FORMOSA
cop2
I.S.T.D./F/383 (RESTRICTED)
337 H 5
5438/46

THE GEOLOGY AND TOPOGRAPHY OF FORMOSA

(This report is a preliminary edition of Part IB of B.R. 877Q, the I.S.I.S. Report on Formosa)

INTER-SERVICE TOPOGRAPHICAL DEPARTMENT

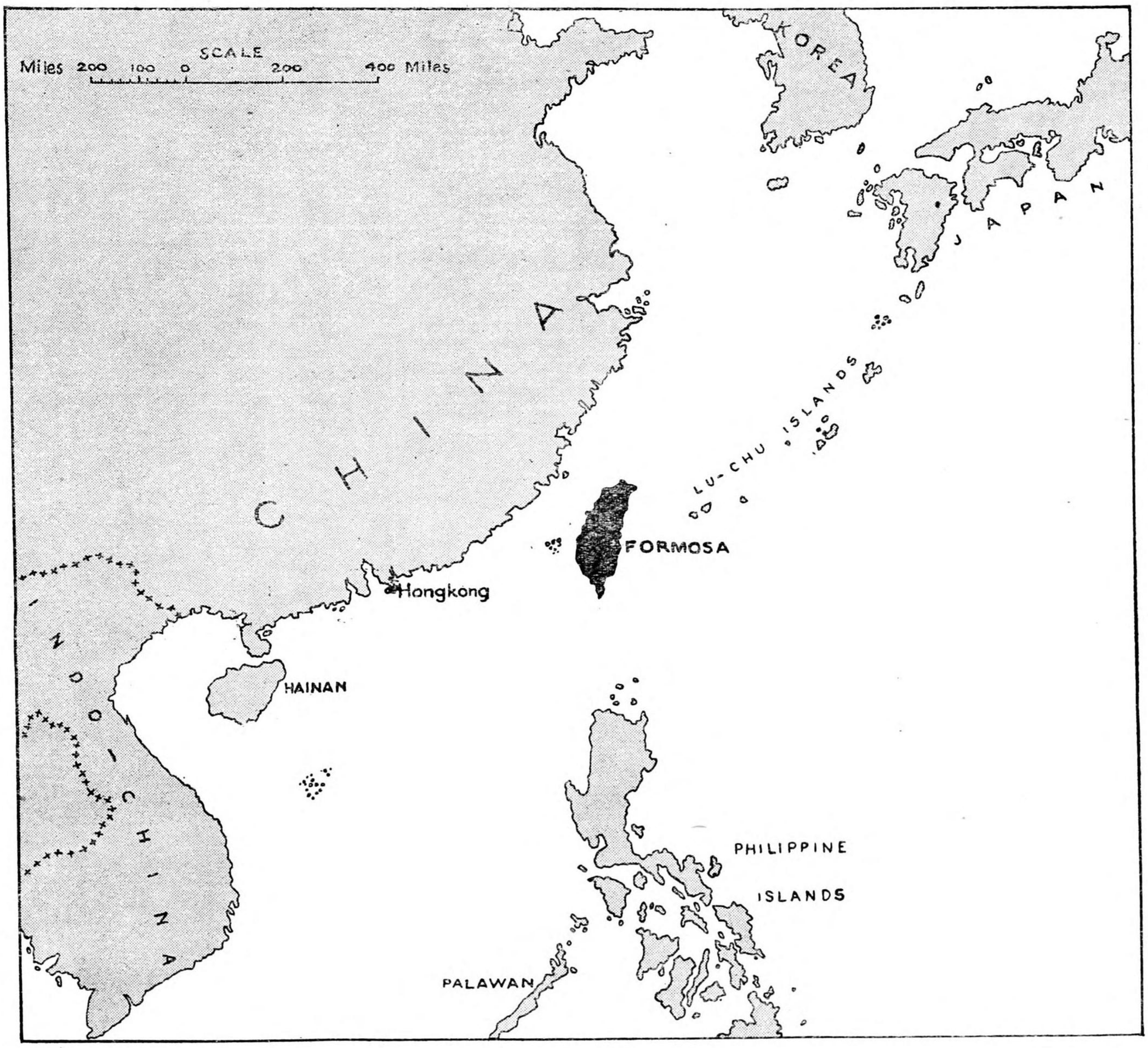
November 1944

RESTRICTED

This book is for the use of persons in H.M. Service only and must not be shown, or made available, to the Press or to any member of the public.

I.S.T.D./F/383 (RESTRICTED)

THE GEOLOGY AND TOPOGRAPHY
OF
FORMOSA



INTER-SERVICE TOPOGRAPHICAL DEPARTMENT

November 1944

B.R. 877 Q/2

A

CONTENTS

pag

(1) **GEOLOGY** . . . 1
INTRODUCTION . . . 1
General . . . 1
Erosion . . . 1
Weathering . . . 1
Hot springs and mud volcanoes . . . 1
Raised coral beaches . . . 1
ROCK TYPES . . . 1
Alluvium . . . 2
Old gravel terrace . . . 2
Young Sediments . . . 2
Clay-slates . . . 2
Schists . . . 2
Gneisses . . . 2
Limestones . . . 2
Volcanic rocks . . . 3
Basic igneous rocks . . . 3
SOILS . . . 3
Mountain soils . . . 3
Foothill soils . . . 3
Terrace soils . . . 3
Volcanic soils . . . 3
River valleys . . . 3
Alluvial plains . . . 3
BIBLIOGRAPHY FOR GEOLOGY . . . 3

(2) **TOPOGRAPHY** . . . 5
INTRODUCTION . . . 5
General . . . 5
Geology and relief . . . 5
Drainage . . . 5
Soils . . . 5
Natural vegetation . . . 5
Land utilization . . . 5
Settlement . . . 5
Predominant colours . . . 5
Suitability for operations . . . 5
Cover . . . 6
Maps, etc. . . . 6
I. THE SHICHISEI UPLAND . . . 6
Description of country . . . 6
General . . . 6
Geology . . . 6
Relief . . . 6
Drainage . . . 6
Soil . . . 7
Natural vegetation and land utilization . . . 7
Settlement . . . 7
Suitability for operations . . . 7
Cross-country movement . . . 7
Cover . . . 7
Observation . . . 7
Suitability for airborne landings . . . 7
Suitability for landing-grounds . . . 8
II. THE RINKO UPLAND . . . 8
Description of country . . . 8
General . . . 8
Geology . . . 8
Relief . . . 8
Drainage . . . 8
Soil . . . 8
Natural vegetation and land utilization . . . 9
Settlement . . . 9
Suitability for operations . . . 9
Cross-country movement . . . 9
Cover . . . 9
Observation . . . 9
Suitability for airborne landings . . . 9
Suitability for landing-grounds . . . 9
(i) Rinko plateau surface . . . 9
(ii) Coastal belt between the Tansui mouth and the sea coast . . . 9

(2) Topography—*cont.* *page*
III. THE TAIHOKU LOWLAND 9
Description of country 9
General 9
Geology 10
Relief 10
Drainage 10
Soil 11
Natural vegetation and land utilization 11
Settlement 11
Suitability for operations 11
Cross-country movement 11
Cover 11
Observation 11
Suitability for airborne landings 11
Suitability for landing-grounds 11

IV. THE CHUREKI LOW PLATEAU 12
Description of country 12
General 12
Geology 12
Relief 12
Drainage 12
Soil 13
Natural vegetation and land utilization 13
Settlement 13
Suitability for operations 13
Cross-country movement 13
Cover 13
Observation 13
Suitability for airborne landings 13
Suitability for landing-grounds 14

V. THE SHINCHIKU-TAICHU COASTAL HILL REGION 14
Description of country 14
General 14
Geology 14
Relief 14
Drainage 16
Soil 16
Natural vegetation and land utilization 16
Settlement 16
Suitability for operations 16
Cross-country movement 16
Cover 16
Suitability for airborne landings 16
Suitability for landing-grounds 17
(i) The Shinchiku-lower Hozan valley area 17
(ii) The middle Au-lieng-k'e valley and Koryu area 17
(iii) Between the Taiko and Taito rivers 17
(iv) The Taian-Taiko delta area 17
Observation 17

