis*, *Culex quinquefasciatus (fatigans)*, *Culex pipiens*, and *Culex sinensis* represent additional suitable vectors of filariasis. Especially *Culex pipiens*, but possibly also other *Culex* species, may represent vectors of B encephalitis.

The common house fly (*Musca domestica*) is very numerous. The sandfly transmits the virus of pappataci fever. Fleas are numerous and are dangerous as plague carriers as well as vectors of the murine type of typhus fever. Lice are found and may carry the epidemic form of typhus fever as well as the organism of louse-borne relapsing fever. Mites are present and are potential carriers of scrub typhus fever, a disease which prevails outside the boundaries of the area surveyed.

Rats are very numerous. They are important in the spread of plague, murine typhus, and leptospirosis. Their bite may cause rat-bite fever (sodoku).

C. Foods.

The staple foods are rice and fish. Many articles of food, including rice, must be imported from abroad, there being little in excess of the needs of the native people. The prevailing method of fertilization necessitates a thorough cooking of vegetables and washing or cooking of fruits. Fresh water fish are frequently infected with flukes or other parasites. The dairy

industry is small, some of the cattle being used for slaughter. Meat plays only an unimportant role in the Japanese diet.

D. Public health.

The Japanese health service is well organized and efficient. Public health is administered by a special ministry established in 1938, the Ministry of Public Health and Welfare (Kosho-sho). The provincial and local bodies for sanitary administration consist of the prefectural governors, police chiefs, and chiefs of towns and villages. Quarantine is regularly carried out at the principal ports open to foreign trade.

During recent years there have been many advances in the field of sanitation, preventive medicine, and personal hygiene, although in the rural areas the standards still remain somewhat backward.

Hospitals similar to those in the Western World exist in the larger cities. The hospitals connected with the medical schools compare favorably both in reputation and in equipment with the teaching hospitals in Europe. Hospital facilities are not so plentiful as in the United States. On the basis of 1932 statistics it has been estimated that Japanese hospitals provide 19 beds per 10,000 people as compared to an average 97 beds per 10,000 people in the United States.

Four of the 9 Imperial Universities are located in Southwest Japan: in Fukuoka, Osaka, Kyoto, and Nagoya. In addition, governmental medical colleges are found in Nagasaki, Kumamoto, Okayama, and Kyoto. There are approximately 62,000 physicians, 22,000 dentists, 60,000 midwives, 124,000 nurses, and 17,000 veterinarians in the whole of Japan. Within the area surveyed there are about 31,000 physicians, or approximately 50% of all Japanese physicians. With regard to the other medical and sanitary personnel, a similar ratio presumably prevails.

The following are among the most important social service agencies: Japanese Red Cross Society, Salvation Army, Japanese Association for the Prevention of Tuberculosis, the White Cross Society of Japan, the Imperial Relief Association, and various health unions and mutual relief associations.

E. Diseases.

Diseases of military importance are bacillary and amoebic dysentery and various forms of diarrhea and enteritis, all of which have a high rate of incidence. Venereal diseases are also of military importance and very widespread in Japan. Other diseases which should be included in this classification are Japanese Summer, or B, encephalitis and a number of dermatological diseases.

Diseases of potential military importance are typhus and other rickettsial diseases, malaria, cholera, which is ordinarily very rare but may assume dangerous proportions, dengue, relapsing fever, and filariasis. Plague is not endemic but might be easily introduced from other Asiatic countries.

Diseases of minor military importance are typhoid and paratyphoid, which have a high rate of incidence among the civilian population. Other diseases to be included in this classification are leptospirosis, rat-bite fever, pappataci fever (sandfly fever), schistosomiasis, intestinal worm infection, liver and lung fluke infections, and tetanus.

Diseases common among the civil population are acute respiratory and infectious diseases, including pneumonia, in-

fluenza, diphtheria, whooping cough, measles, scarlet fever, cerebrospinal meningitis, poliomyelitis, smallpox, and chickenpox. Cerebrospinal meningitis has occurred in epidemics and tends to break out in the spring and early summer. Occasional cases of smallpox occur in spite of compulsory vaccination.

Various forms of diarrhea, enteritis, and food poisonings are common in this area.

Tuberculosis in its many forms is very widespread. It is estimated that there are about 35,000 to 50,000 persons afflicted with leprosy in the whole of Japan proper.

Trachoma is very common. It has been stated that approximately 15% of the young men examined for military service show some evidence of the disease.

Beriberi is still a fairly frequent disease among the population, although its incidence has diminished considerably.

Miscellaneous diseases of minor importance are actinomycosis, yaws, anthrax, rabies, and kala-azar.

Diseases of cattle and livestock which may be a potential danger to man are brucellosis, foot-and-mouth disease, and glanders.

F. Recommendations.

Recommendations of special importance in Southwest Japan include the following:

1. Proper treatment of water supply, all of which should be considered unsafe.
2. Proper care of waste disposal.
3. Mosquito control for the prevention of malaria, filariasis, dengue, and encephalitis.
4. Fly control for the prevention of enteric diseases.
5. Typhus control through measures against lice, fleas, rats, and mites.
6. Sandfly control for the prevention of pappataci fever.
7. Plague control through flea and rodent extermination as well as rat proofing.
8. Venereal disease control.
9. Proper prevention of schistosomiasis.
10. Proper handling of food supplies and supervision of food handlers

12. Defenses

The development of the defenses of Southwest Japan has been given careful attention by the Japanese over a long period of years. This area has played an important role in Japan's recent program of expansion. The densely populated and highly industrialized regions have furnished much of the personnel and equipment of the Japanese Army, and the well-developed transportation facilities have aided materially in supplying the overseas forces.

A. Organization of army defense forces.

(FIGURE I-31).

The Central District Army with headquarters at Ōsaka and the Western District Army with headquarters at Fukuoka control the administrative and defensive tactical functions of the Japanese Army in Southwest Japan. Each Army district is split into 4 divisional districts, each of which is in turn divided into 3 or 4 regimental districts. There are 27 regimental districts in Southwest Japan.

The total strength of forces normally disposed in Southwest Japan is estimated at 325,000 to 350,000. This figure includes 22,000 troops in fixed units, 187,700 troops in mobile units,

and 120,000 to 140,000 line-of-communication, supply, and miscellaneous troops. The fixed units include fortress garrisons and heavy artillery regiments located in the fortified areas. The mobile units include depot and active divisions; independent infantry groups; and infantry medium artillery, tank, and antiaircraft regiments.

Most of these troops are replacement units, but they may be considered full strength tactical units which would serve as a nucleus for any defensive action against a possible attack on Southwest Japan. Any landing or attempt at penetration in this area will be resisted desperately with all available means at hand and reinforcements from other parts of Japan.

B. Supply and maintenance.

(FIGURE I-32)

The industries and agriculture of Southwest Japan have supplied a large part of Japan's overseas troops. It is believed that these resources, aided by adequate transportation facilities, are capable of sustaining as many troops as the Japanese would employ in the defense of this area.

A number of major depots, believed capable of supplying several armies, are located in the area. Most of these depots are in the immediate vicinity of Ōsaka and Ujina, the 2 main ports of supply for Japan's overseas forces.

In addition to the major supply depots there are 8 depot divisions and 1 depot brigade. Local troops normally stationed in each divisional district are maintained by the supply facilities of the various components of the depot division.

The supply depots and depot division headquarters are well served by roads and railroads, and in some instances by port facilities. Except in Shikoku, which is much less important than the other major islands of Japan proper, the railroads form a well-integrated system. The roads are less developed and are intended primarily to supplement the existing railroads. The numerous good harbors in Southwest Japan and the sheltered waters of the Inland Sea have led in the past to an extensive use of shipping. The shortages in shipping brought about by the war have thrown a heavy burden on the railroads and roads. Nevertheless, it is believed that the existing transportation facilities will continue to fulfill logistical needs of Southwest Japan, unless heavy and persistent attacks disrupt the rail and port facilities in this area.

C. Fortifications.

(FIGURE I-33)

The great preponderance of fortified areas in Japan proper is in Southwest Japan. The known coastal fortifications of this area guard the approaches to northwestern and northern Kyūshū; they defend the Shimonoseki-kaikyō, Bungo-suidō, and Kii-suidō, which lead into the Inland Sea; and they protect the 3 major naval bases of Kure, Sasebo, and Maizuru, as well as the important shipbuilding center and port of Nagasaki.

All Southwest Japan is well adapted for defense, with numerous offshore islands, restricted water channels suitable for mining and easily covered by coastal batteries, and high terrain along the coasts.

The coastal guns range from 3 to 16 inches in caliber, and are of Japanese, French, English, or Russian manufacture. Most frequently reported is a 240-mm (9.4-inch) gun of French design.

The defenses in Southwest Japan were established at a rela-

tively early date. Many old type fortifications are probably still present, although the most important batteries have been strengthened and modernized. Camouflage has not been used extensively, and many of the fortifications are conspicuous both from sea and air.

Stationary defenses of Southwest Japan may be supplemented by mobile artillery units. The following have been identified: 3 heavy artillery regiments (normal armament: eight 150-mm guns each); 2 medium artillery regiments (normal armament: twenty-four 150-mm howitzers or sixteen 105-mm guns each); seven field artillery regiments (normal armament: thirty-six 77-mm field guns and twelve 105-mm howitzers each); and 1 mountain artillery regiment (normal armament: thirty-six 75-mm mountain guns each).

The Japanese are believed to have thirty 240-mm Schneider railway guns. These can be operated from the main Japanese railway lines along the coasts of Honshū and Kyūshū.

Antiaircraft batteries have been observed at some strategic points, and doubtlessly they are located at all important military and industrial centers. In addition, there are in Southwest Japan 16 antiaircraft regiments, each equipped with twenty-four 75-mm antiaircraft guns and sixteen 20-mm antiaircraft machine cannon. An extensive air warning system affords further protection to important targets.

Defenses have doubtless been erected at many locations not previously known to be fortified. Certain additional areas have been singled out as potential defense zones. These include landing beaches and sheltered harbors not described among the known defenses.

13. Naval Facilities

A. Organization and administration.

Most of the home bases and facilities of the Japanese Navy are situated in Southwest Japan. The main islands of Japan proper and their adjacent waters are divided into 4 naval districts and 2 guard districts. This study includes all the land area of the Second Naval District (with headquarters at Kure), of the Third Naval District (Sasebo), and of the Ōsaka Guard District; the major portion of the land area of the Fourth Naval District (including the headquarters and base at Maizuru); and the western part of the First Naval District (but not its main base and headquarters at Yokosuka) (FIGURE I-34).

Within their respective areas these districts are charged with the following responsibilities: (1) maintenance of construction and repair facilities for the fleet, (2) protection of the sea and air frontiers of Japan, (3) recruiting, training, and supply of naval enlisted personnel, (4) coordination of all naval activities and maintenance of security, and (5) production, inspection, and distribution of naval aircraft, supplies, and stores. Each district is under a commander in chief (usually a vice admiral but occasionally at Yokosuka and Kure, a full admiral) who is also commandant of the major naval base within his district and who is under the Chief of the Naval General Staff for war plans and operations and under the Navy Minister for administrative matters.

Sea forces attached to districts include the following components: defense squadrons and defense divisions, guard squadrons and guard divisions, patrol divisions and picket boat divisions.

District land forces man the defense and lookout stations, and guard naval fortresses, fortified zones, etc.

Air forces attached to districts function as escort and patrol forces, or as training forces.

B. Naval bases and stations.

Sasebo, headquarters of the Third Naval District, has within its port area a large fleet anchorage, extensive building and repair facilities, a small arsenal, torpedo and mining establishments, coal and oil storage facilities, a naval air station, and naval barracks. The harbor, which has a narrow entrance, is nearly landlocked and had deep water over most of its area. There are mooring facilities for 11 battleships or aircraft carriers, 8 cruisers, 45 destroyers, 19 submarines, and numerous special duty ships and small craft. The total waterfront of the dockyard is said to be in excess of 2 miles. There are extensive warehouses and supply dumps within the port. The base includes 6 drydocks (the largest of which is about 1,000 by 175 feet), 3 building ways (the longest 600 feet), and adjacent machine shops. The Sasebo Arsenal is equipped to outfit and repair all classes of naval craft.

The Maizuru naval base, headquarters of the Fourth Naval District, is Japan's only base on the Japan Sea facing Korea and the Russian Maritime Province. It is the newest of the naval bases, having been a minor station before December, 1939. Situated on an arm of the most deeply indented bay on the Japan Sea coast of Honshū, its harbor is well-sheltered. The base is connected by rail with the port of Tsuruga and with the manufacturing centers of Ōsaka, Kōbe, and Nagoya, on the other side of Honshū. Maizuru's facilities have been developed in recent years and are now believed to include enlarged building facilities. It functions primarily as a repair station for destroyers and submarines, secondarily as a naval munitions plant, and thirdly as a shipyard for construction of new naval vessels. The shipyard includes 5 drydocks (the longest 735 feet) and 6 building ways (the longest 800 feet). The arsenal is believed to specialize in manufacture of naval mines and to produce about 75% of the total Japanese output.

Tokuyama Minor Naval Station on the Inland Sea primarily a fueling depot, was raised to the status of a station within the Second (Kure) Naval District in March 1938. Since that time its facilities have been constantly expanded. As the Third Naval Fuel Depot it stores approximately 1,750,000 tons of fuel oil and 200,000 tons of coal. It has laboratories and refineries charged with fuel research and production. It is a processing and transshipment point for fuel destined for other naval stations and bases. Privately operated shipyards on Kasado-jima within the limits of the station specialize in tanker and small cargo ship construction.

The Kure naval base, headquarters of the Second Naval District, is on sheltered waters giving adequate protection for a large fleet anchorage on Hiroshima-wan, an arm of the Inland Sea. The base is the largest combined dockyard, shipbuilding yard, and naval industrial plant in Japan. It has 5 drydocks (the longest 1,000 feet) and 3 building ways. The industrial plant includes, in addition to the Kure Arsenal, the more recently established Hiro Arsenal, and the naval aircraft factory and engine and turbine factory also at Hiro. Kure's oil storage facilities, with about 1,000,000 tons capacity, are more extensive than those at any of the other 3 naval bases.

In addition to these bases there are a large number of sites

suitable as anchorages, potential bases, or stations. In the Kyūshū sector, 14 such sites are listed; in Shikoku, 7; and on the coasts of Honshū included in this study, 17.

C. Supply and maintenance.

Each naval base operates as a supply and maintenance depot with extensive fuel storage facilities, and additional depots are established at strategic positions elsewhere in the area, usually in protected waters used for fleet anchorages. Three of the 5 such major depots operated in Japan are within the area of this study: at Yokkaichi on Ise-wan (bay) (the Second Naval Fuel Depot), at Tokuyama on the Inland Sea (the Third Naval Fuel Depot), at Saitozaki in Fukuoka Prefecture (the Fourth Naval Fuel Depot). The largest of these depots at Tokuyama and Kure are on the Inland Sea. The 4 main oil storage sites are estimated to have the following capacities:

Sasebo	400,000 tons
Maizuru	400,000 tons
Kure	1,000,000 tons
Tokuyama	1,750,000 tons
Total	3,550,000 tons

Additional naval oil storage sites of lesser importance are known to exist at 9 locations around the island of Kyūshū: Shibushi, Tomitaka, Nobeoka, Saeki, Moji, Saitozaki, Ōshima, Sashiki, and Kagoshima; and at 5 sites in Honshū: Miyazu, Wakayama, Toba, Yokkaichi, and Nagoya. Extensive commercial fuel stores, particularly on Honshū, are at the disposal of the Navy.

Each of the naval bases and the minor station at Tokuyama also maintain large coal stores.

Repair and shipbuilding facilities of the Japanese Navy are established at the yards maintained at the bases of Sasebo, Maizuru, and Kure, supplemented by the Hikari Arsenal near Tokuyama, and by the commercially operated yards in the area. These latter include most of Japan's privately operated yards, the most important of which are on the Inland Sea and at Nagasaki.

The major supply routes to Japan proper from the Asiatic mainland, from the Indies, and from the Mandates converge in the coastal waters of this area to the ports of Nagasaki, Shimonoseki - Moji, Ōsaka, Kōbe, and Nagoya, and follow routes close inshore.

14. Air Facilities

A. Organization.

The air services of Southwest Japan are largely the responsibility of the Japanese Navy and are an integral part of the air defense of the homeland. Training is the principal function of the Army air forces in the area.

Organization of the Naval Air Service is flexibly broken down into air fleets, air flotillas, and air groups, with no uniform number of aircraft assigned to these various echelons. Tactically the naval air forces are organized on the task force principle.

The primary function of air strength in Southwest Japan is the defense of the homeland, particularly the industrial and military installations around and near the Inland Sea. It is estimated that this air strength, during the first half of 1944, has grown from about 30% to more than 40% of Japan's total operational air force.

B. Installations.

In Southwest Japan, prior to 7 December 1941, civil and training airfields were in the majority. Since that time, and to an ever increasing extent, the work of constructing defensive air facilities has been carried on. This activity has centered particularly on Kyūshū, where such facilities were developed later than on Honshū.

The principal concentrations of first class airfields and naval air facilities of Southwest Japan (FIGURE I-35) are listed below by islands.

(1) Kyūshū.

(a) *Southern tip.* The southern tip of the island, closest point to the homeland to the Southwest Pacific approaches, is dotted with air facilities including at least 1 fighter and 2 medium bomber airfields.

(b) *Sasebo-Nagasaki.* The general port area of Sasebo-Nagasaki on the west coast of the island has a number of installations, some of indeterminate classification but including at least 2 fighter airfields.