VI. THE SEIRA PLAIN 18
Description of country 18
General 18
Geology, relief, and drainage 18
Natural vegetation and land utilization 18
Settlement 20
Suitability for operations 20
Cross-country movement 20
Cover 20
Observation 20
Suitability for airborne landings 20
Suitability for landing-grounds 20

VII. THE TAINAN-TAKAO COASTAL PLAIN 20
Description of country 20
General 20
Geology and relief 20
Drainage 22
Soils 22
Natural vegetation and land utilization 22
Settlement 22
Suitability for operations 22
Cross-country movement 22
Cover 23
Observation 23
Suitability for airborne landings 23
Suitability for landing-grounds 23

page
(2) Topography—*cont.* 23
VIII. THE HEITO PLAIN 23
Description of country 23
General 23
Ryukyu-sho 23
Geology 23
Relief and drainage 25
Soils 25
Natural vegetation 25
Land utilization 25
Settlement 25
Suitability for operations 25
Cross-country movement 26
Cover 26
Observation 26
Suitability for airborne landings 26
Suitability for landing-grounds 26
IX. THE MOUNTAINS 26
Description of country 26
General 26
Geology and relief 28
Drainage 28
Soil 28
Natural vegetation and land utilization 29
Settlement 29
Suitability for operations 29
Cross-country movement 29
Cover 29
Observation 29
Suitability for airborne landings 29
Suitability for landing-grounds 29
X. THE GIRAN LOWLAND 29
Description of country 29
General 29
Geology 29
Relief 30
Drainage 30
Soil 30
Natural vegetation and land utilization 31
Settlement 31
Suitability for operations 31
Cross-country movement 31
Cover 31
Observation 31
Suitability for airborne landings 31
Suitability for landing-grounds 31
XI. THE KARENKO-TAITO VALLEY 31
Description of country 31
General 31
Geology 31
Relief 32
Drainage 32
Soil 32
Natural vegetation and land utilization 33
Settlement 33
Suitability for operations 33
Cross-country movement 33
Cover 33
Observation 33
Suitability for airborne landings 33
Suitability for landing-grounds 33
Karenko plain 33
Taito plain 33
XII. THE EAST COASTAL PLAIN 33
Description of country 33
General 33
The islands of Kasho-to and Koto-sho 35
Geology 35
Relief 35
Drainage 35
Soil 35
Natural vegetation and land utilization 35
Settlement 35
Suitability for operations 35
Cross-country movement 35
Cover 35
Observation 35
Suitability for airborne landings 35
Suitability for landing-grounds 35

page

(3) **NOTES ON SUITABILITY FOR THE RAPID CONSTRUCTION OF AIRFIELDS** . 36
TOPOGRAPHY 36
SOILS 36
METEOROLOGY 36

DIAGRAMS

Fig. 1 Formosa. Location map . . . . . *on title page*
Fig. 2 Japanese maps available . . . . . *facing page* 1
Fig. 3 Topographical regions . . . . . ,, *page* 5
Fig. 4 Region I. The Shichisei upland 6
Fig. 5 Region II. The Rinko upland 8
Fig. 6 Region III. The Taihoku lowland 10
Fig. 7 Region IV. The Chureki low plateau 12
Fig. 8 Region V. The Shinchiku—Taichu coastal hill region 15
Fig. 9 Region VI. The Seira plain 19
Fig. 10 Region VII. The Tainan—Takao coastal plain 21
Fig. 11 Region VIII. The Heito plain 24
Fig. 12 Region IX. The Mountains 27
Fig. 13 Region X. The Giran lowland 30
Fig. 14 Region XI. The Karenko—Taito valley 32
Fig. 15 Region XII. The east coastal range 34
Fig. 16 Typical daily rainfalls in certain months at Tainan 37

PHOTOGRAPHS . . . . . *at end*

PLANS . . . . . *in pocket at back*

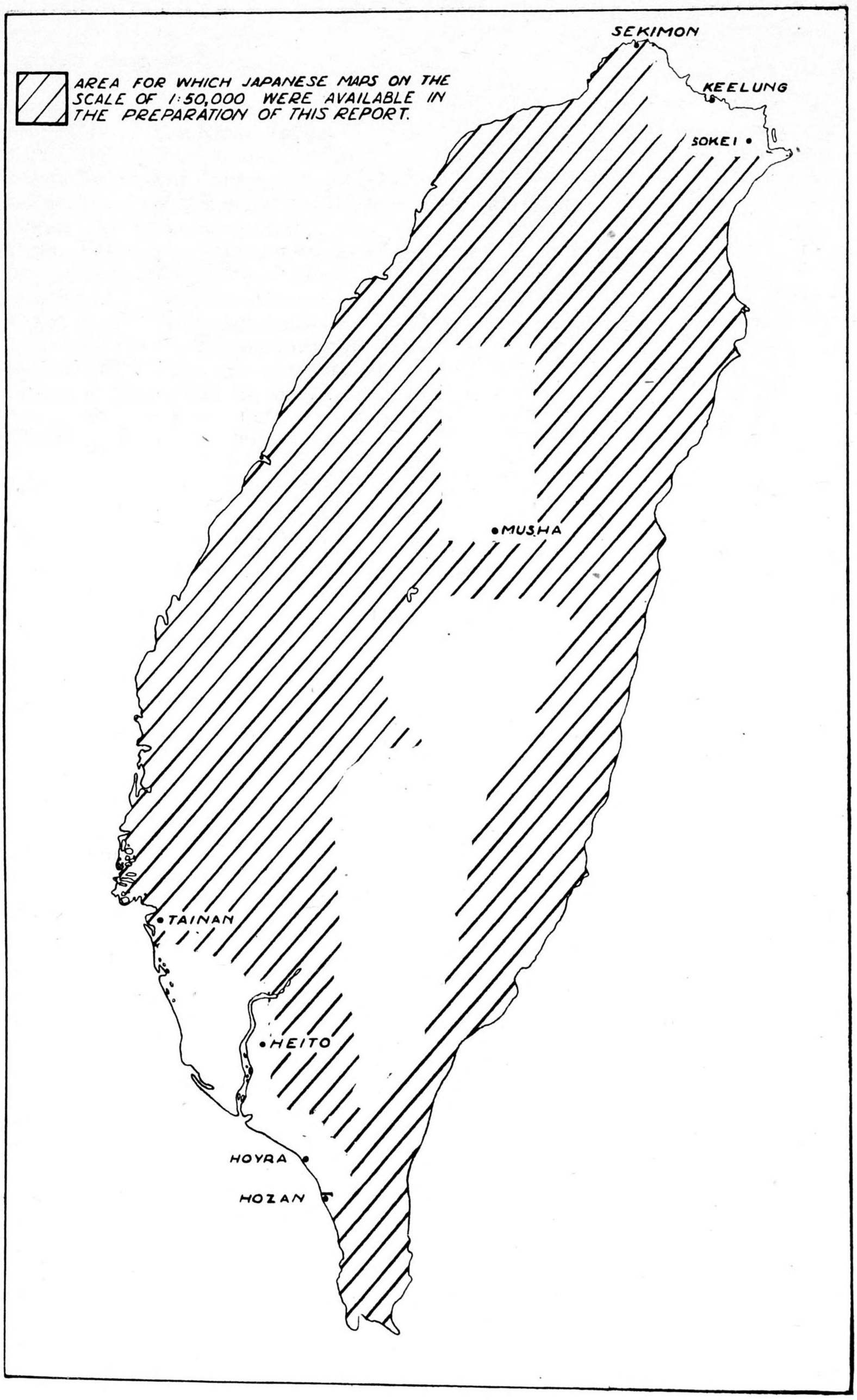


Fig. 2. Japanese maps available

GEOGRAPHY

(1) GEOLOGY

(*Plans* 2, 12-19; *photographs A*.8, 12, 17, 22, 33, 41, 69, 71-77, 79-85, 87)

INTRODUCTION

The available literature and maps include very little detailed geology, the only fully mapped area being one some 20 miles (north and south) by 10 miles (east and west) east of Toyahara (*Bib.* 5*). Most of the literature is of a very general nature. The geological map (*Plan* 2) is a simplification based on one published in 1926 by the Section of Commerce and Industry, Bureau of Productive Industry, Government General of Taiwan. The detail on this map is not considered to be accurate as many of the geological boundaries appear to have been drawn conjecturally.

General

Although Formosa is an island some 90 miles off the mainland of Asia, it is still part of the continental mass, the edge of which skirts the island's eastern shores. This edge marks a line of weakness in the earth's crust along which intense stresses have long been active and where adjustments cause earthquake shocks. These stresses have folded, faulted and altered the older strata of Formosa (*photograph A*.71) and deformed the younger beds to a lesser degree. Successive subsidences and uplifts have first provided basins for sedimentation in submerged areas and then elevated portions of the accumulated deposits above the level of the sea. In this manner a succession of sedimentary strata (shales, sandstones, conglomerates and a little limestone) has been built up, each younger one being less deformed than those preceding it. Some volcanic activity took place during later periods and contributed eruptive rocks, many beds of which lie concordantly with the sediments in the Taito coast range, and a few elsewhere. The only recognizable volcano (now extinct) at present is Mount Daiton which has added eruptive rocks on the northern tip of the island. Intrusive rocks have apparently played a very small part in the formation of the island; relatively small occurrences of igneous rocks, diabases, diorites and serpentines are found in the mountainous regions.

Thus Formosa is composed of a backbone of folded, faulted and altered rocks (*photographs A*.71-75), now largely slates, schists, limestones, quartzites and sandstones, flanked by younger, less compacted and less deformed shales, sandstones and conglomerates (*photographs A*.83, 84) which, to the east in the Taito coast range, have a number of associated volcanic beds. Here and there small masses and sheet-like sills or dykes of diorite, serpentine and diabase cut through the sediments. At the northern end of the island the Daiton volcano has built up a cone of eruptive rocks, now dissected by erosion.

In recent geological times Formosa was a very much smaller island than it is to-day. Rapid erosion brought down large quantities of debris which accumulated in the shallow seas surrounding the island as beds of gravel with sand and clay layers. At the same time coral reefs were formed off the southern and south-western coasts and around the present islands of Ryukyu-sho, Kasho-to and Koto-sho. Subsequent uplift gradually brought the island to its present elevation with the gravels forming the old terraces (*photographs A*.12, 17, 83) and the coral limestone giving the hills and cliffs now found around the southern shores and on the islands mentioned above (*photographs A*.79, 80). Finally further rapid erosion dissected the old gravel terraces and washed masses of detritus, mainly coarse, down on to the lower ground thus forming the alluvium.

*See Bibliography, p. 3.

Erosion

One of the main features of Formosa is the very widespread occurrence of gravel (*photographs A*.12, 69, 85, 87). The last tectonic movement, being one of uplift, has kept the river gradients steep; this, in combination with torrential rains, has caused rapid surface erosion and the transportation of much coarse detritus from the mountainous regions. As these rivers debouch into flatter country the boulders and gravels are dropped in the form of spreads. Flood waters carry these gravels even farther afield, eventually covering wide areas. Another result of the turbulent drainage is that the finer silts and clays are largely carried out to sea; in fact the only surface area of any extent where there is deposition of finer sediments is along the west coast from Rokko to Takao.

Weathering

Rock weathering in Formosa is very largely influenced by the rapid erosion. Although the island has a sub-tropical climate the usually attendant rotting of rocks in situ is not much in evidence owing to rapid denudation. Rock weathering is, therefore, more similar to that found in temperate climates. Some lateritization (development of red earth rich in iron oxides and hydroxides) is evident, more particularly in the soils overlying the old gravel terraces. Bleaching accompanies the weathering of many rocks, more particularly the schists and clay-slates. Weathering generally effects a softening of rocks, more in some than in others, but seldom to depths of more than a few feet. Notes on the resistance of rocks to weathering will be found under the descriptions of 'Rock types'.

Hot springs and mud volcanoes

Many hot springs are reported on the island, chiefly rising through rocks of the Young Sediments. The most prolific hot spring areas are in the Taito coast range and on the Koshun peninsula (conspicuously at Shichohei).

Mud volcanoes, also rising from the Young Sediments, occur at a few localities in the western lowlands, the chief one lying east of Kyoshito (*photograph A*.33).

Raised coral beaches

Around the southern shores of Formosa and around the islands of Kasho-to, Koto-sho and Ryukyu-sho much coral has been formed. The recent uplift has brought some of this coral either above sea level (*photograph A*.82) or to a point where it is exposed at low tide, when it forms very rough beaches (*photographs A*.80, 81).

ROCK TYPES

Alluvium (*photographs A*.17, 22, 87)

The alluvium is composed of unconsolidated sands, gravels, clays and silts. For the most part coarser materials prevail and seldom, except on the west coast between Rokko and Takao and on rice fields, is pure clay alluvium likely to be widely encountered at surface. Gravel and boulders predominate in the numerous alluvium fans deposited by the larger rivers (*photograph A*.69). The thickness of the alluvium varies very considerably from a few inches at the base of the foothills to many scores of feet in the bigger valleys and along the coasts. One bore-hole

at Twatutia (near Taihoku) intersected from the surface:—

17 ft. of clay.
12 ft. of sand.
55 ft. of clay.
20 ft. of sand.
60 ft. of sand and clay.
Gravel (water-bearing).

Old gravel terrace (*photograph A*.83)

Poorly consolidated gravel with some sand and clay layers is found. These terraces, which may attain thicknesses of several scores of feet, occur chiefly along the western edge of the higher hills from Taihoku to Kagi and themselves form many of the foothills. The height above sea level of the tops of these deposits varies from 300 to 1000 ft. They are usually covered with anything up to 33 ft. of loose red lateritic earth. The terraces are easily dissected by erosion, leaving steep sided, irregular plateaux or benches attached to hills of older rocks. On disintegration these deposits provide gravelly and sandy soils.

Young Sediments (*photograph A*.83)

These are a very thick series of sedimentary beds, alternating layers of shales, sandstones, sandy shales and conglomerates with a few impersistent beds of limestone and volcanic lavas and ashes. The widest occurrence is a belt which runs from Kirun in the north in a broad sweep just east of the coastal belt to just north of Takao. The other major occurrences are in the Taito coast range and the Koshun peninsula. These strata are gently to moderately folded, sometimes faulted, and are generally compact, soft to medium-hard rocks. Coal is found in some of the lower beds and oil in the lower and middle parts of the series. From Kirun to Kagi the sandstones of this series are more common at surface where they sometimes form dip slopes in the topography; from Kagi to north of Takao shales are preponderant; in the Taito coast range all the sedimentary types occur with associated volcanic rocks; while in the Koshun peninsula the series consists of sandstones and conglomerates to the west underlain by shales to the east: the beds here dip 20°-40° westward. Briefly described the rock types are (numbers are those used in the legend on *Plan* 2):—

1. SHALE. Fine, soft laminated rocks. Mixed with sand and not so well laminated in the middle of the series. Easily eroded. Produces clayey residual soil.

2. SANDSTONE. Coarse, medium-hard light-coloured rock. More resistant to weathering. Produces sand and sandy loam soils.

3. PEBBLE BEDS (conglomerate). Coarse rounded pebbles and boulders with sandy matrix. Hard. Resistant. Produces gravelly soils.

4. LIMESTONE. Fine and soft. Mediumly resistant. Produces fine loamy soils.

Clay-slates (*photographs A*.71, 72, 76, 77)

This very thick series occupies a broad belt from the Giran plain to the Koshun peninsula following the crest and western flanks of the main range. The series is composed from east to west (i.e. from bottom to top) of phyllites (lustrous slates) with thin beds of quartzite and limestone followed by clay-slates with thin sandstone beds. These rocks are more folded and faulted than the Young Sediments and their dips are steeper. Generally the folding is less severe and the dips not so steep (30°-40°) lower down the western flanks of the main range. On the whole these rocks are of medium hardness, tough, dark-coloured (except where bleached by weathering) and fine-grained. The sandstone, quartzite and limestone beds are harder than the slates (*photograph A*.76).