(c) *Fukuoka-Wakamatsu.* The industrial area on the northern and northwestern coast of the island has a concentrated airbase complex including at least 1 fighter, 1 medium bomber, and 2 heavy bomber airfields; 1 fighter and 1 heavy bomber landing ground (under construction); and 3 seaplane stations.

(2) Shikoku.

Shikoku is the least developed sector from the standpoint of air facilities, although a number of fields are located at intervals around the perimeter of the island, spaced most closely along the north shore.

(3) Honshū.

(a) *Hiroshima-Kure.* This area, which includes the Kure Naval Base, has well-developed air facilities, with at least 1 medium bomber and 2 fighter airfields, and 2 seaplane stations.

(b) *Ōsaka-Kōbe.* In the vicinity of this heavy industrial and port area on the northeastern coast of the Inland Sea are at least 1 medium bomber and 3 fighter airfields, 1 seaplane station, and numerous other air installations of a lesser or indeterminate classification.

(c) *Ise-wan.* The industrial area around Ise-wan, including the city of Nagoya, has a heavy concentration of air installations, some of them connected with aircraft factories. There are at least 2 heavy bomber, 2 medium bomber, and 2 fighter airfields.

(4) General.

The following numbers of air installations are described or listed in CHAPTER XIV:

Heavy bomber airfields	6
Medium bomber airfields	9
Fighter airfields	14
Heavy bomber landing grounds	1
Medium bomber landing grounds	1
Fighter landing grounds	3
Seaplane stations	14
Auxiliary seaplane stations	3

Also listed are 131 fields and 55 seaplane installations of uncertain or undetermined classifications. In addition there are listed 25 suitable locations where airfields or seaplane facilities may or may not exist.

Details are given in CHAPTER XIV, TABLES XIV-1 to XIV-3.

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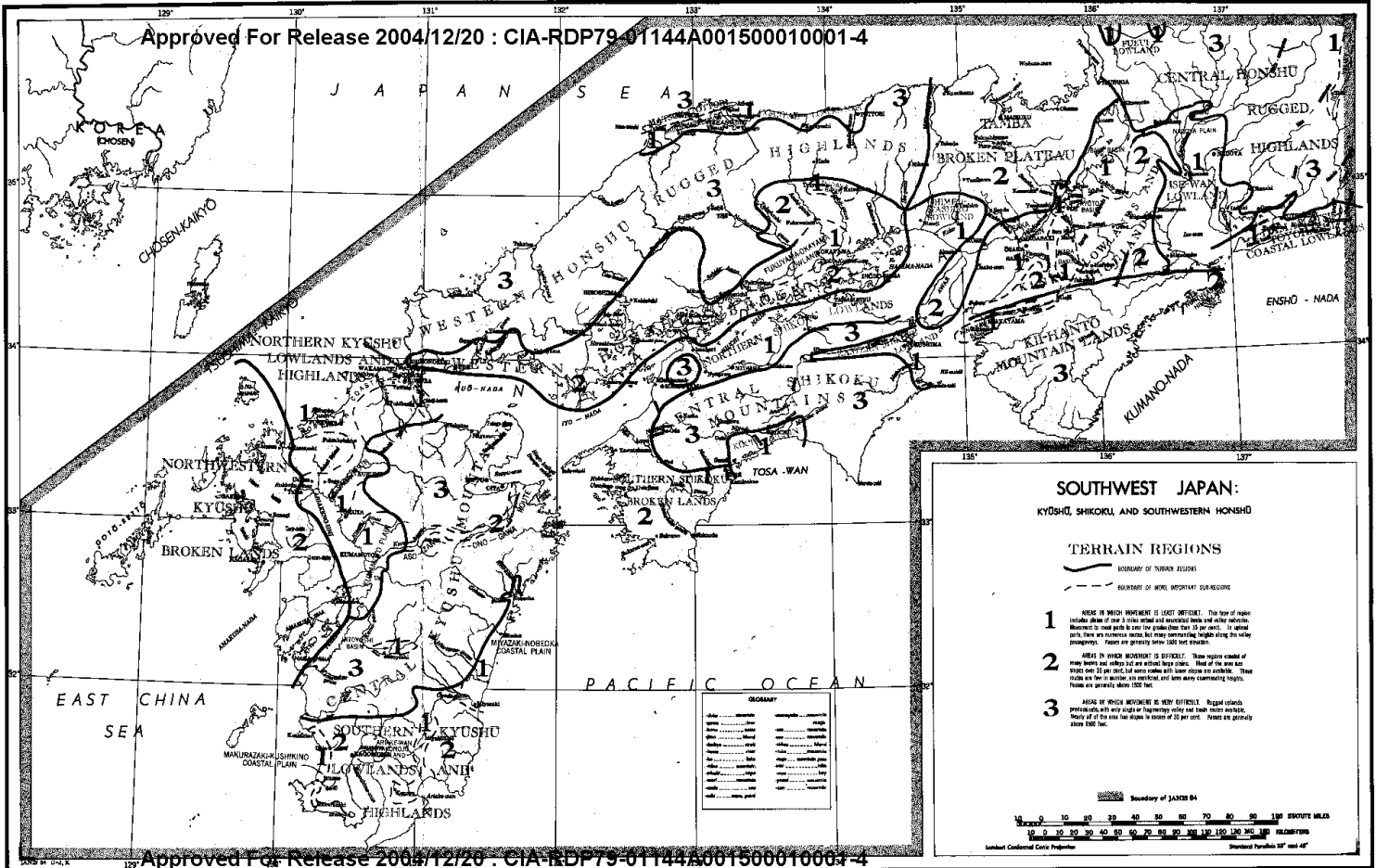
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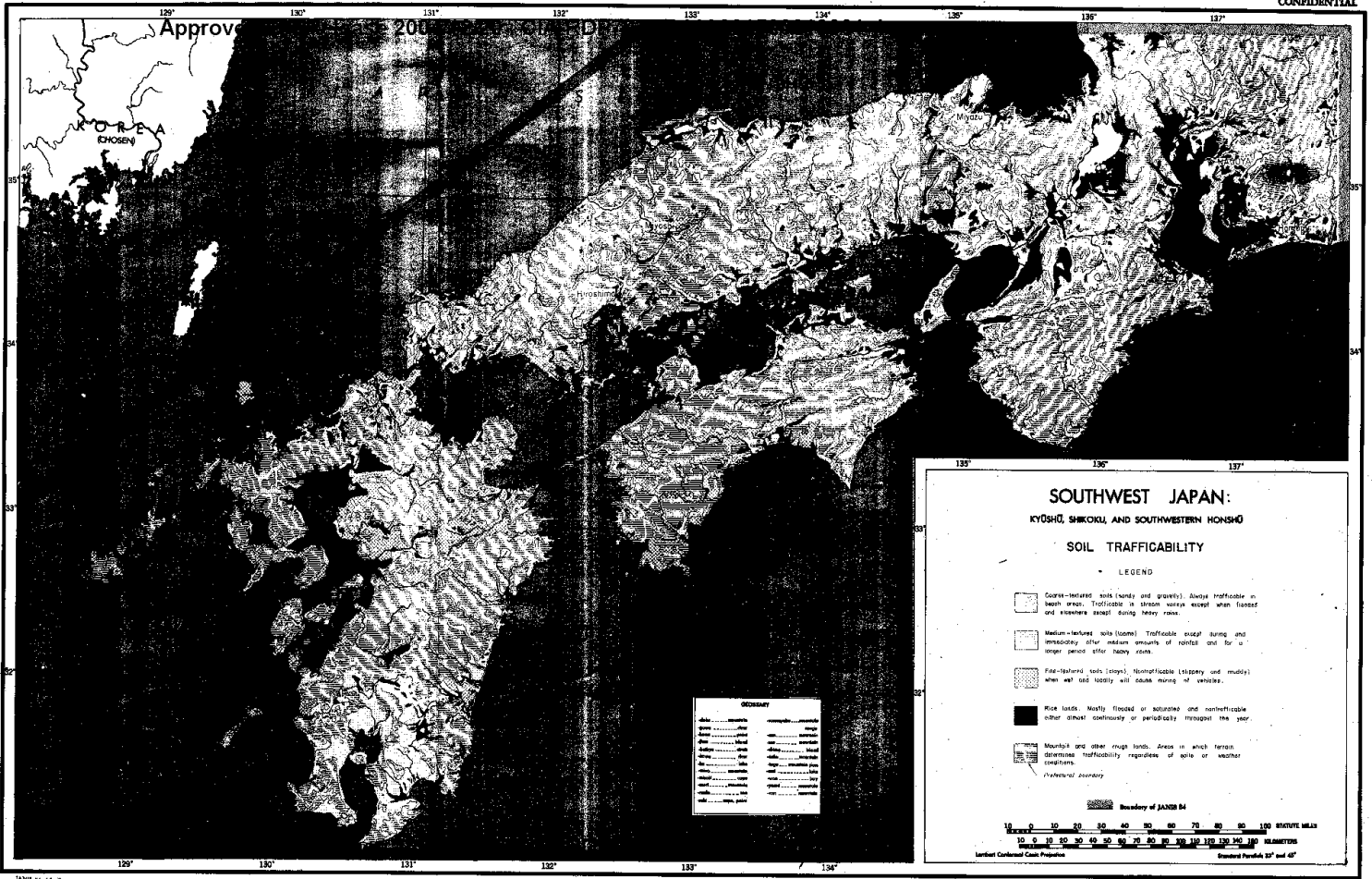
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FIGURE I-7
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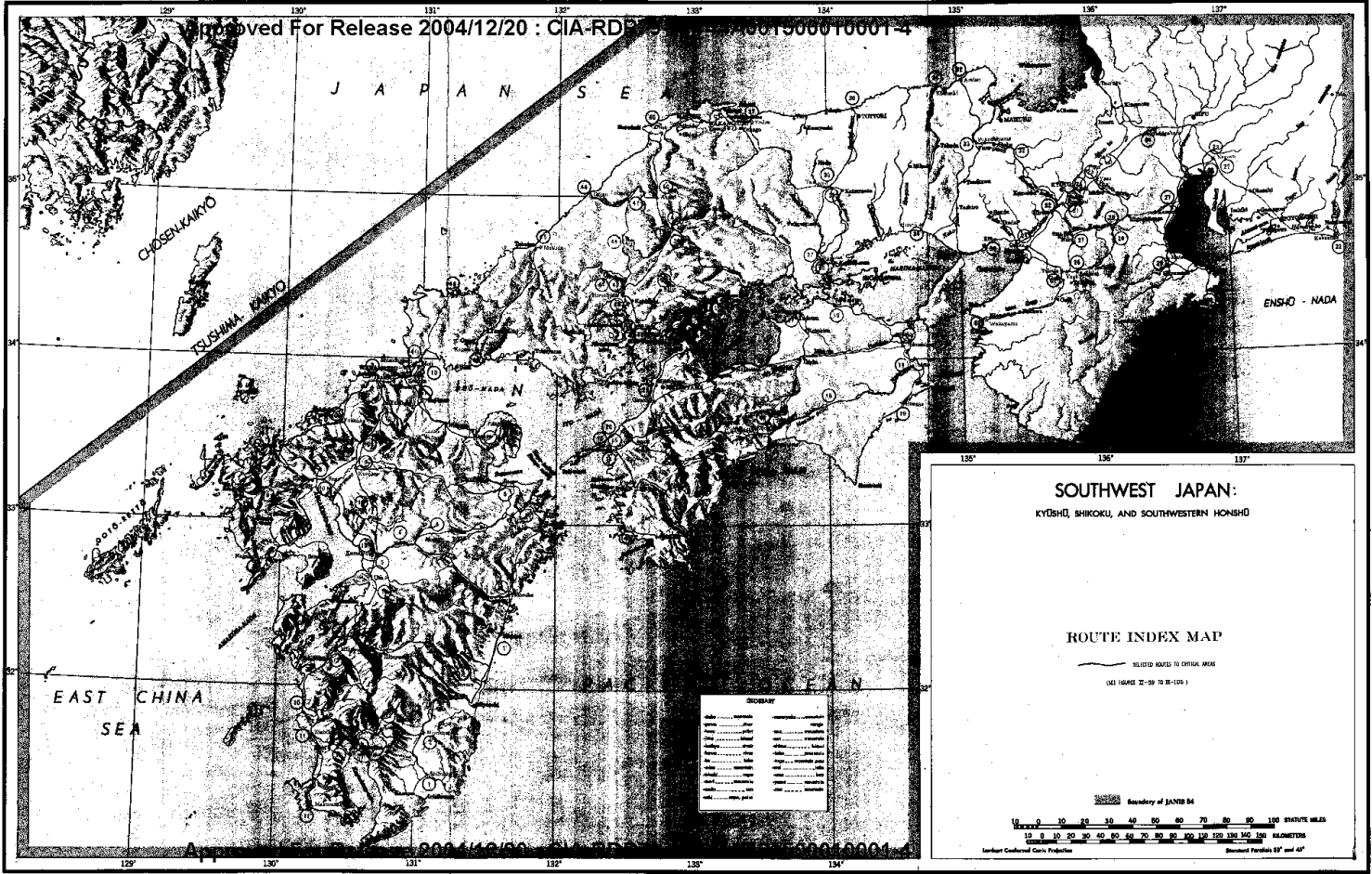


FIGURE 1-8
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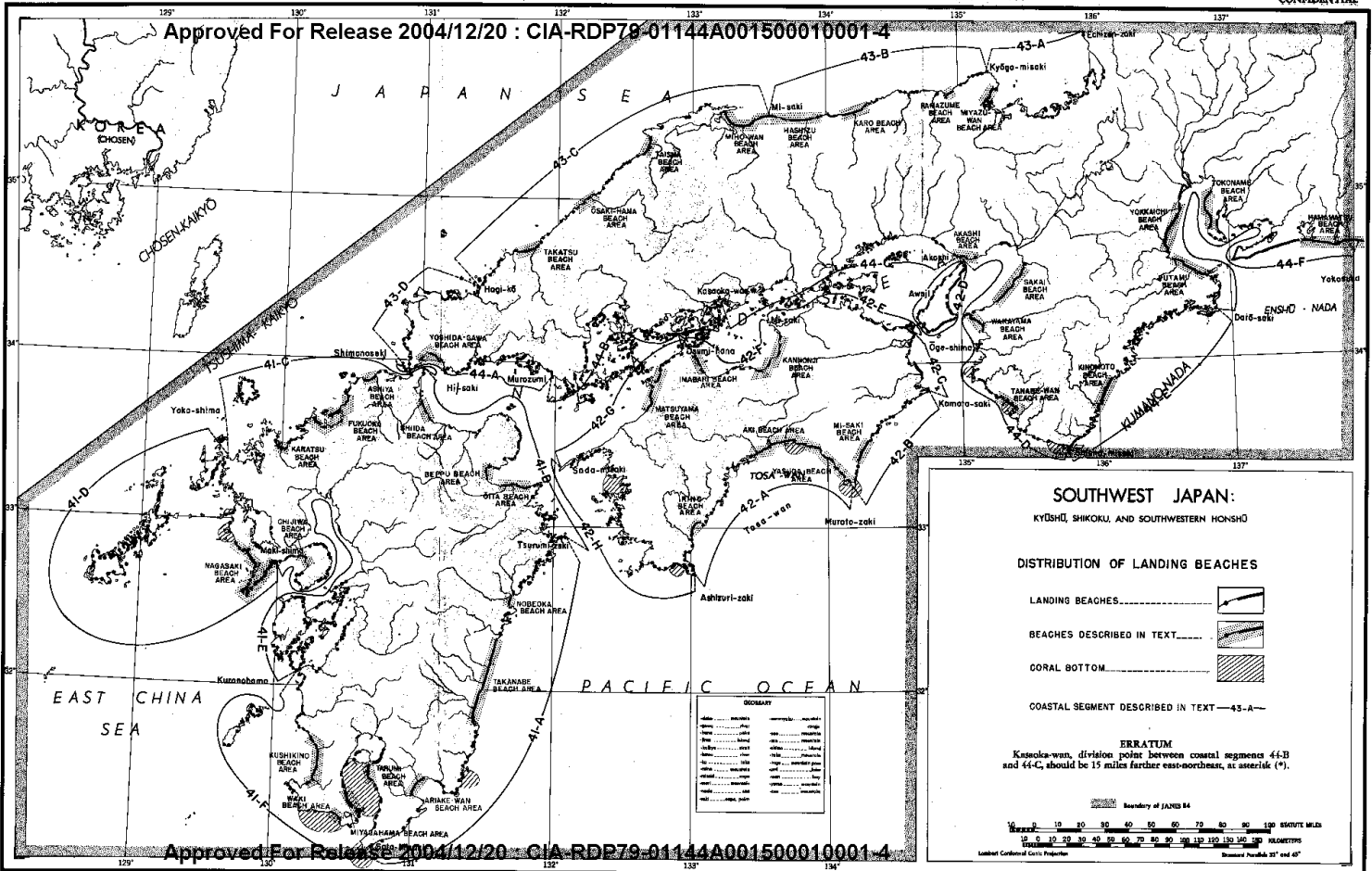
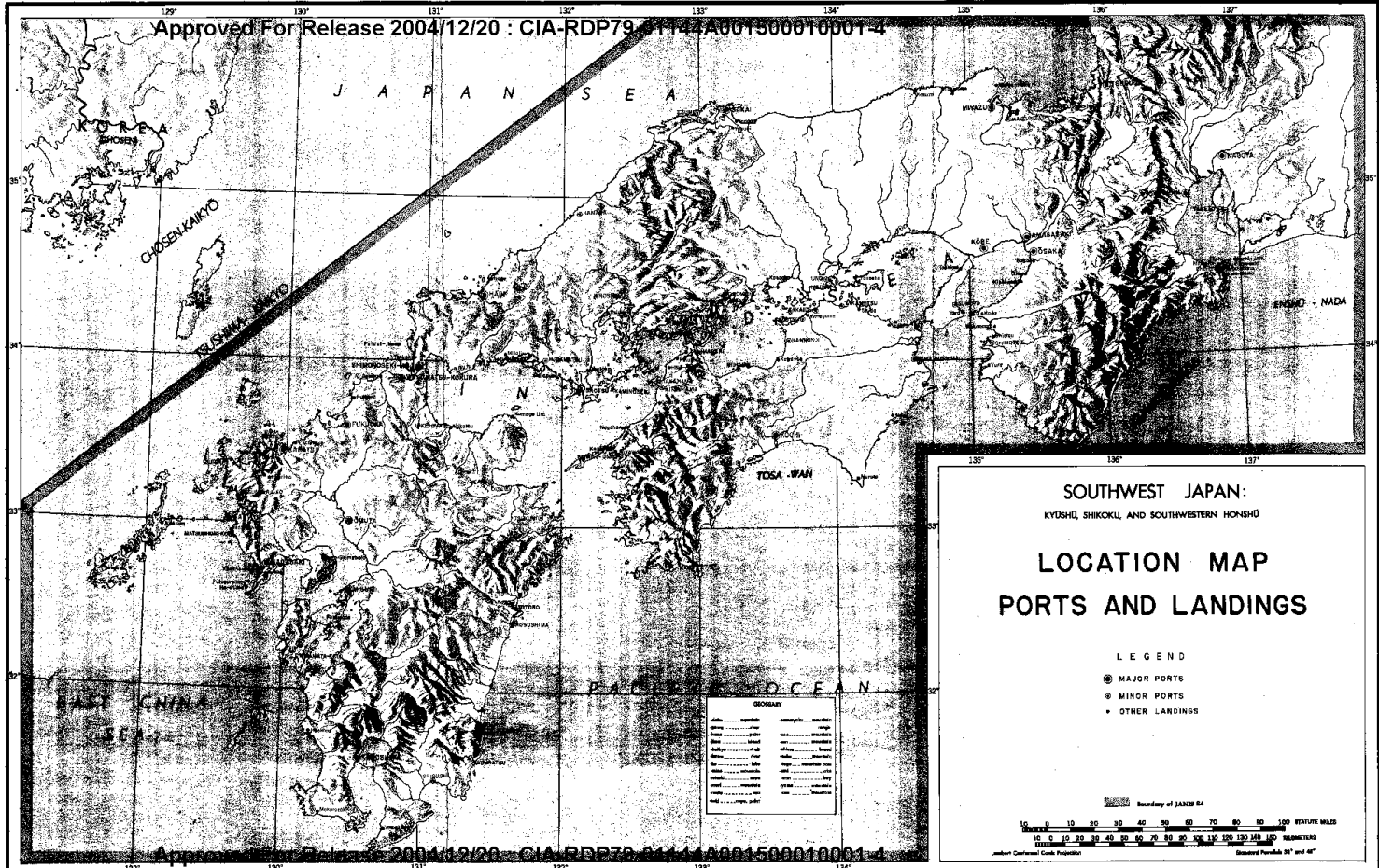
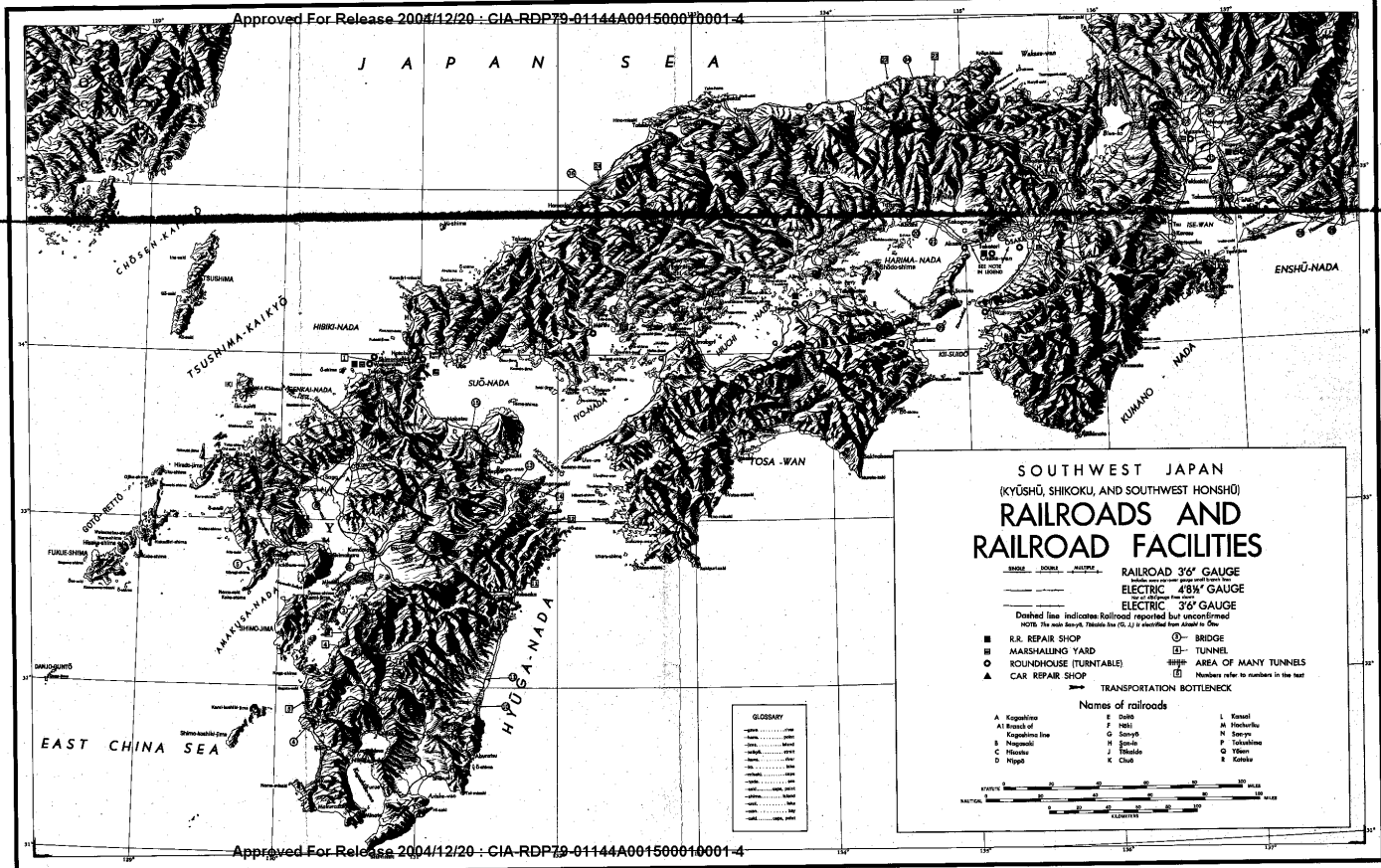
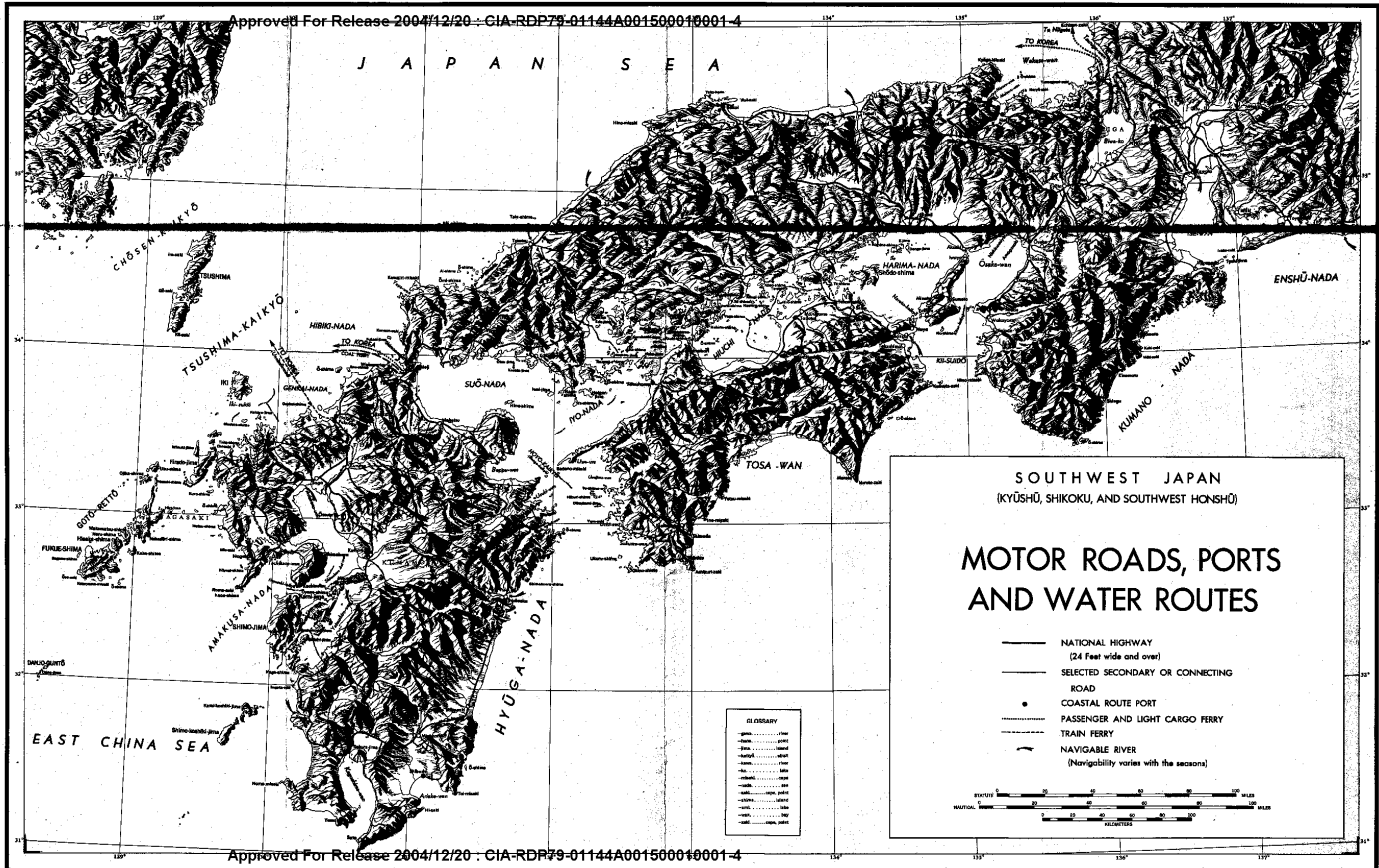