5. CLAY-SLATES. Fine, soft, black, laminated, sometimes contorted. Bleaches and softens with surface pitting on weathering (*photograph A*.77). Fairly resistant. Produces clayey loams.

Sandstone beds in (5). Hard, coarse-grained. Resistant. Produces sandy and sandy loam soils.

6. PHYLLITE. Fine, soft, black, lustrous, laminated, sometimes contorted. Rather tough. Bleaches and softens on weathering. Resistant. Produces clayey loams.

Quartzite beds in (6). Very hard, coarse-grained. Very resistant. Produces sandy and sandy loam soils.

Limestone beds in (6). Hard, massive, crystalline. Very resistant. Produces fine loams.

Schists (*photographs A*.73, 75)

This thick series extends along the eastern flanks of the main range from south of Suo to Tamari on the west coast. Together with the associated gneisses (9) and crystalline limestones (10) these rocks are the oldest on the island. They consist of graphitic, chloritic and micaceous schists in which are intercalated beds of quartzite and sandstone. For the most part these rocks are highly contorted (*photograph A*.75) and faulted; inclinations are generally very steep.

7. GRAPHITE SCHISTS. Tough, black, foliated rocks.

CHLORITIC SCHISTS. Tough, dark-green, foliated rocks.

MICACEOUS SCHISTS. Tough, dark-grey, glistening, foliated rocks.

All the schists are resistant to weathering and form broken, craggy relief. Produce loamy soils.

8. QUARTZITE AND SANDSTONE. Hard, grey, banded, coarse-grained. Very resistant. Produce sandy loam soils.

Gneisses

9. GNEISSES. The occurrence of these rocks is restricted to the mountainous region between Karenko and Suo where they occur, usually interbedded, with the schists. They are folded and much faulted and dip at very steep angles as a rule. The gneisses are dark-coloured, often mottled, hard, granular, foliated rocks. Very resistant to weathering. Produce sandy loam soils.

Limestones

10. CRYSTALLINE LIMESTONE. This oldest limestone occurs interbedded in the schists on the eastern flanks of the main range. Beds of it are folded and much faulted with steep inclinations. It is a hard, grey, massive rock. Very resistant to erosion, likely to form bold relief with cliffs. Possibility of caves. Produces fine loamy soil.

11. Described above under *Young Sediments*.

12. CORAL LIMESTONE (*photographs A*.79, 80, 82). These are coral deposits which have formed around the southern coasts and around the islands of Ryukyo-sho, Kasho-to and Koto-sho which have subsequently been elevated. They are unfolded, soft, open textured limestones in which caves may be found. Resistant. Produce coral sand soil.

Note. Ape's Hill near Takao is mapped as coral limestone but described as being compact in parts (*Bib.* 7).

Volcanic rocks

Except for the few intercalated beds found in the lower horizons of the Young Sediments the eruptive rocks all appear to be relatively young in age; the main occurrences lie (*a*) in the north end of the island, (*b*) in the Taito coast range, (*c*) on the islands of Koto-sho, Kasho-to and Kisan-to. Around the volcano of Mount Daiton, at the north end of Formosa, lavas form the higher slopes and volcanic ashes occur on the lower eastern, northern and western slopes. Both lavas and ashes are of andesitic character. In the Taito coast range, agglomerates and some andesitic lavas occur widely associated with the Young Sediments. The islands of Kisan-to and Kasho-to are of lava while Koto-sho is composed of lava to the south and volcanic ash to the north. As a rule the volcanic rocks form sheets which are gently inclined; they may be somewhat folded in the Taito coast range.

13. LAVAS. Very fine-grained, hard, dark rock. Very resistant. Produce fine clayey and silty soils.

14. VOLCANIC ASH. Very fine, hard, dark rock. Resistant. Produces fine clayey and silty soils.

15. AGGLOMERATE. Aggregate of coarse angular rock fragments with an ashy matrix. Resistant. Produces fine clayey silt with angular pebbles and boulders.

Basic igneous rocks

Small irregular semi-elliptical masses (up to 3 miles by 1 mile) of diorite or serpentine and thinner sheet-like dykes or sills of diabase are found cutting through (or interbedded with in the case of sills) the schist, clay-slate and young sedimentary series. The occurrences of these rocks are limited in size and number, yet it is certain that many more, particularly small ones, actually exist than are shown on the map. These rocks are unstratified and probably unfolded but are likely to be broken by faults.

16. DIORITE. Very limited occurrence. Hard, dark, coarse-grained massive rock. Resistant. Produces a rich loamy soil in which lateritic earth is common.

17. DIABASE. Dark, hard, fine-grained unbedded rock usually occurring as sheet-like dykes (cutting through host rock) or sills (interbedded with host rock). Resistant. Produces a fine red loamy soil in which lateritic earth may develop.

18. SERPENTINE. Found in Taito coast range north of Taito and on the Tansui river south-east of Taikokan. Dark-green, massive rock of medium hardness. Resistant. Produces a rich loamy soil.

SOILS

There are no soil maps or literature dealing with the soils of the island. Information has been derived from (*a*) the geology, (*b*) references in other literature, and (*c*) contacts with ex-residents.

The soils of Formosa may be considered under six headings according to terrain and the underlying rocks, viz. (1) Mountain, (2) Foothill, (3) Terrace, (4) Volcanic, (5) River valleys and (6) Alluvial plains.

(1) Mountain soils

These occur in the main and Taito coast ranges and are derived from schists, gneisses, limestones, clay-slates, quartzites and sandstones in the first region, and sandstones, shales, conglomerates and volcanic rocks in the second. Although in the main range the most widespread types, schists and clay-slates normally produce fine clayey and heavy loamy residual soils, it is seldom that such soils can accumulate; rapid denudation causes the removal of much of the finer constituents and an admixture of semi-weathered rock rubble (*photograph A*.41). The other rock types all produce coarser, more porous soils. Consequently all the mountain soils in the main range should be immature stony loam types with little or no vegetable matter. In the Taito coast range the shales and volcanic rocks would produce fine clayey soils but the rapid erosion tends to give the same results as in the main range. Mountain soils generally only form a thin cover and rock outcrops are common.

(2) Foothill soils

These soils occur mainly on the lower northern and western slopes of the main range and are derived chiefly from the Young Sediments. Their character will depend largely on the predominant rock type in the locality. To the north of Kagi sandstones are said to be prevalent and the soils should therefore be light sandy loams in the main. From Kagi south to just north of Takao shales are the predominant surface member of the Young Sediments and therefore clayey soils may be expected. Thicker soil cover should prevail because denudation in these areas is not so rapid as in the steep mountainous regions. These soils are less stony (except over conglomerates) as the underlying rocks are not so resistant to disintegration.

(3) Terrace soils

These are confined to the tops of the old gravel terraces and the younger, less extensive, river terraces which border many of the larger valleys. Most of these soils are of loose red lateritic earth, others of sand and gravel. Thicknesses vary from a few inches to about 33 ft. The slopes of the terraces are generally steep and will be bare or carry loose gravel rather than soil.

(4) Volcanic soils

Except for small local areas in the Young Sediments and in the Taito coast range (*see* (1) *above*) soils derived from volcanic rocks only occur in the northern extremity of the island around Mount Daiton. These will be fine silty loams and clays which will be stony on steeper slopes and where agglomerates occur.

(5) River valleys

These are not true soils but flood deposits of sand, gravel and boulders. During floods the rivers bring down large quantities of very coarse debris which they spread over practically the whole area of flooding (*photographs A*.12, 69, 84). Following floods the rivers cut numerous courses through these coarse deposits in the wider parts of their valleys, courses which may be changed by the next flood.

(6) Alluvial plains

The character of these soils depends chiefly on the nature of the underlying alluvium. In most cases it has a fair, if not high proportion of sand or other coarse material mixed with clay, so the resulting soil should be a loamy type. Some areas, such as the Heito plain, have predominantly sandy alluvium. The Karenko, Taito and other similar small plains surrounded by mountains will be covered largely by coarse material recently washed down. The only extensive area where clayey alluvium may be expected is along the west coast from Rokko to Takao; here silting of the river estuaries is in progress owing to decreased river gradients. Locally, along the coasts, where lagoons have formed, they may subsequently become silted giving swampy areas with fine clayey soils.