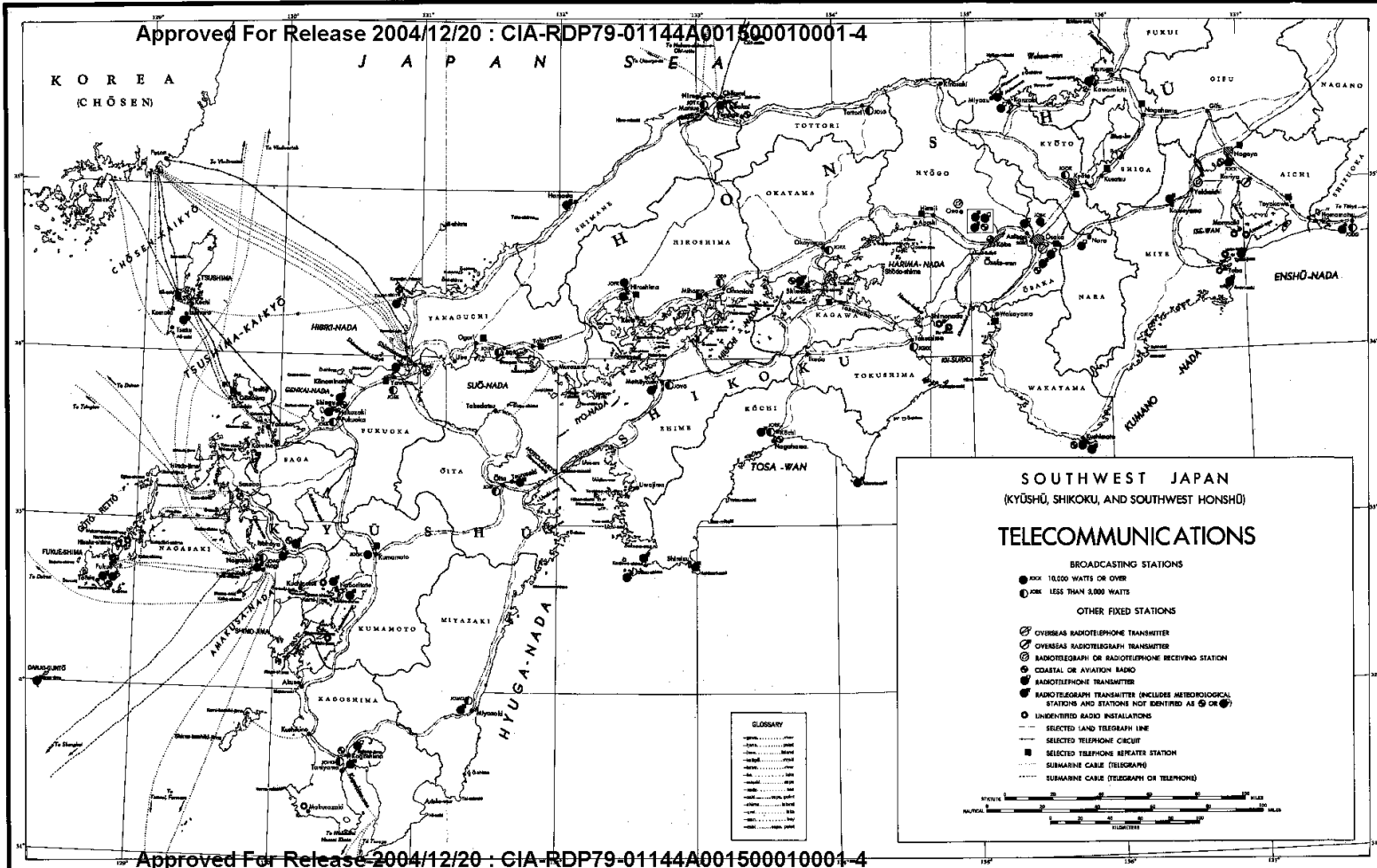
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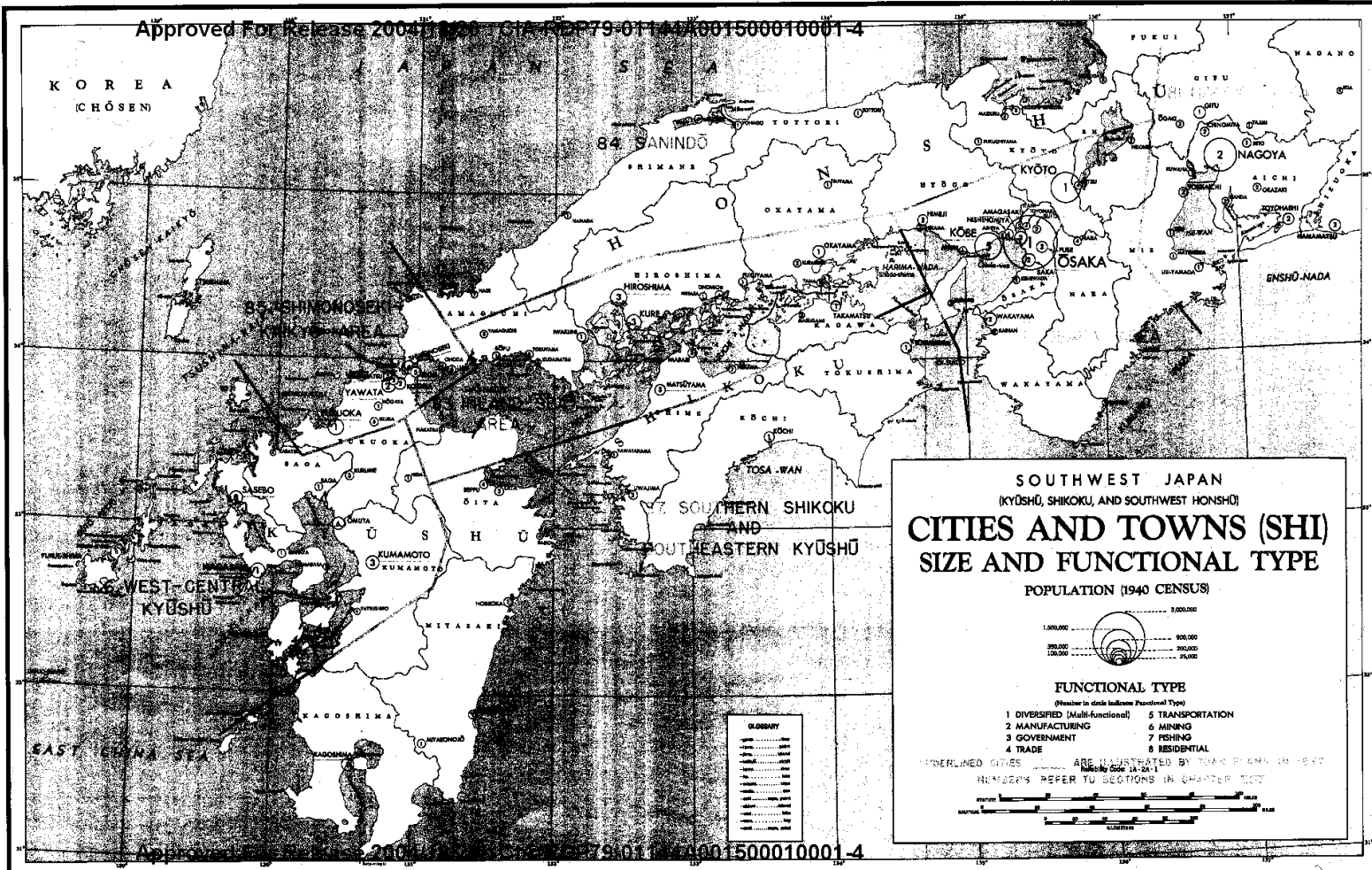
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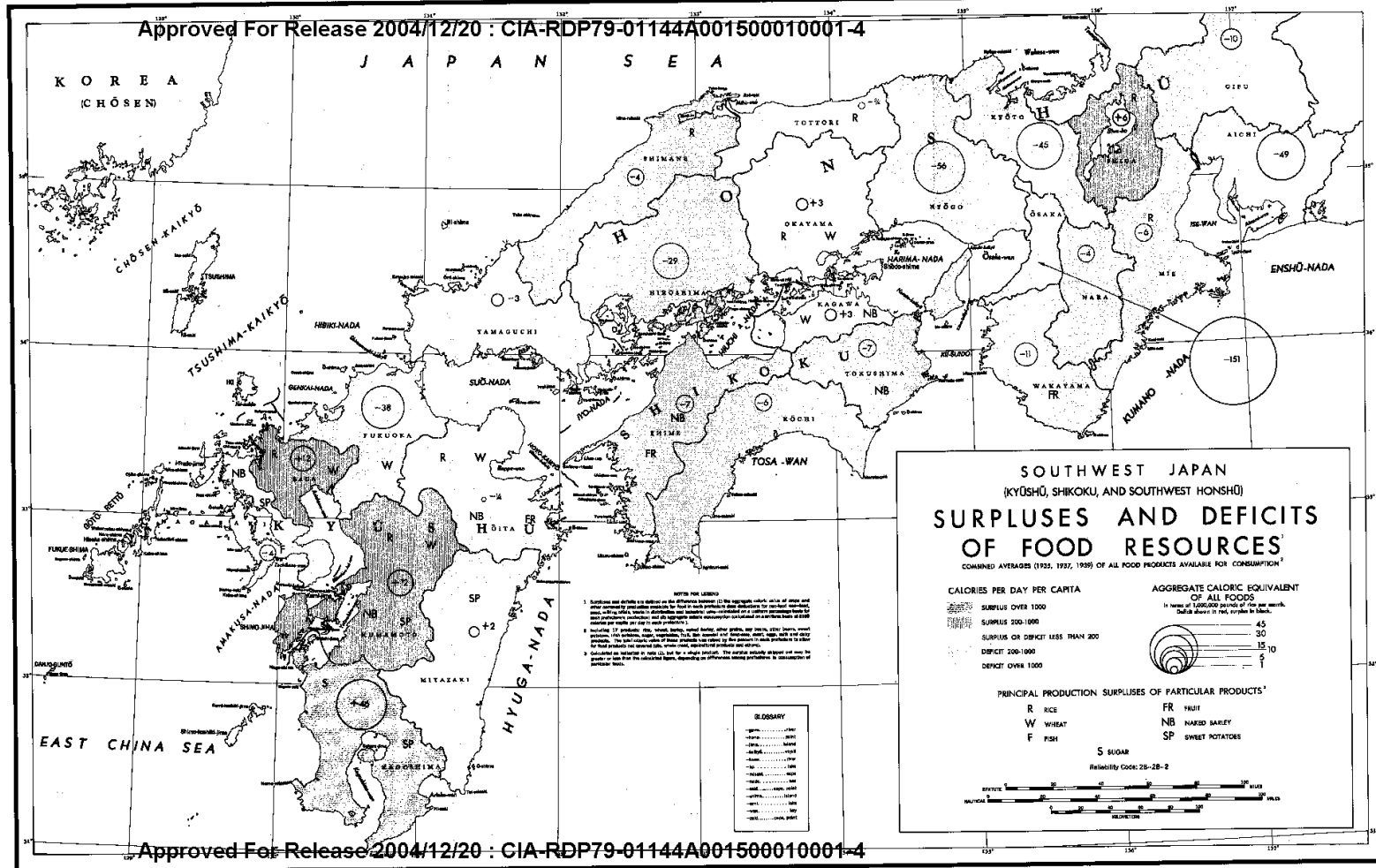
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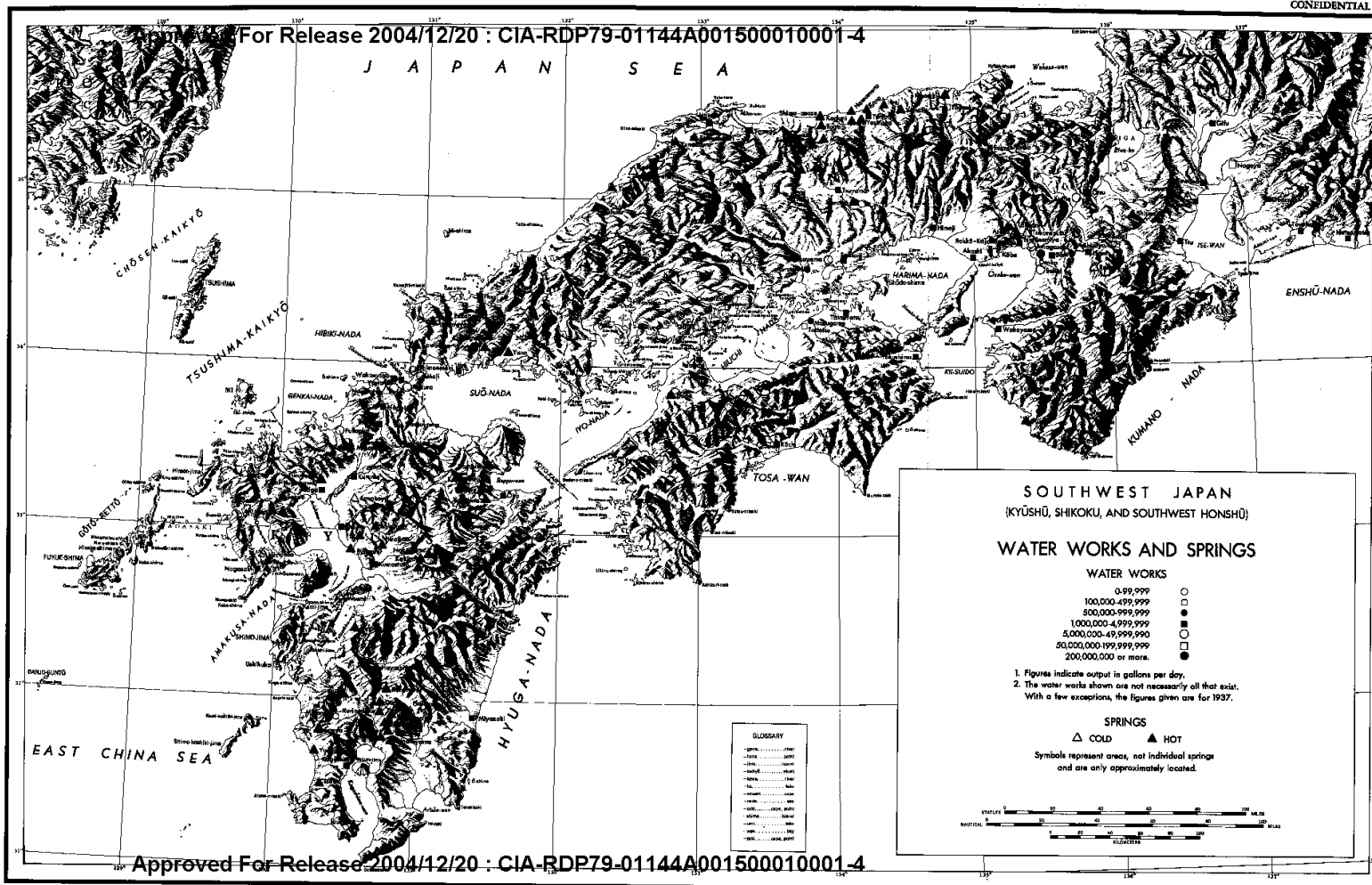
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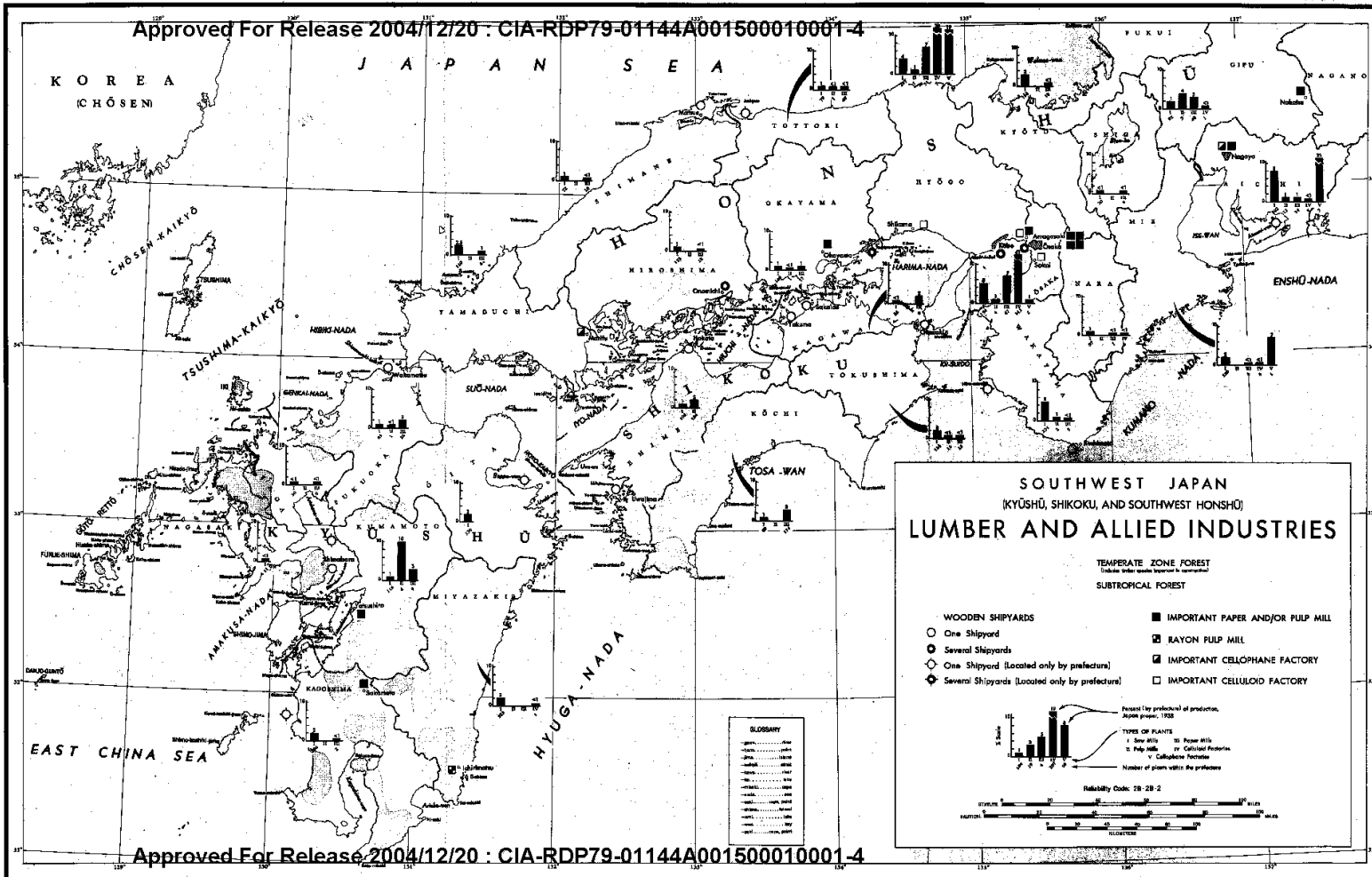


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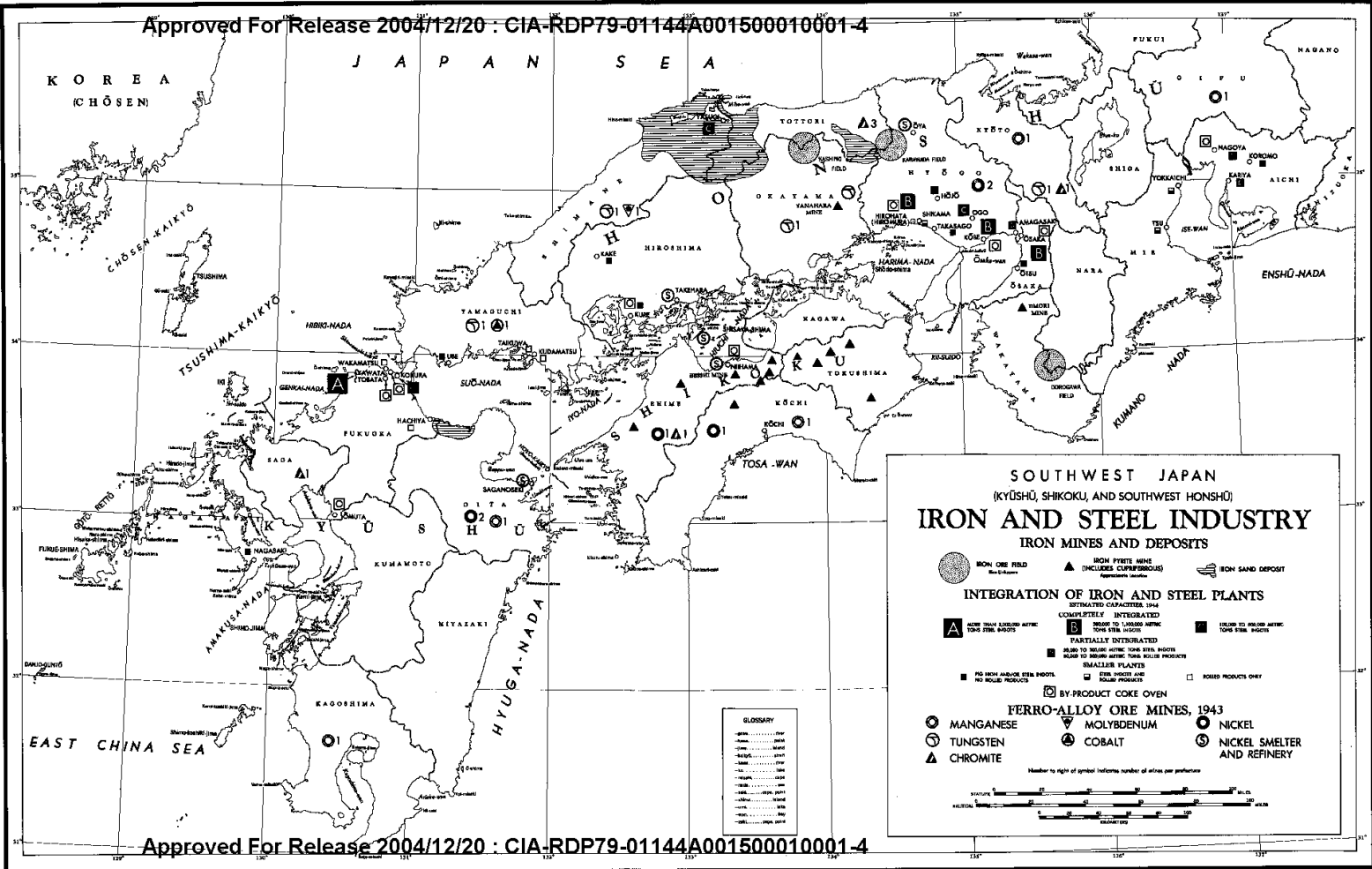
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FIGURE 1-18
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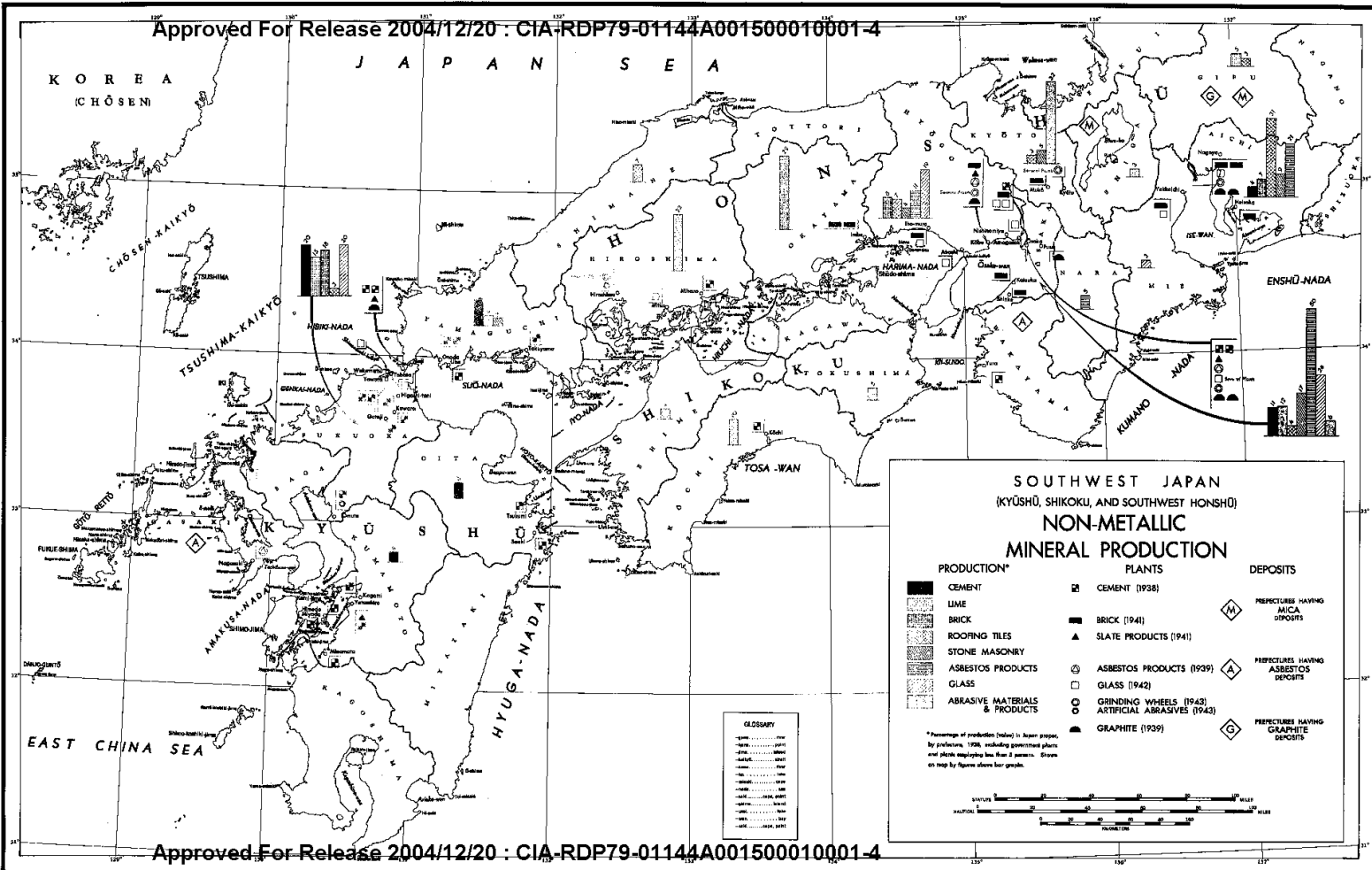


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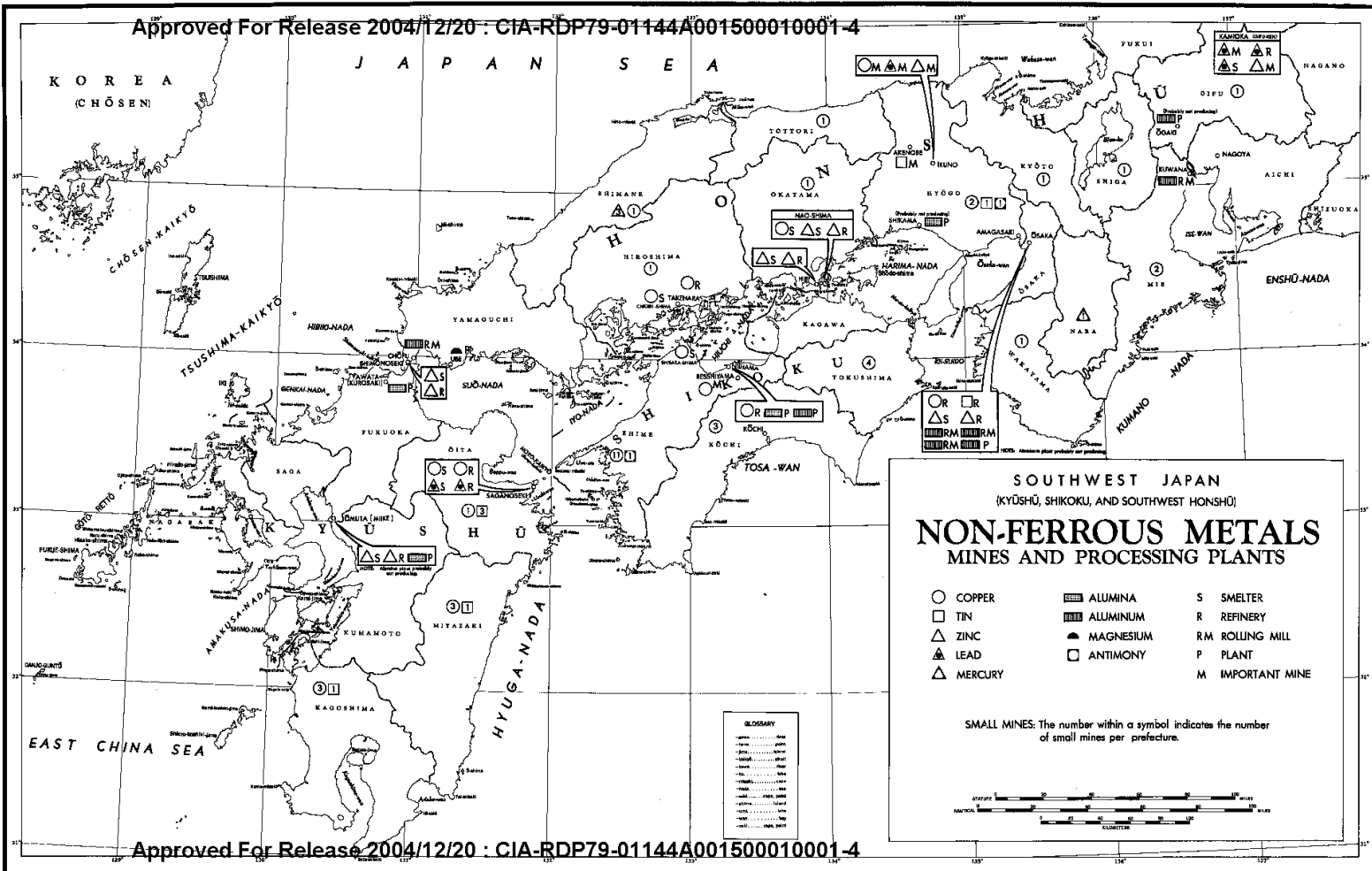


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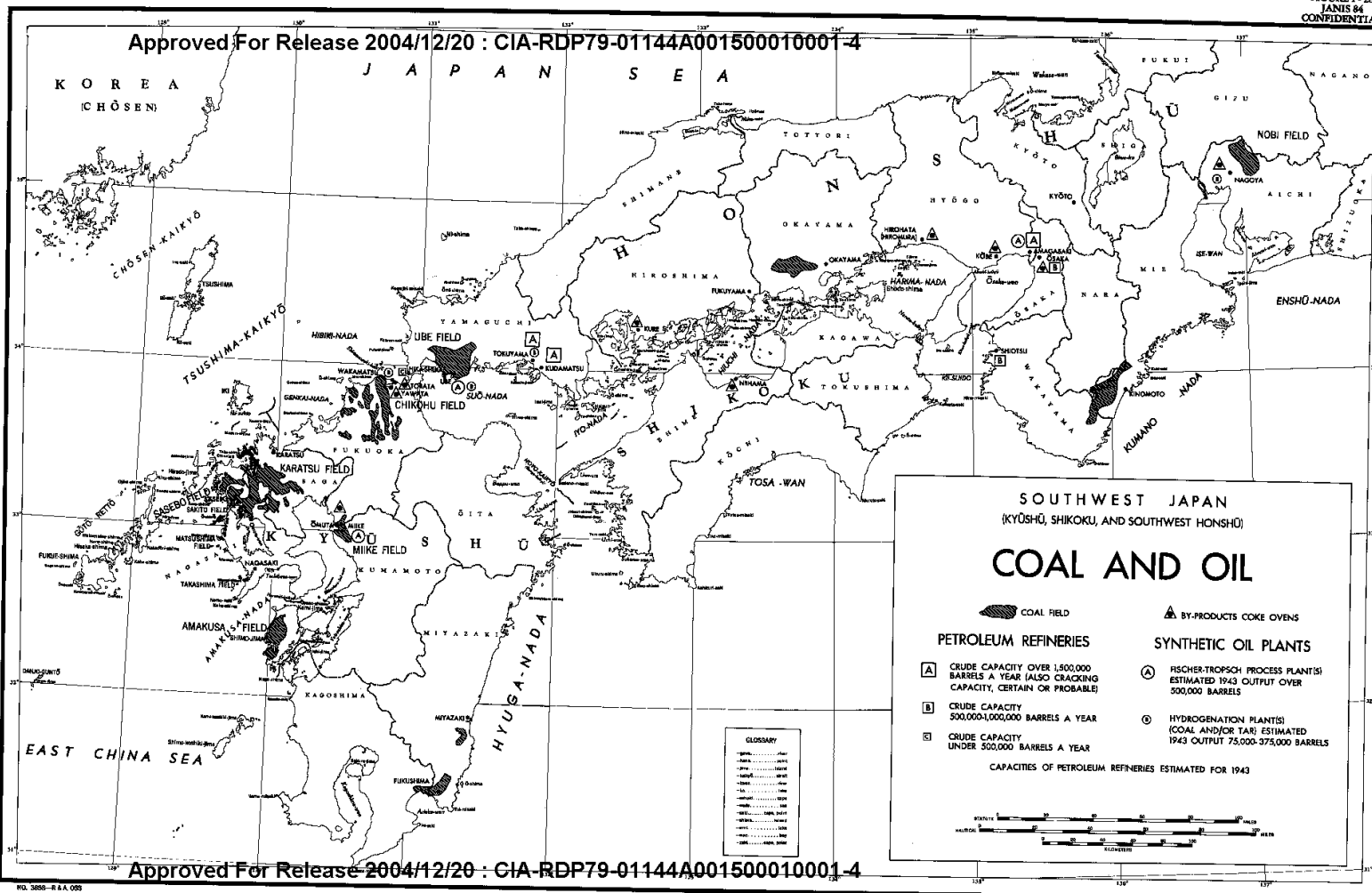
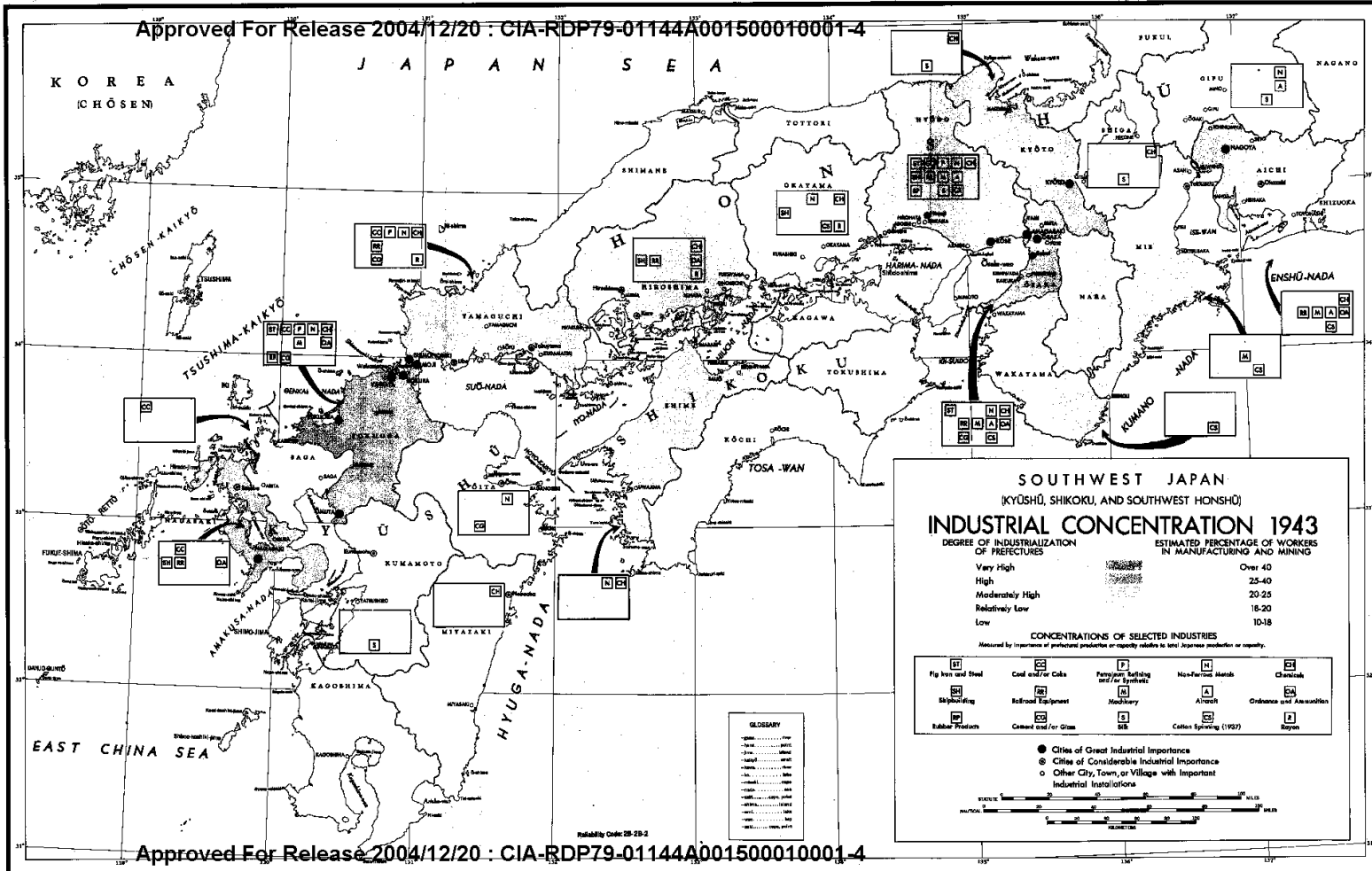