Effect of rice cultivation on soils. A large area of the island has been terraced for rice cultivation. The combination of levelling and irrigation results in deposition of fine clay so that clayey top soils will be found locally wherever cultivation has been practised. Lower lying areas of 'wet paddy' probably had clayey soils originally; cultivation will certainly have increased the amount of clay at surface by subsequent accumulation (*photograph A*.8).

BIBLIOGRAPHY FOR GEOLOGY

1. *Outlines of the Geology of Japan.* Imperial Geological Survey of Japan. 1902.
2. *The Geology and Mineral Resources of the Japanese Empire.* Imperial Geological Survey of Japan. 1926.
3. Various summaries. *Japanese Journal of Geology and Geography.* Vol. XV. 1938.
4. Yabe and Hanzawa. *Geological History of the Island of Taiwan.* Proceedings of the Imperial Academy, Tokyo. Vol. VI, No. 8.
5. Tyokee Rin. Stratigraphical Studies on the Younger Tertiary and Pleistocene Formations of the Toyohara District, Taiwan. *Memoirs of the Faculty of Science and Agriculture, Taihoku University.* Geology No. 10, Vol. XIII, No. 3. 1935.
6. Alvarez. *Formosa.* Barcelona. 1930.
7. Kleinwachter, G. H. J. Researches into the Geology of Takow, Formosa. *Journal of the North China Branch of the Royal Asiatic Society.* N.S. 16. 1881.
8. Hosie. *Report on the Island of Formosa.*
9. Guppy, H. B. Some Notes on the Geology of Takow, Formosa. *Journal of the North China Branch of the Royal Asiatic Society.* N.S. 18. 1883.
10. Nakamura. *Ethnogeographic Survey of Japan.*

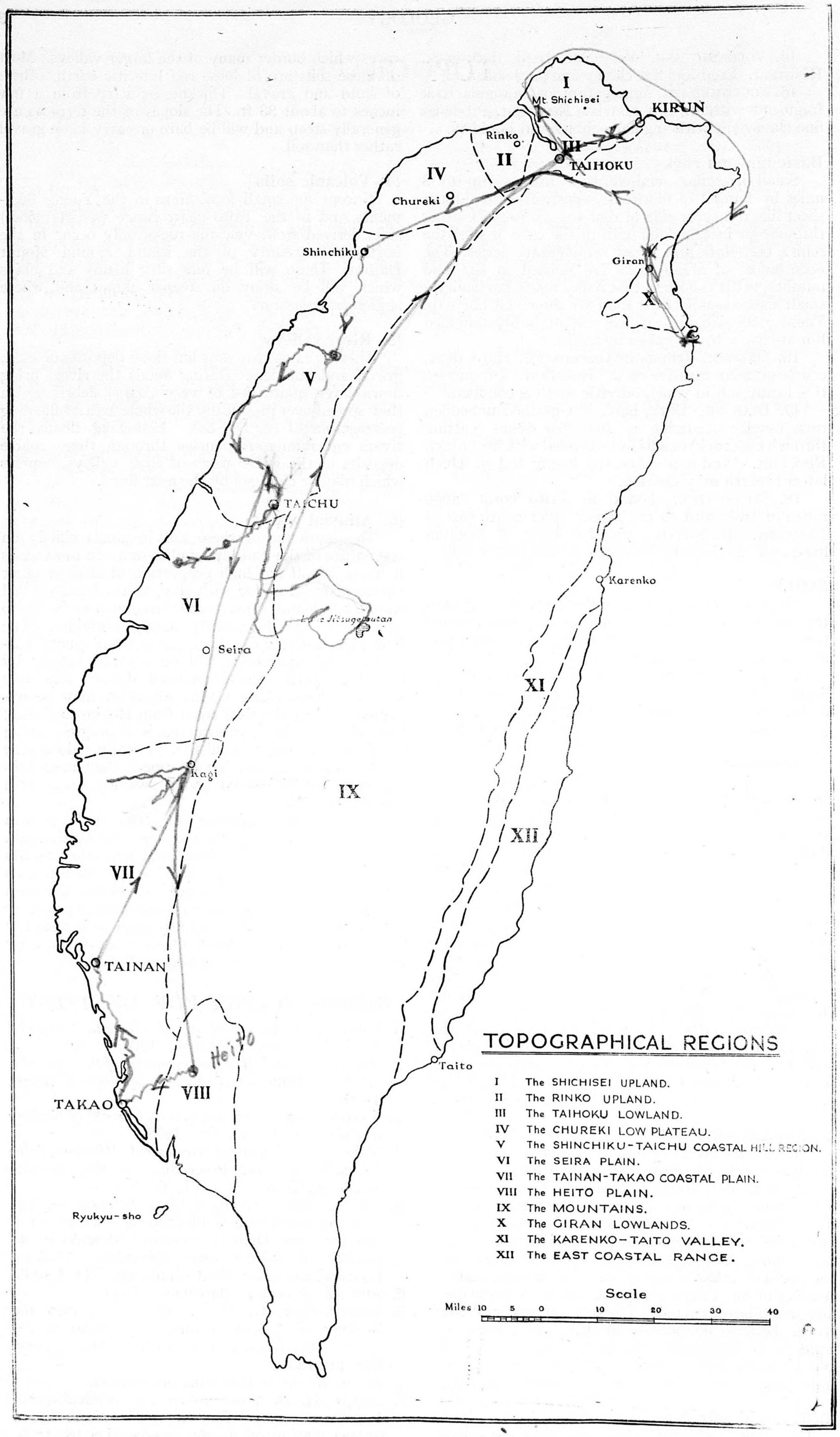


Fig. 3. Topographical regions

(2) TOPOGRAPHY

(*Plans* 1-3, 12-19; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 1, 4, 5, 11-15; *Japanese Maps* (1:50,000) *where available*; *photographs A*.1-95)

INTRODUCTION

General

The island of Formosa lies about 110 miles east of the coast of China, and has an extent of about 240 miles north to south, and 90 miles east to west at its widest part. Its major axis runs approximately north and south and the Tropic of Cancer runs midway across the island.

Geology and relief

Two-thirds of the island, the eastern and central parts, consist of high mountains; plains occupy the west and some isolated areas along the eastern side.

The mountains are made up chiefly of folded clay-slates and sandstones, with schists, gneisses and basic igneous rocks towards the east. Their relief is characterized by a series of ridges generally oriented north-north-east to south-south-west and deeply dissected by many rivers and streams. On the east the mountains descend in great cliffs to the sea between Karenko and the Giran plain. The main range is separated from the east coastal range by the Karenko-Taito valley. Crest levels of 13,000 ft. are frequently reached in the main range and at its north-eastern end there is the almost enclosed triangular plain of Giran. At the northern tip of the island the Shichisei upland, an extinct volcanic cone, forms a prominent feature.

The plains of the western side have two types of terrain, the flat or gently undulating coastal plain of recent alluvium, and the slightly higher areas of older alluvium, deeply dissected in ravine and plateau-top or ridge, which usually back the coastal plain. The dissected older alluvial uplands have a greater development north of the Seira river. Coasts are generally precipitous along the east where the mountains reach the sea, while low sand dunes or lagoons characterize the lowland and coastal plain area.

Drainage

The lines of drainage are influenced by the mountainous main range, off which rivers flow to the west and east. In the mountain region the rivers are normally in deep gorges, but in the plain they spread out over wide beds in braided streams.

The island comes under the influence of the monsoons, and in general the western and south-western regions receive the most of their rainfall between May and October, while the eastern regions have their rainfall from November to April. This rainfall variation is reflected in the regime of the rivers: those of the west are at their maximum flow during the months of May to October, and those of the east from November to April. During the drier periods the rivers are reduced to small streams meandering through sand, gravel and boulder-encumbered beds.

Flash floods may occur during the August to November period, the period of typhoons, and many of the rivers in the lowlands have control works along their banks to limit the destruction by such flooding. Other river works include damming for irrigation purposes. The construction of pools, which are equivalent to Indian tanks, on the higher and older alluvial plateaux of the lowlands, is also an important feature.