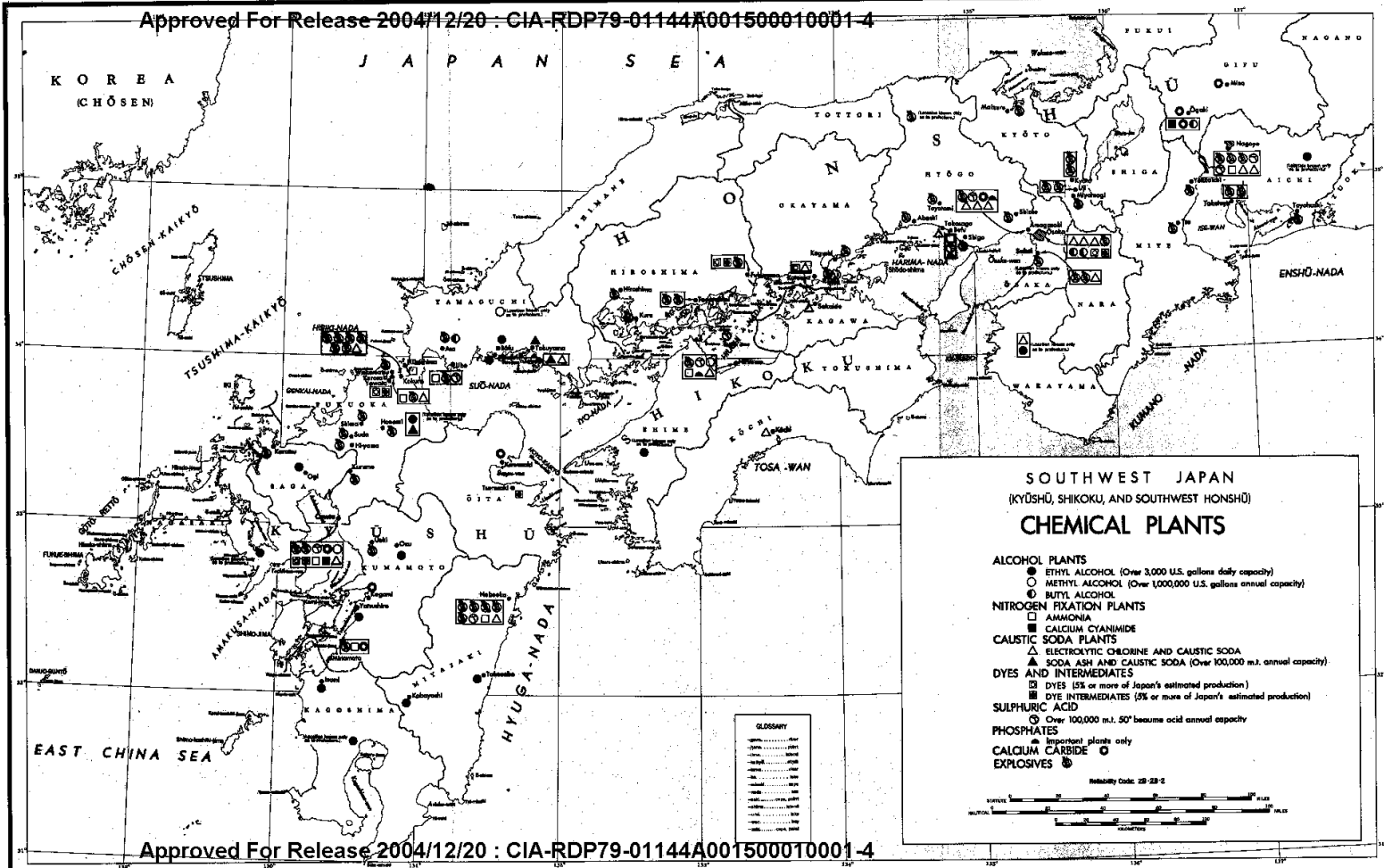
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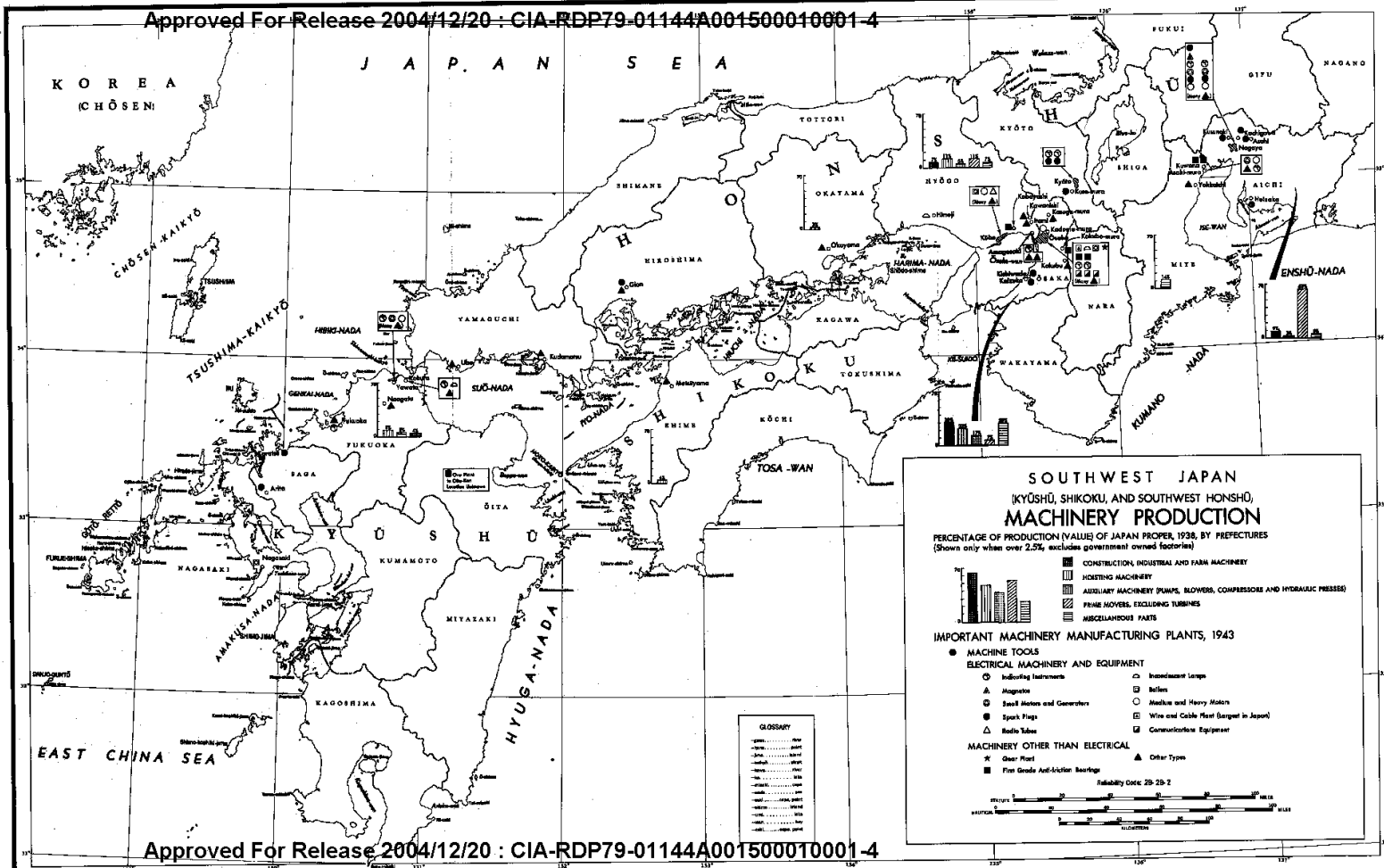
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SOUTHWEST JAPAN
(KYŪSHŪ, SHIKOKU, AND SOUTHWEST HONSHŪ)
MACHINERY PRODUCTION

PERCENTAGE OF PRODUCTION (VALUE) OF JAPAN PROPER, 1938, BY PREFECTURES
(Shown only when over 2.5%, excludes government owned factories)

	CONSTRUCTION, INDUSTRIAL AND FARM MACHINERY
	HOISTING MACHINERY
	AUXILIARY MACHINERY (PUMPS, BLOWERS, COMPRESSORS AND HYDRAULIC PRESSES)
	FRAME MOWERS, EXCLUDING TURBINES
	MISCELLANEOUS PARTS

IMPORTANT MACHINERY MANUFACTURING PLANTS, 1943

MACHINE TOOLS

- Machine Tools
- Indicating Instruments
- △ Magnets
- Small Motors and Generators
- Spark Plugs
- △ Radio Tubes

ELECTRICAL MACHINERY AND EQUIPMENT

- Incandescent Lamps
- Bellows
- Medium and Heavy Motors
- Wire and Cable Plant (Installed in Japan)
- Communication Equipment

MACHINERY OTHER THAN ELECTRICAL

- ★ Gear Plant
- First Grade Anti-friction Bearings
- ▲ Other Types

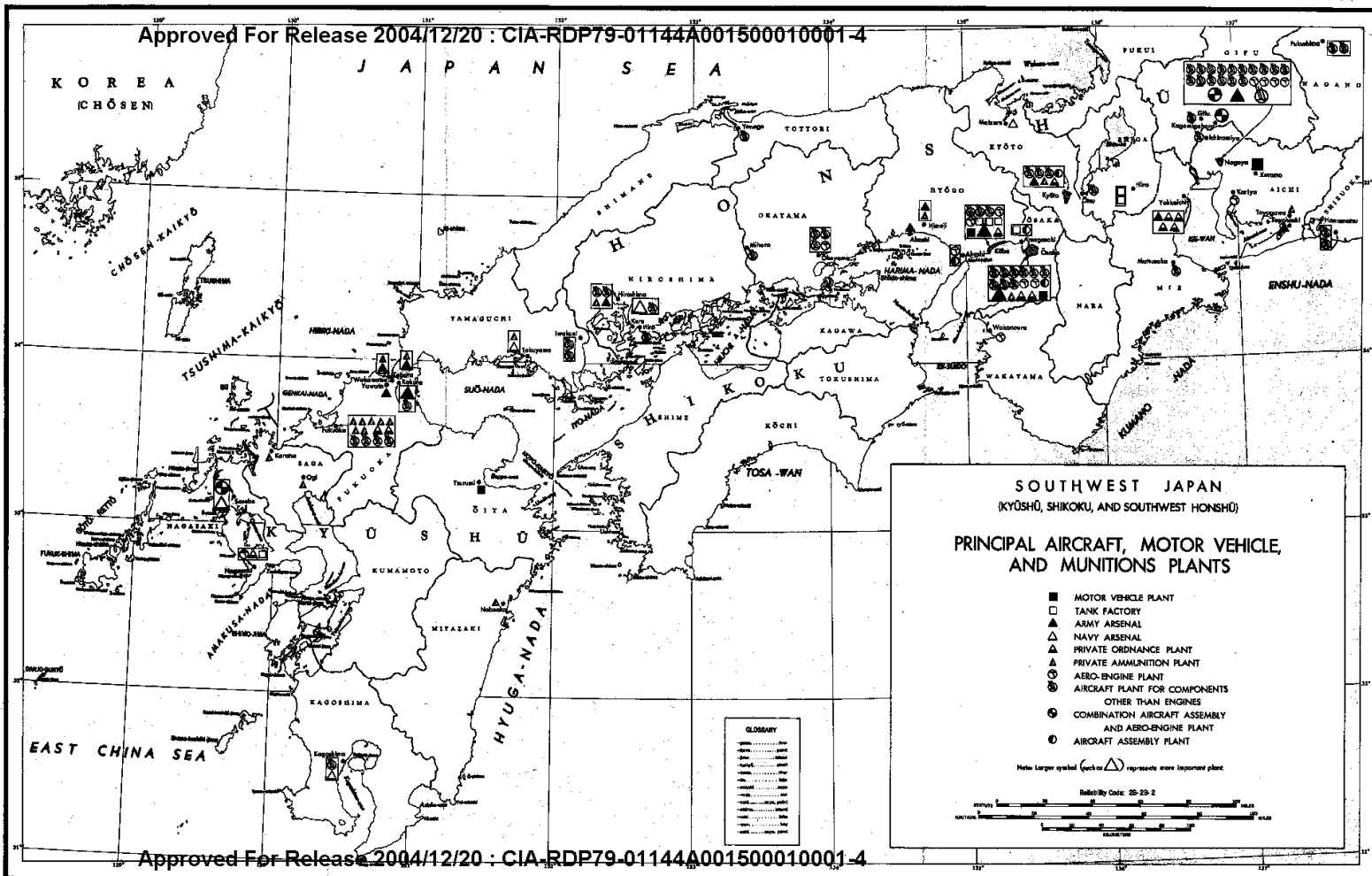
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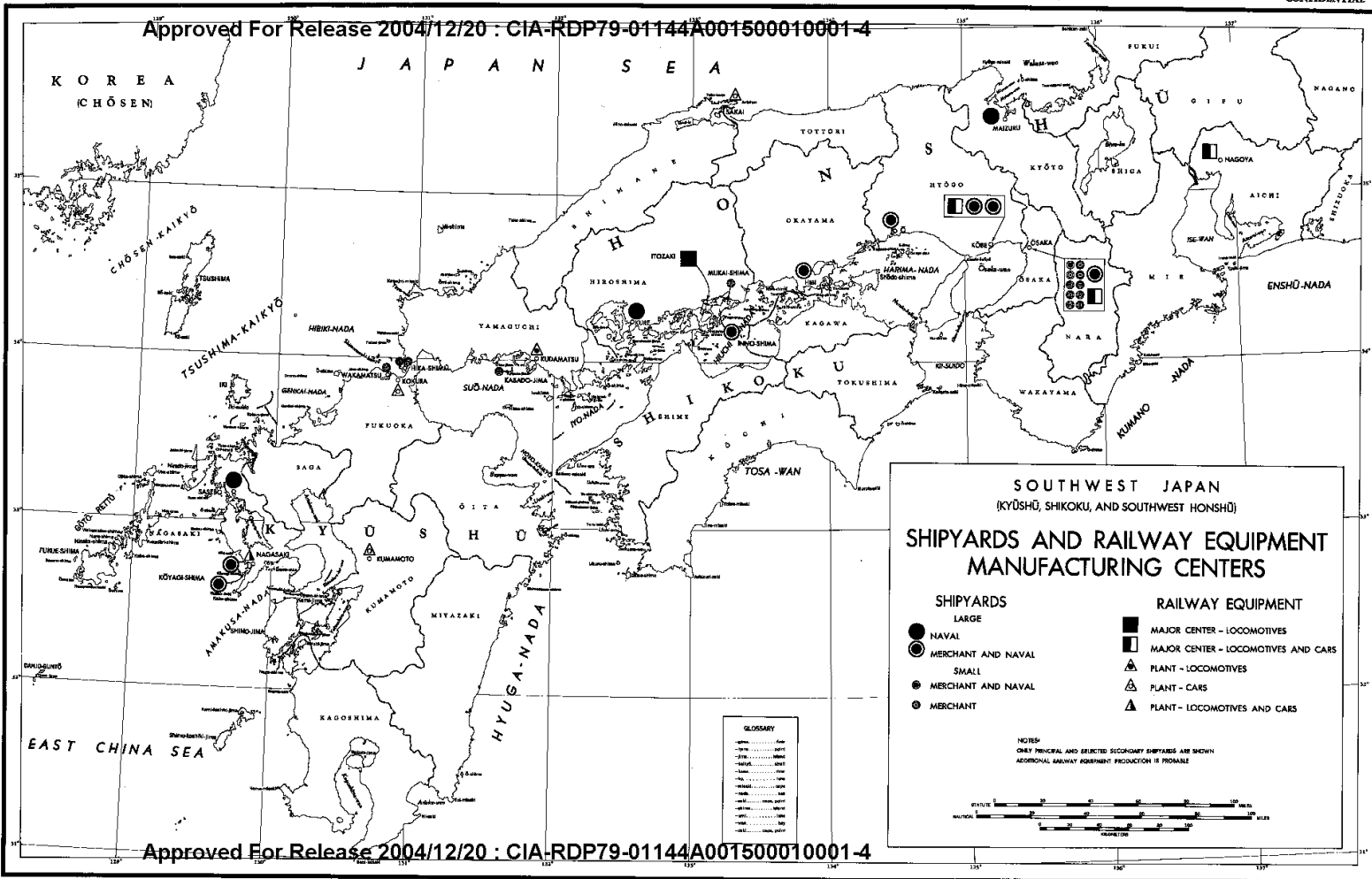
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FIGURE I-24
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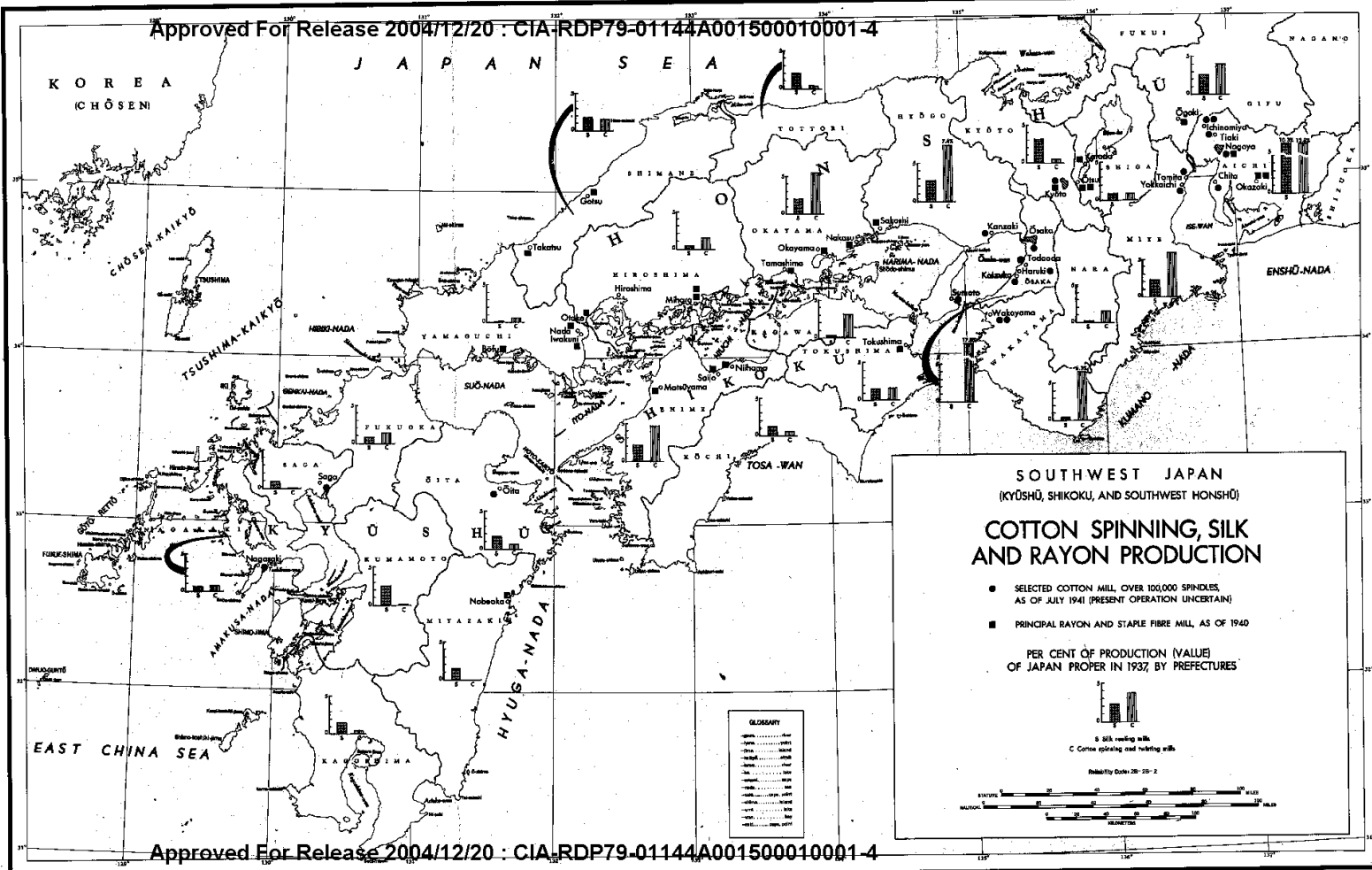