Soils

The soils of the lowlands vary from coarse permeable gravels and sands to impermeable clays and silts. They are probably coarse along the mountain edge of the plains, and become progressively finer towards the coast. The mountains have a generally thin soil cover of clayey loams and loams.

Natural vegetation

Forests of broad-leaved trees with undergrowth, which becomes sparser as the altitude increases, predominate in the mountain areas up to about 7500 ft. Above that level coniferous forests, with little or no undergrowth and open grassy spaces, are the chief features of natural vegetation. In the lowlands scrub and limited tree cover is to be found on the steep slopes of the higher older alluvium and in the areas of coarse gravel deposits. The isolated, dissected, coral limestone hills in the Takao district have a cover of stunted trees and shrubs. Coarse grass and shrubs are found along the sand dune belt of the west coast.

Land utilization

The greater part of the lowlands is under cultivation. The chief crops are rice, sugar-cane, sweet potatoes, tea and fruit trees of various kinds.

RICE. Two crops of rice per year are generally obtained from the same field in Formosa so that the rice fields are dry only at the harvesting periods in June and October. Fields growing two crops of rice a year are usually on land which can be flooded easily. The fields are small rectangles, separated one from the other by low bunds 1 to 2 ft. high and wide.

SUGAR-CANE. The south-west of Formosa has the greatest area of sugar-cane land. The fields are large rectangles, generally grouped about the refineries. The sugar-cane is planted between the months of July and September, in ridges about 2 to 3 ft. high. After 18 to 20 months growth it attains a height of 12 to 15 ft.

SWEET POTATOES. This crop is one of the basic food crops of the community. It is usually grown as the dry season crop on fields which were occupied by rice in the wet season.

TEA. Tea growing is confined principally to slopes of the rather broken relief in the northern lowlands. The bushes grow 2½ to 3 ft. apart, in rows of 4 to 5 ft. apart. The bush rarely attains a height of 4 to 5 ft.

FRUIT TREES. Normally fruit trees are found about the villages and towns, and in some districts a particular fruit is cultivated on a large scale, such as the hori pear and bananas, in the Hosan area. Only in the plantations is there regularity in the rows of trees.

Settlement

Settlement is sparse in the mountains and dense in the western plains. The compact village, surrounded by bamboo clumps, is the chief type, though isolated farm-houses are to be found in the central area of the western coastal plain. The usual house type is a brick or mud walled house of one storey, with a tiled roof. In the large towns stone and ferro-concrete buildings are to be found in the business and commercial quarters.

Predominant colours

Greens of varying shades predominate. In August and September the wintering trees are generally brownish reds and the ripening crops of rice are yellowy-brown. The ripening of rice is repeated in January to February when second crops of the year are harvested.

Suitability for operations

The upland and mountainous areas have predominantly steep slopes, forming major obstacles to movement. Throughout the lowlands movement is only restricted by the rivers, entrenched streams, and the frequently damp coastal areas.

Cover

Cover from air and ground view is usually ample in the uplands and mountains and scanty in the lowlands.

Observation over the uplands is limited by the tumbled relief of ridge and valley, while any small rise gives wide views over the lowlands.

Maps, etc.

Japanese maps of Formosa on a scale of 1:50,000 have been one of the chief sources of information for this report (*Fig.* 2). Grid references are keyed to the A.M.S. Series L 592, scale 1:250,000.

Air photographic cover for considerable portions of the island was also available, and was of great assistance in the Takao area, for which no 1:50,000 sheets exist.

I

THE SHICHISEI UPLAND

(*Plans* 1, 2, 3, 16; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheet* 1; *Japanese Maps* (1:50,000), *Sheets*: *Tansui, Fuki-kaku, Taihoku-Seibu, Taihoku-Tobu*; *photographs A*.1-5, 15, 16)

DESCRIPTION OF COUNTRY

General

This region is an upland area, roughly rectangular in shape, at the extreme north of Formosa. It is bounded by the coast on the north-west from the mouth of the Tansui river (RW 4277) to the promontory of Fuki-kaku (RW 5490) and on the north-east from Fuki-kaku to just north of Kirun (Keelung) (RW 7674).

The limits on the south-west and south-east are the lowlands of the Tansui and Keelung river valleys. This gives a maximum distance north to south of about 15 miles, and east to west of about 18 miles.

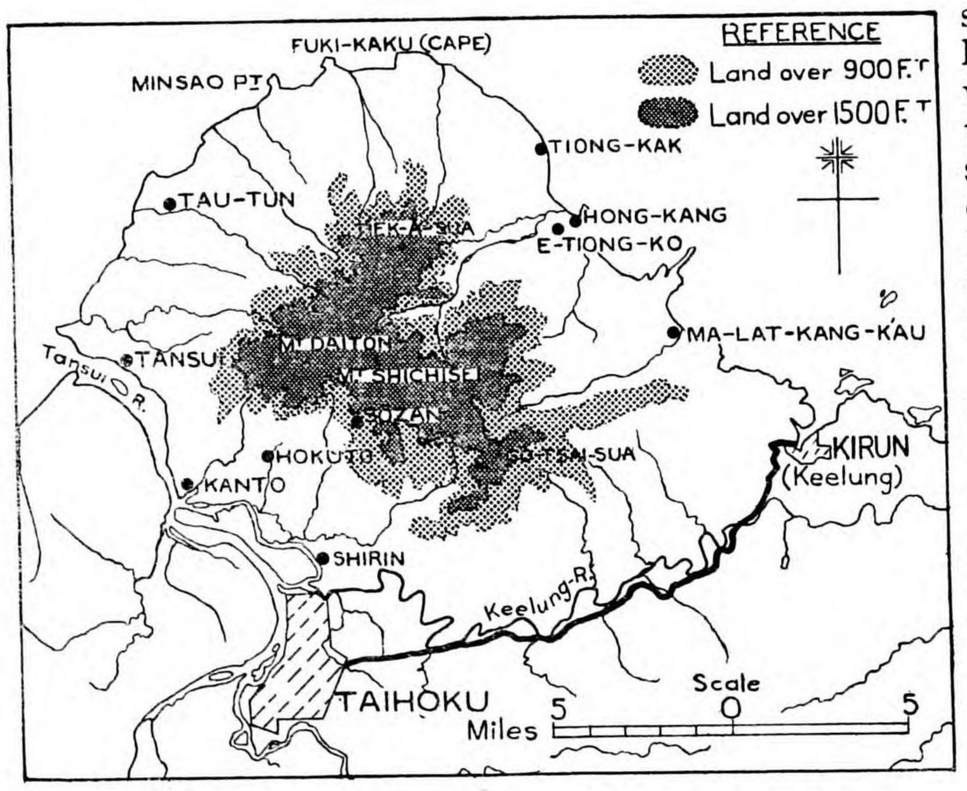


Fig. 4. Region I. The Shichisei upland

Geology

This region is an extinct volcano. The crater was in the Shichisei-Daiton area. The slopes down in all directions are formed of weathered lavas, ashes, and agglomerates, which rocks are hard, but rather brittle. They are semi-permeable.

The north-east coastal strip, some 2½ miles wide, up to Fuki-kaku (RW 5490), is underlain by coarse sandstone, clay, and some conglomerate beds of the young sedimentary series.

There are almost continuous sand dunes along the coast from the mouth of the Tansui to Fuki-kaku point. These vary in width, but frequently are about 100 yds. wide. There are also stretches of sand dunes along the north-east coast, but detailed cover is not available to delimit these areas.

Relief

Broadly speaking this region is a conical upland rising to its greatest height in Mount Shichisei, 3675 ft. (RW 5675), with Mount Daiton, 3543 ft., about 2 miles to the west (RW 5376). These peaks are reported to be occasionally snow-covered in winter.

The lower slopes extend to the coast on the north-west and north-east, and to the Tansui-Kirun lowlands on the south.

On the west the slopes are comparatively gentle up to about 800 to 1000 ft., which height is generally reached at about 3 miles from the coast. These slopes are cut into by many short streams, which make well-marked valleys; three of these between Tansui and Minsao Point (RW 5289) are fairly wide and flat near the coast.