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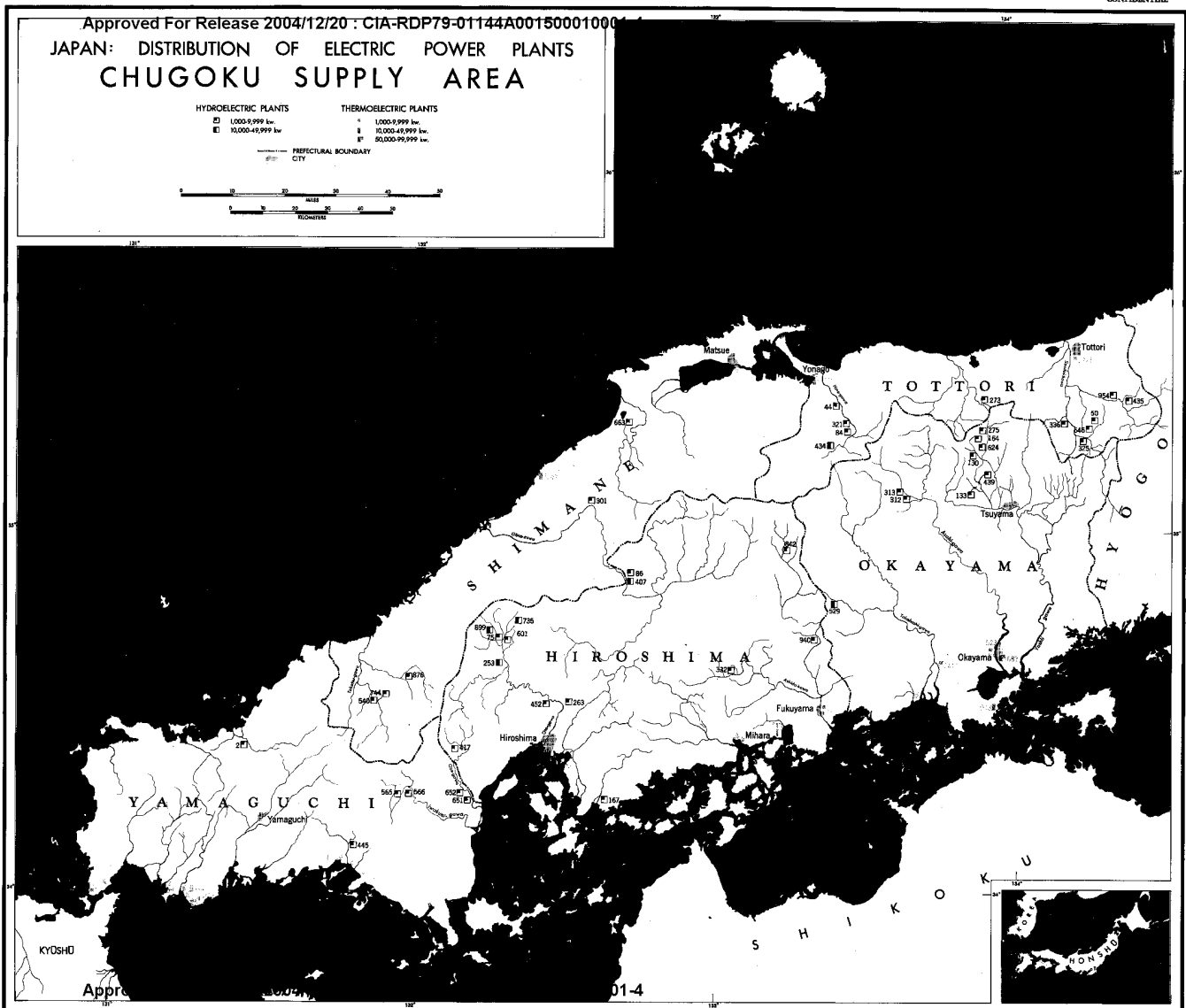
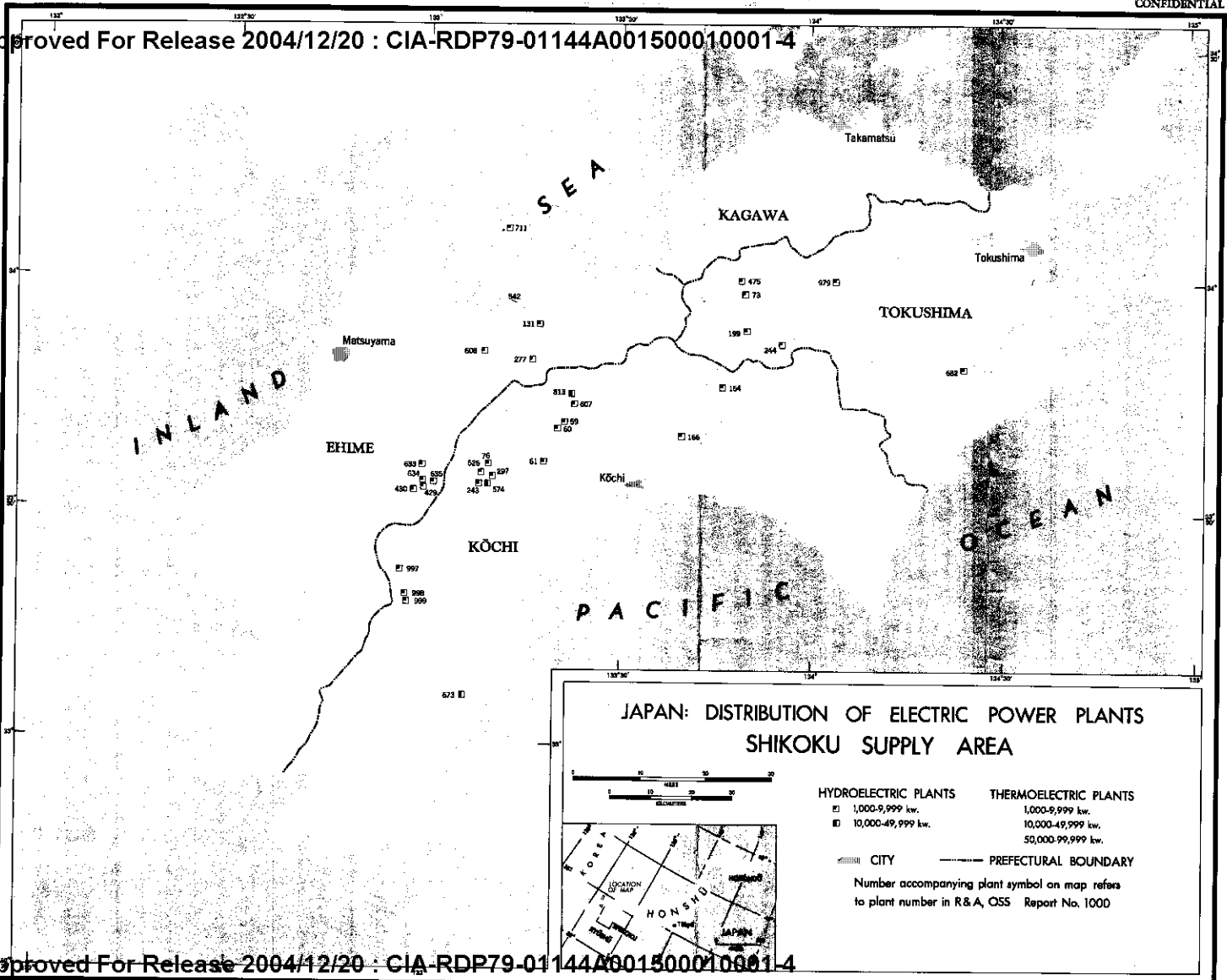


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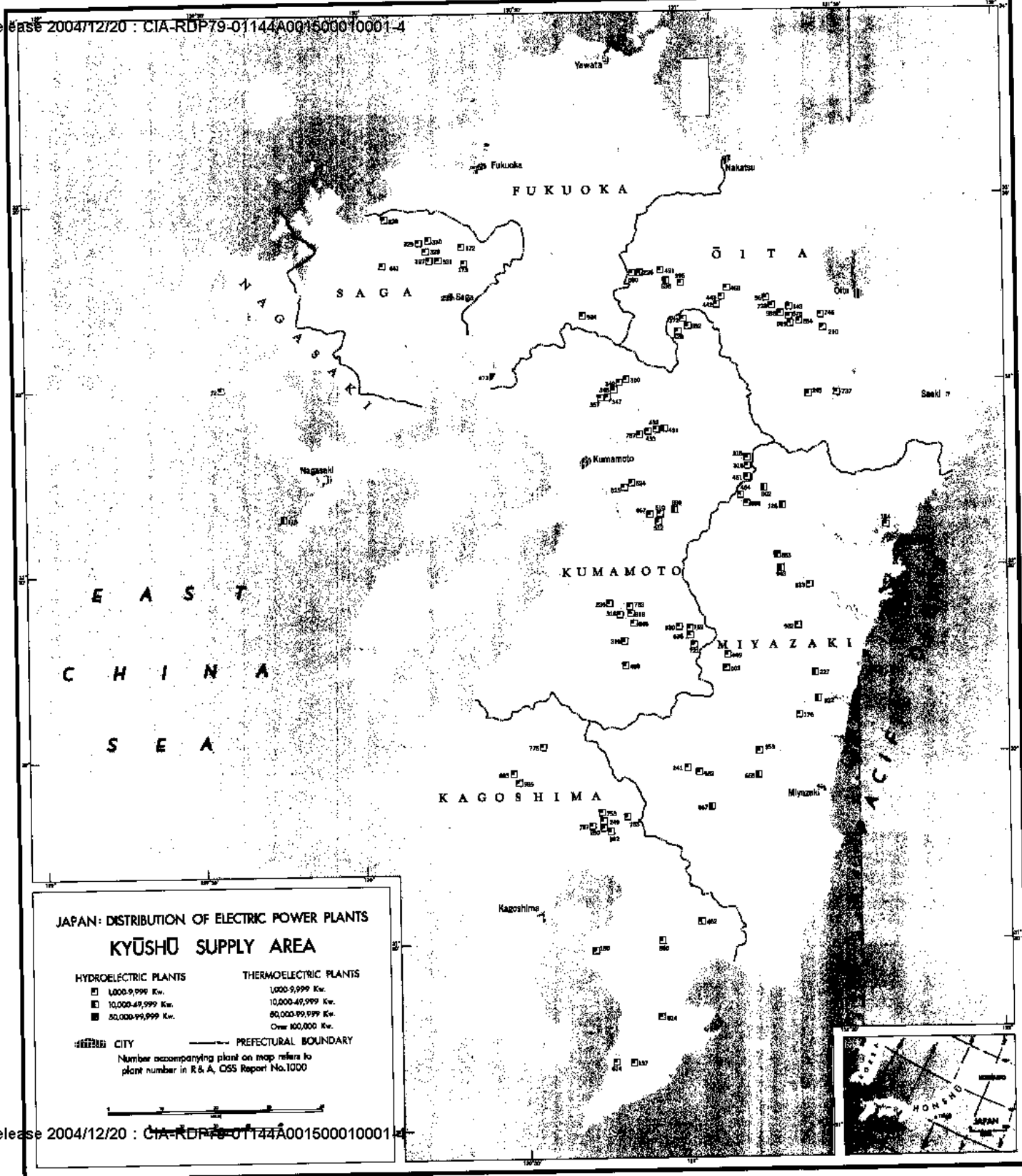
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FIGURE I - 29
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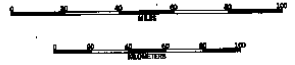
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FIGURE I-30
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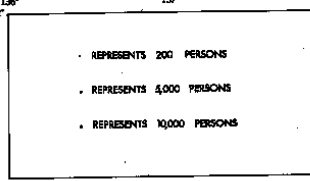
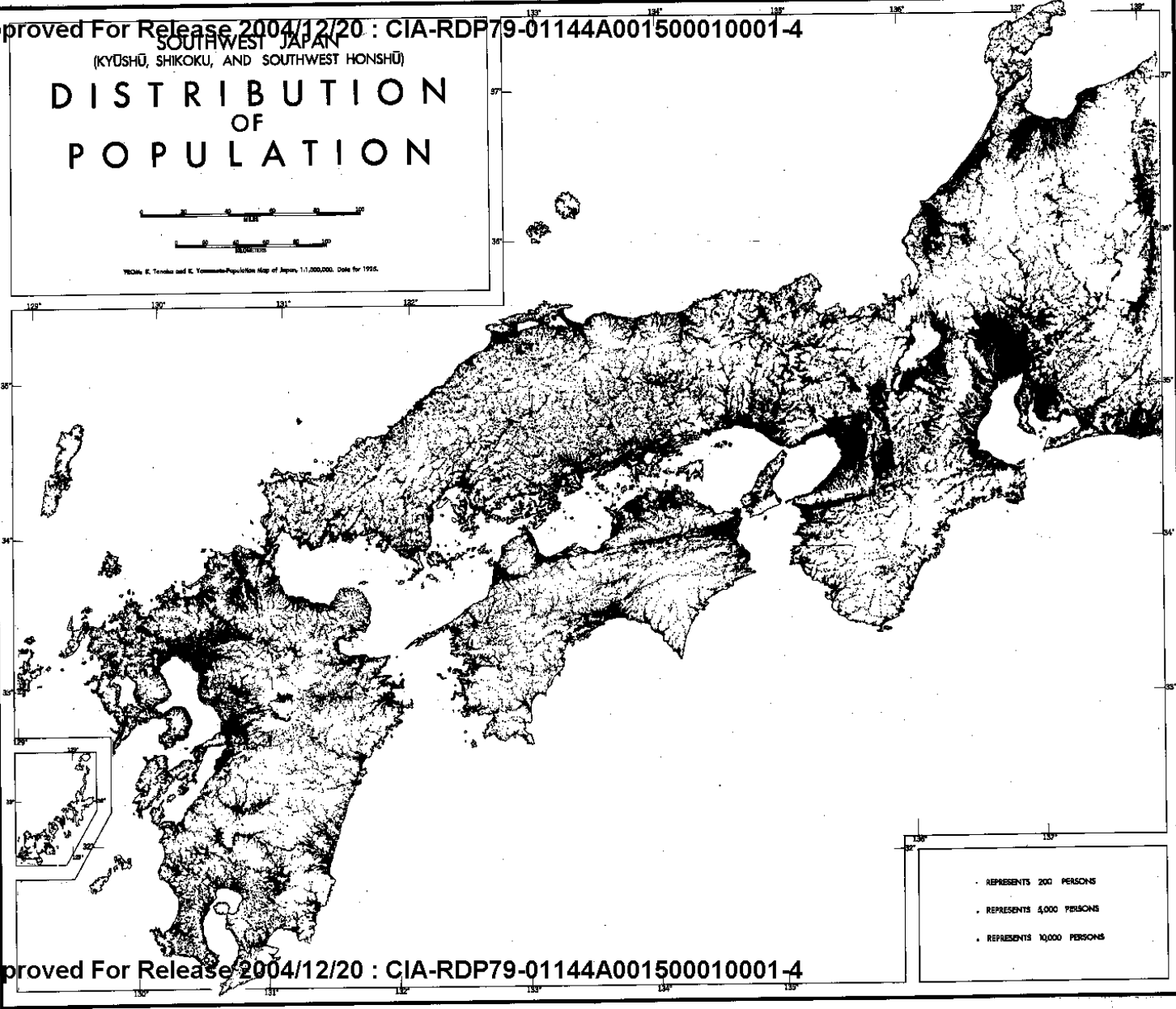
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SOUTHWEST JAPAN
(KYŪSHŪ, SHIKOKU, AND SOUTHWEST HONSHŪ)

DISTRIBUTION OF POPULATION

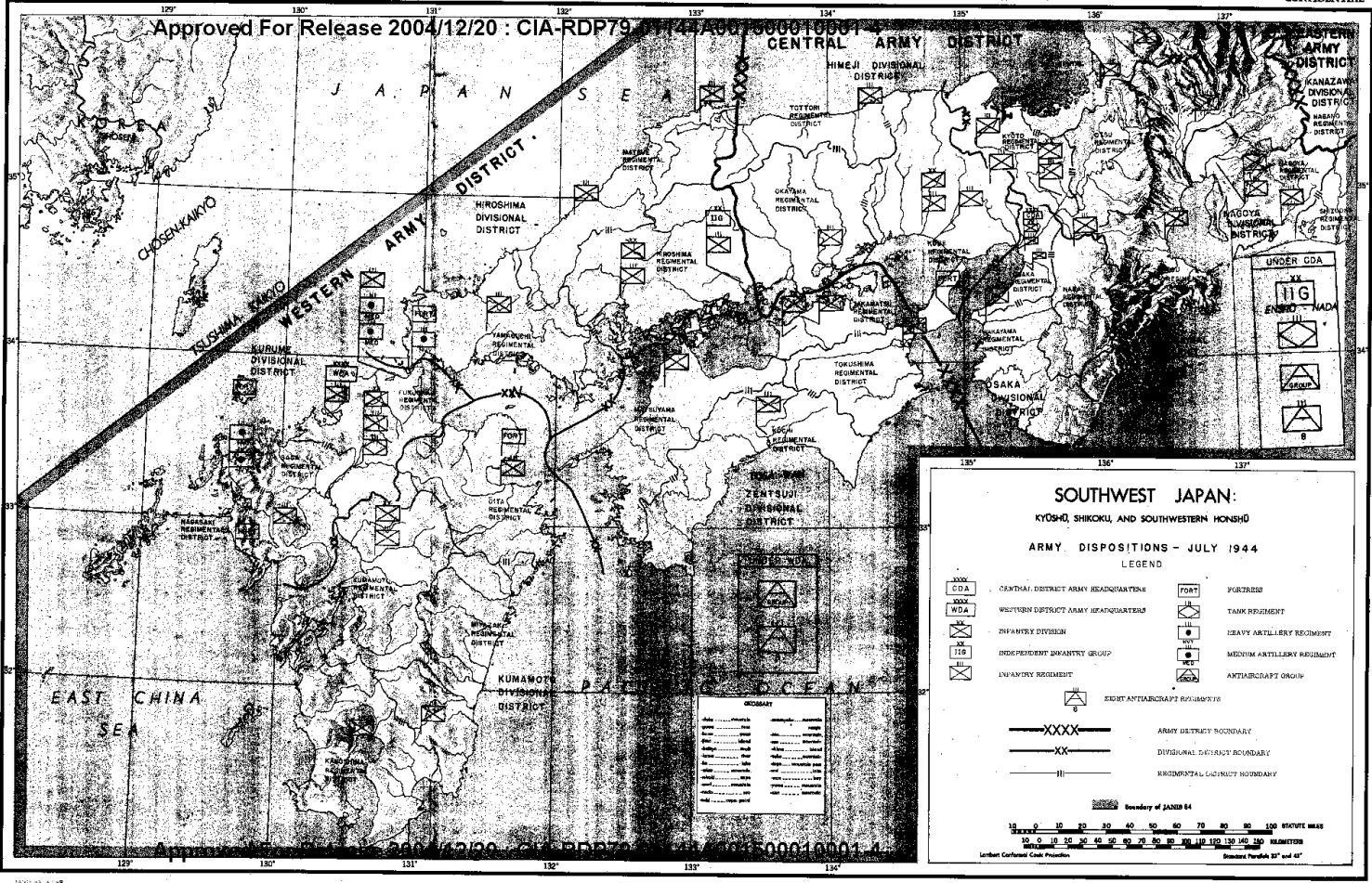


Yoshio K. Terada and K. Yamamoto: Population Map of Japan, 1:1,000,000. Date for 1976.