These are:—

(i) Just north of Tansui, about 1 mile across from north to south.

(ii) Near Tua-tun (RW 4783), about 1200 yds. north to south.

(iii) Just south-west of Minsao Point, about 1½ miles north-east to south-west.

On the north and east the lower slopes are not steep, but mostly extend right down to the coast. Frequently spurs of higher ground reach to the coast to form headlands, with small sandy bays between. The valley of the river Hong-k'e, which rises on the northern slopes of Mount Shichisei and flows north-eastward to the sea just north of Hong-kang (RW 6582), is quite wide and flat-bottomed, and is followed for much of its course into the hills by the one road that crosses the upland from E-tiong-ko (RW 6582) to Hokuto.

On the south the hills rise quite steeply from the lowland of the Keelung and Tansui valleys, but they are very dissected and there are continuous rises and falls before the main slopes are reached. This is particularly so in the south-west where steeply undulating country, with occasional gentler slopes, separate the small Sozan basin (RW 5673) from the lowland between Hokuto and Shirin (RW 5367). Two valleys from these towns, followed by roads, lead up to the Sozan basin. The valley from Hokuto has sulphur springs at its western end, surrounded by one of the few small areas of bare rock (*photograph A*.3). Most of the Sozan basin is occupied by a sharply-rising round hill whose summit is about 800 ft. above the basin floor (*photographs A*.1, 2).

The upper slopes of this region (usually above about 1000 ft.) are uniformly steep, rising to form a divide running north-east to south-west through Mount Daiton (RW 5376) and Mount Tiek-a-sua (RW 5881), which is marked on the map by the Gun boundary line. This divide is over 3000 ft. high for most of its length, falling away in the south-west towards Kanto (RW 4870), and in the north-east towards Tiong-kak (RW 6485). A second, but less well-marked divide stretches south-east from Mount Shichisei (3675 ft.) towards Go-tsai-sua (2247 ft.) (RW 6271).

Other summits apart from these two main divides help to give this whole upland area a complex surface aspect.

Drainage

This region has a well-marked radial drainage pattern. For the most part the streams are short and swift, usually having their sources at about 1500 ft. The valleys are continued back into the mountains for some distance above this, but normally they will be dry, having streams only after heavy rain. This means that much of the upland above 1500 ft. will have no surface streams in normal times.

On the lower, gentler slopes the valleys are frequently wide and flat-bottomed, particularly near the coast. Along the north-western coast there are three such river valleys. These are:—

(i) Just north of Tansui, about 1 mile wide.

(ii) Near Tua-tun (RW 4783), about 1200 yds. wide.

(iii) Just south-west of Minas point, about 1½ miles wide.

There are two wide valleys on the north-east coast. The biggest is that of the river Hong-k'e, which rises on the northern slopes of Mount Shichisei and flows north-east to its mouth near Hong-kang. This river has braided stream beds, indicating a flat, boulder-strewn valley bottom. The other fairly wide valley on the north-east is that of the river Ma-lat-k'e, whose mouth is at Ma-lat-kang-k'au (RW 7077).

There is unlikely to be such a seasonal variation in the river regime as there is farther south. The northern and eastern slopes come under the influence of the north-east monsoon and the streams may be expected to be in spate from the end of November to February. The western and southern slopes are in the rain shadow of the north-east monsoon but receive heavy rain from the summer typhoons, so the streams on these slopes are likely to have most water in June to August.

None of the rivers is likely to form an insuperable barrier, even in spate. Nor are they capable of use for transport along their length.

There are some irrigation storage ponds on the lower slopes and in the wider river valleys near the north-west coast.

Soil

On the volcanic rocks the soil is likely to be clayey silts with boulders and loose debris. In the lower river valleys and on the lower slopes near the coast, loamy conditions are most likely with well-drained patches of sand and gravel.

Natural vegetation and land utilization

Paddy is cultivated in all the flat valley bottoms and up the valley sides in patches, where terracing is not too difficult and water is readily obtainable (*photograph A*.4). As a rule terraced paddy does not occur above 900 ft. The size of the steps between the terraces varies with the degree of slope of the land; 2 to 4 ft. is the normal depth, but steps up to 6 ft. in depth are reported. Two crops of paddy are grown a year on practically all the fields. This means that they are wet nearly all the year, except for July and December when the crop is harvested. The fields are never really hard, even during harvesting time.

There are small areas of tea cultivation scattered about the lower slopes. One of the more extensive of these extends along the southern side of the valley south of Minsao point. It is about 1¼ miles long by about 400 yds. wide and reaches up to about 600 ft. The tea bushes are about 2 ft. high and have cleared ground between the rows of bushes (*photographs A*.15, 16).

Apart from the lower parts of the valleys and the valley sides, most of this region is uncultivated. The natural vegetation cover is rough grassland, scrub and broad-leaved trees. In the rough grassland on the lower slopes there are occasional areas of bamboo grass. This is thin and wavy, growing to a height of about 6 ft. The scrub and grassland covers the steeper slopes, and nearly all the higher ground (*photograph A*.2). Most of the tree growth is broad-leaved, but there are some conifers. In these wooded areas the trees are reported to be well-spaced and with little or no undergrowth.

On the belt of sand dunes along the coast there is a sparse covering of coarse grass.

Settlement

The general settlement pattern of this region is marked by the peripheral arrangement of most of the villages at the foot of the main upland mass, that is around the coast.

The largest town is Tansui on the right bank of the Tansui river near to its mouth. The rest of the settlements are just villages.

Some small villages are found as far up the river valleys as they are cultivated; between them, and frequently up the valley beyond them, and particularly on the terraced paddy slopes, single farm dwellings are found. There are also a few isolated dwellings among the rough grassland and trees of the lower slopes.

SUITABILITY FOR OPERATIONS

Cross-country movement

Steepness of slope is the chief hindrance to free cross-country movement within this region.

The one narrow zone allowing possibility of comparatively easy movement is the coastal belt at the foot of the upland. The rivers are not likely to be a serious hindrance even in spate. They can be expected to have most water in November to February on the north and east, and in June and August in the south. The streams on the north-east are always likely to have some water. The paddy fields of the valleys are usually wet except for the harvesting months of July and December. There is, however, an almost continuous sand dune belt, about 100 yds. wide, along the north-western coast, and a succession of sand dunes and headlands on the north-eastern. Movement round the central highest summits, 2 or 3 miles inland from the coast, will avoid the necessity of crossing the valleys and paddy areas at their widest, but would involve crossing a succession of spurs and valleys, with the possibility of meeting occasional terraced paddy slopes.

On the upland slopes difficulty of movement is not likely to be increased by the vegetation cover of rough grassland and broad-leaved trees with little or no undergrowth.

There are some tracks into the upland. The only one that crosses the main north-east to south-west divide runs from the valley east of Tansui, along the northern slopes of Mount Daiton and Mount Shichisei, reaching a height of 2500 ft., and down to the valley leading to Hong-kang on the east coast. Much of this track is through rough grassland.

Cover

Cover is provided mainly by the vegetation, but the wooded areas on the slopes are likely to provide fair cover from the air. Patches of wavy bamboo grass grow to 6 ft. on some of the lower slopes. The general rough grassland and scrub of much of the higher slopes can be expected to be 2 to 4 ft. high.

There is little cover in the valleys where paddy is predominant or on the slopes where tea is grown.

Observation

Unimpeded views across the river valleys from the steep slopes above are possible. Observation across the flat Taihoku lowland and out to sea can be maintained from the upland slopes, but the possibility of clouds enveloping the highest summits reduces the value of these as observation points.

Suitability for airborne landings

There are not any very good facilities for airborne landings, but both parachute and glider landings might be made with varying degrees of difficulty in the following areas:—

(i) The undulating ground to the west and north of Tansui, which is mostly under paddy cultivation. One small area within this, which might provide good conditions, is the Tansui golf course, which is north-west of Tansui town, and is believed to be about 1000 yds. square (*photograph A*.5).

(ii) The lower parts of the bigger river valleys, which are almost entirely given up to paddy cultivation, growing two crops a year, harvested in July and December.