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FIGURE I-31
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CENTRAL ARMY DISTRICT

HIMEJI DIVISIONAL DISTRICT

TOTTON DISTRICT

OKAYAMA REGIMENTAL DISTRICT

ROKUSAWA REGIMENTAL DISTRICT

YAMAGUCHI REGIMENTAL DISTRICT

TOYURAMA REGIMENTAL DISTRICT

OSAKA DIVISIONAL DISTRICT

YAMAGATA REGIMENTAL DISTRICT

YAMAGUCHI REGIMENTAL DISTRICT

YAMAGUCHI REGIMENTAL DISTRICT

YAMAGUCHI REGIMENTAL DISTRICT

YAMAGUCHI REGIMENTAL DISTRICT

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YAMAGUCHI REGIMENTAL DISTRICT

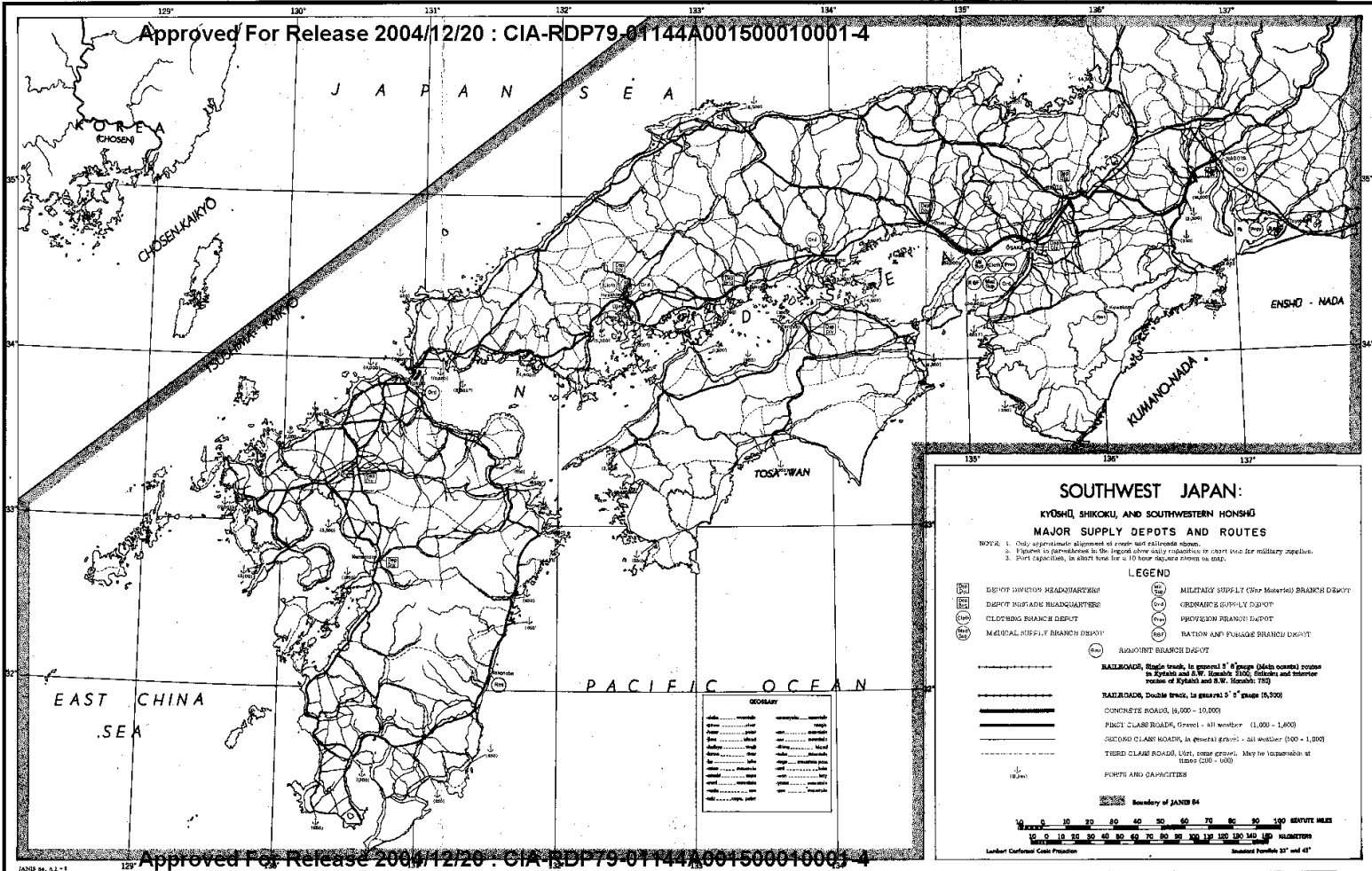


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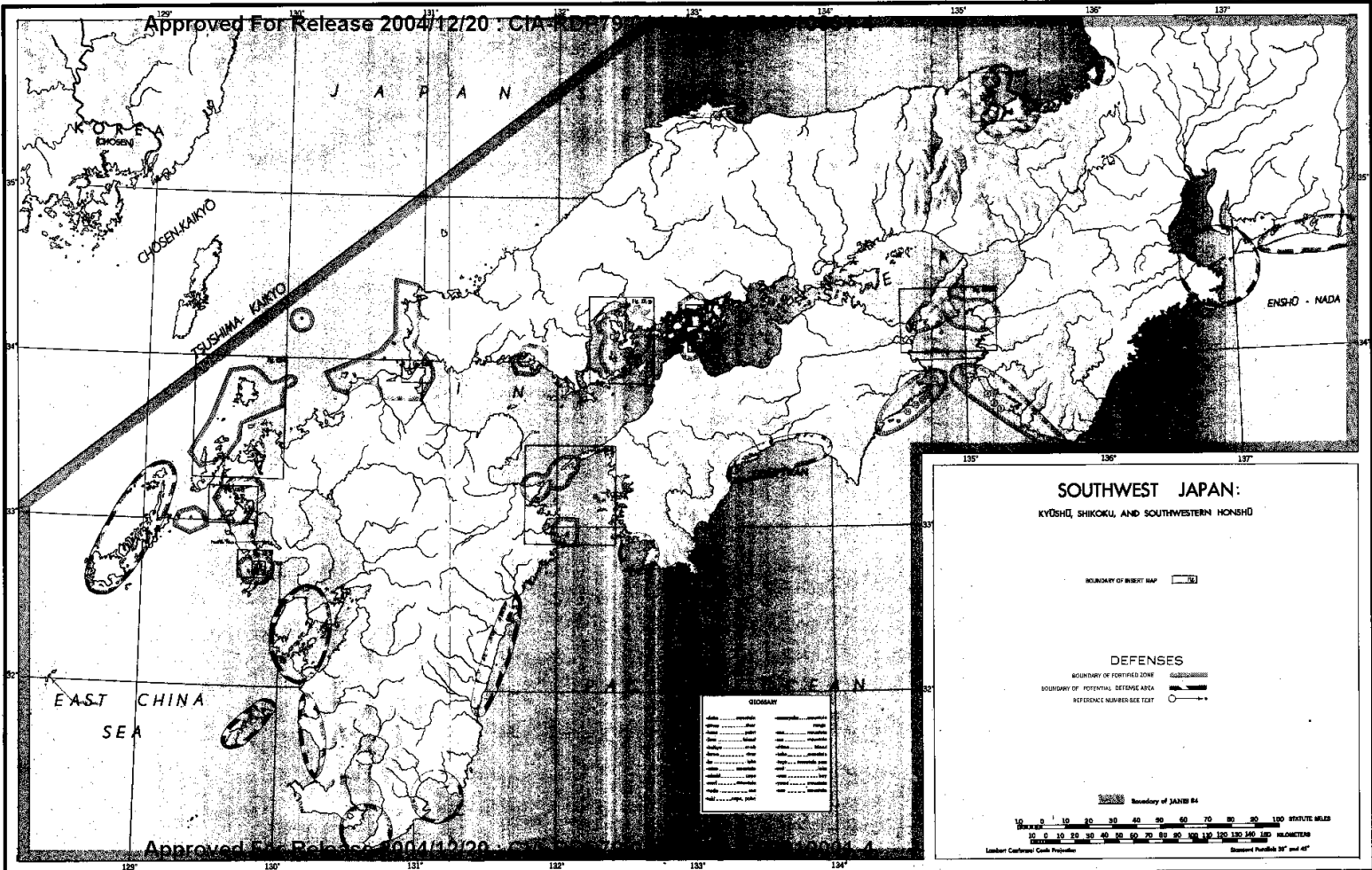


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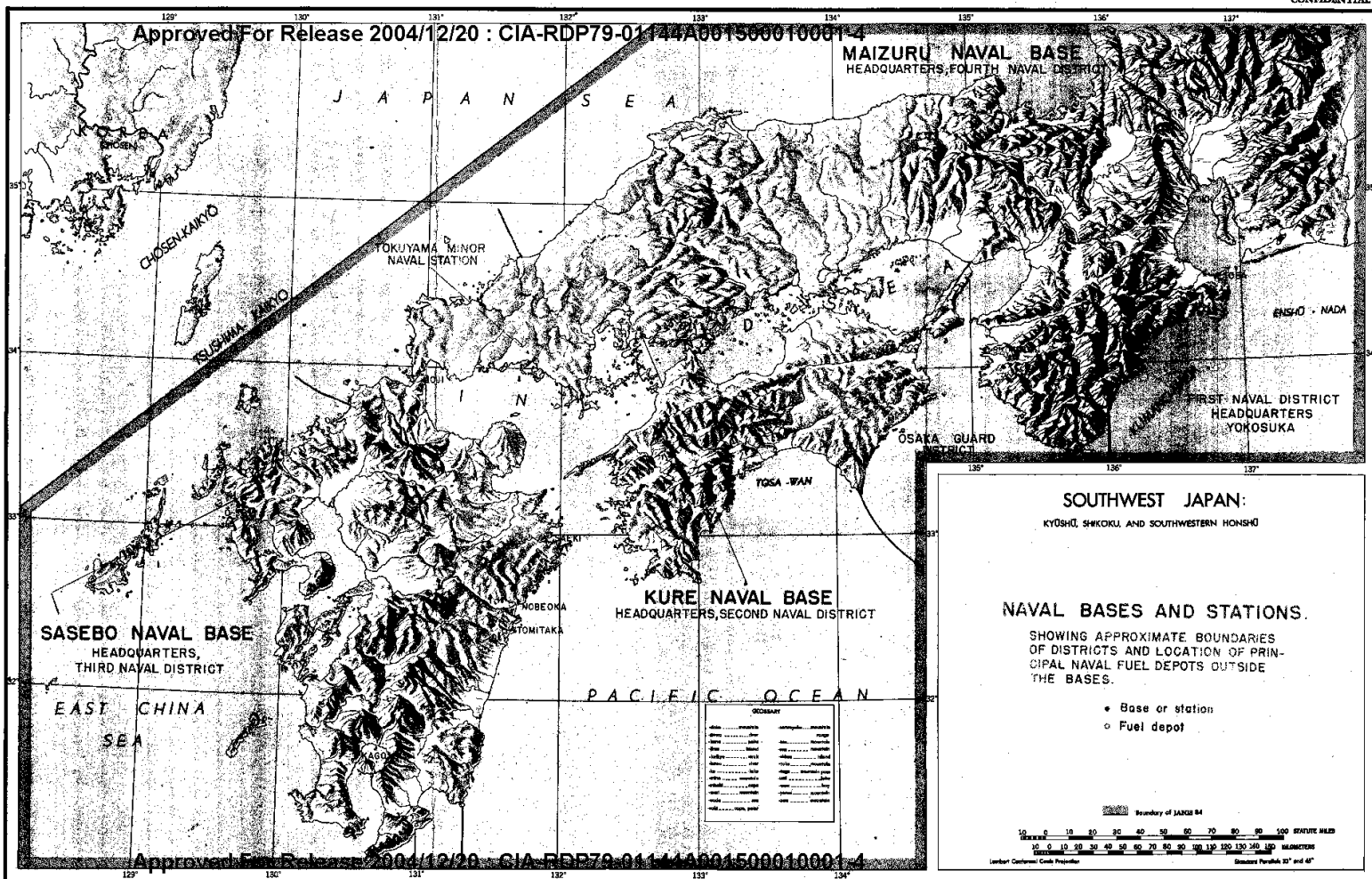
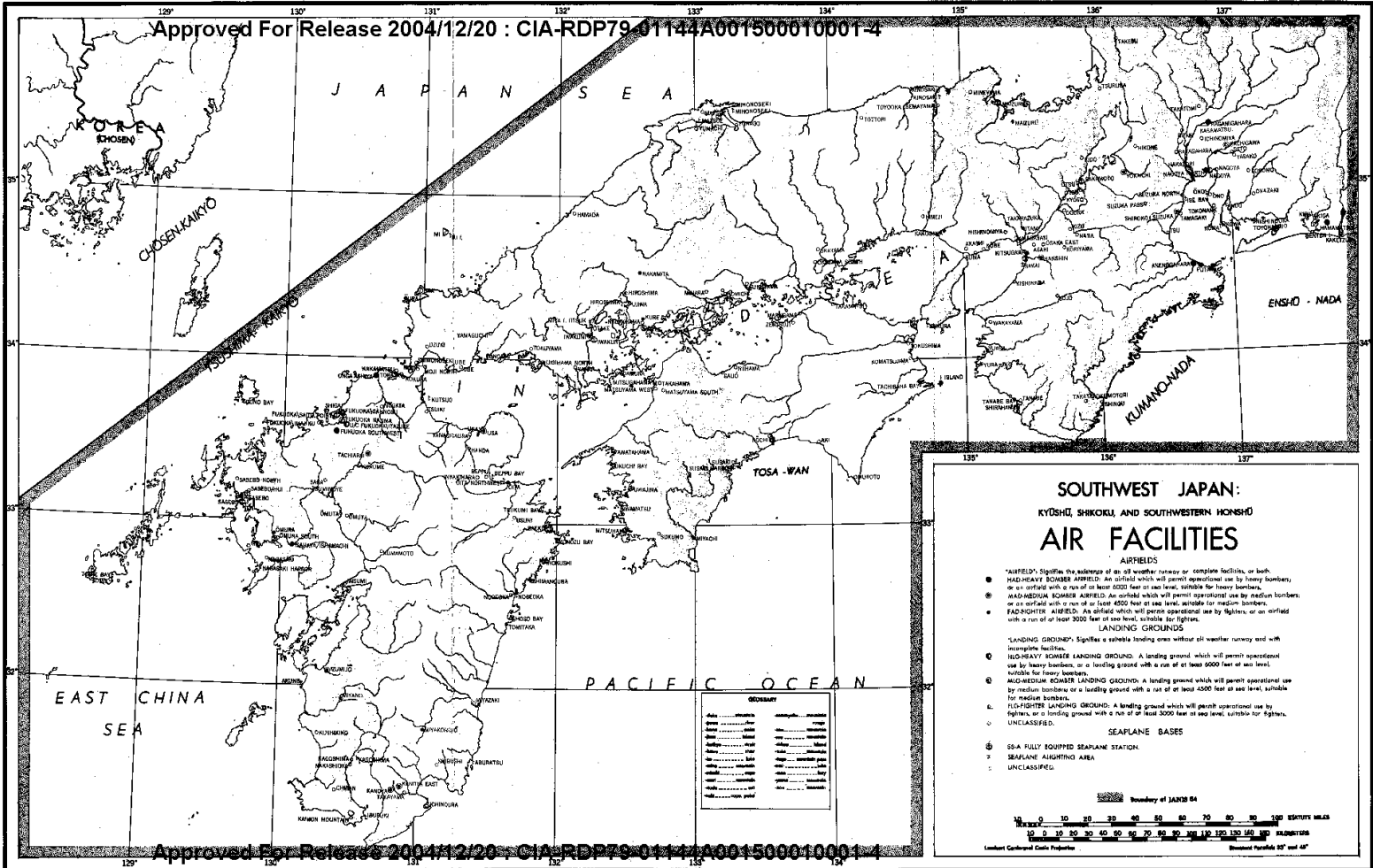


FIGURE I-35
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