(iii) The sand dune belt along the north-west coast, which is usually about 100 yds. wide, but may be wider at some places.

(iv) Difficult parachute landings might be achieved on the slopes under tea cultivation (e.g. along the southern side of the valley south of Minsao point, which extends for about 1¼ miles by 400 yds.), or on the gentler of the scrub-covered slopes.

Suitability for landing-grounds

The possibility of providing sites for landing-grounds is poor. Reconnaissance might be directed most profitably to the undulating country immediately north of Tansui town.

Size. About 3 miles north to south by 2 miles east to west.

Altitude. From sea level to 250 ft.

Degree of flatness. Undulating.

Underground rocks. Permeable sedimentaries.

Drainage. Good. Possibility of seasonal flooding (June to August) in the flat river valley north-west of Tansui.

Soil. Wet top layer due to irrigation for paddy.

Vegetation and land utilization. Mostly paddy fields, terraced in the gentler slopes. Broad-leaved trees on steeper slopes to the eastern side of the area.

Obstacles to air approach. Upland mass immediately to the east, rising to over 3500 ft.

Landmarks. Sea coast and mouth of the Tansui river.

Local construction material. Gravel from river mouth of the Tansui. Some of the volcanic rocks would be suitable for filling in, but might prove brittle.

Local labour available. Tansui and surrounding villages would probably supply many labourers.

Water supply. Ample from river and streams.

Ground approaches. Railway and road from Taihoku.

II

THE RINKO UPLAND

(*Plans* 1, 2, 3, 16, 17; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 1, 5; *Japanese Maps* (1:50,000), *Sheets*: *Tansui, Taihoku-Seibu, Ozono* (*Toen*); *photographs A*.15, 16)

DESCRIPTION OF COUNTRY

General

This region comprises the steep-sided plateau area about Rinko (Ch'iu-na-k'au) (RW 4065) and the roughly conical Mount Kuan-im-sua (RW 4471) north-east of it. This upland area rises from the Tansui valley on the south and east, from the Chureki lowland on the west, and from the coast on the north. These limits give maximum distances north to south of about 12 miles, and east to west of about 11 miles.

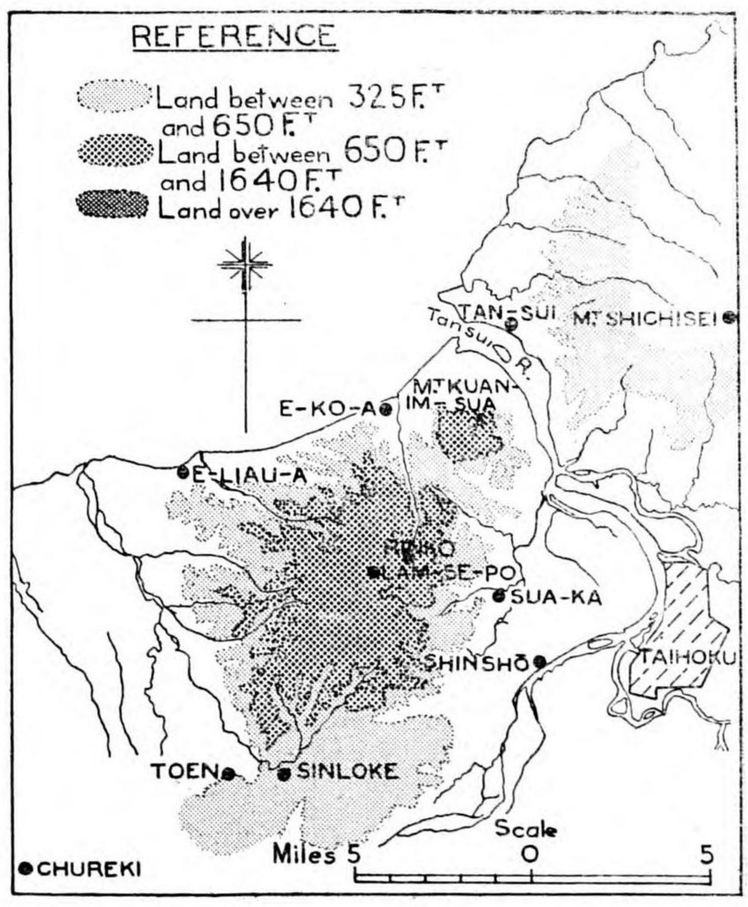


Fig. 5. Region II. The Rinko upland

Geology

For the most part this region consists of the old plateau gravels, capped by red lateritic earth. Mount Kuan-im-sua is largely composed of lava, while skirting it to the west and south are sandstone and shale beds of the Young Sediments. Similar sandstones and shales occur to the north of Okaseki. Alluvial sands and clays occupy the north-western part of the region on the Chureki lowland and also a narrow coastal strip as far as E-ko-a.

All these rocks, except the shales and lavas, are highly permeable.

Relief

This upland region is divided into two unequal divisions, the steep-sided plateau with its gently undulating surface at about 750 ft., and to the north-east of this the roughly conical Mount Kuan-im-sua (RW 4471), with its summit rising to 2008 ft., overlooking the mouth of the Tansui river.

The slopes of the upland rise abruptly from the surrounding lowlands on the east, south and west. On the south the base of the slope forms the bank of the northern channel of the Tansui river, and the base of Mount Kuan-im-sua forms its western bank for over four miles before its mouth. Along the north there is a narrow, flat coastal belt between the shore and the base of the uplands. This is usually about 200 yds. wide, but widens to over 1300 yds. for 2 miles south-west from the mouth of the Tansui river.

On all sides the slopes rise with uniform steepness and are all deeply cut into by the steep-sided valleys of streams, which radiate from the upland in all directions. Some of the valleys are cliff-sided for short stretches. The lower parts of these valleys are usually flat-bottomed, forming 'tongues' of the adjoining flat lowland or coastal belt into the upland slopes, e.g. at E-ko-a (RW 3972), near E-liau-a (RW 3069), at Sin-lo-k'e (RW 3556) and at Sua-k'a (RW 4463).

The plateau, with Lam-se-po (RW 3964) roughly centrally-situated in it, stretches for about 6 miles north to south and about 2½ miles east to west. The surface is gently undulating and cut into, particularly at the northern and southern ends by deep-cut valleys. The general altitude of the plateau surface is 750 ft.

The south-western slopes of Mount Kuan-im-sua are separated from the plateau by two over-lapping valleys, one draining north, the other south. The sides of this mountain are deeply dissected by stream valleys. The steepest slopes are between 600 ft. and 1500 ft., while round the actual summit, which is 2008 ft., the surface is fairly gently-rounded.

Drainage

The drainage of this region has a radial pattern. The streams are all short and swift, and have cut steep-sided valleys back into the upland. Nearly all the streams have their sources just below 600 ft., although the line of their valleys continues above this, probably containing streams only after heavy rains. This means that normally there are no surface streams above 600 ft.

The catchment area of each stream is so small that variation of regime is not likely to be very marked, but it can be expected that they have most water after the summer typhoons.

There are several small irrigation storage ponds on the plateau surface.

Soil

It is thought that the soils are mostly coarse sands and gravels, which are well drained. On the central plateau there is a covering of laterite earth over the gravel. Recent finer alluvial deposits on the flat valley bottoms are utilized for almost continuously wet paddy fields.

Along the coast is a narrow belt of sand dunes,

Natural vegetation and land utilization

All the flat valley bottoms and most of the narrow, flat coastal strip are utilized for paddy cultivation. On the plateau surface there are paddy fields round the villages, and, in a few small scattered areas on the gentler slopes, there are some paddy terraces. Nearly all these fields produce two crops a year. These are harvested in July and December. Thus the fields are dry, but not really hard, for about six weeks at the end of June and through July, and again at the end of November and through December.

On the plateau surface the dominating crop is tea. Practically the whole of the gently-undulating surface, and the gentler sloping spurs leading off from the plateau are covered in tea plantations, with the short bushes, about 2 ft. high, arranged in rows (*photographs A*.15, 16).

The slopes have a natural cover of broad-leaved trees with little or no undergrowth, and with some rough grassland and scrub, which is probably up to about 4 ft. high, except for patches of bamboo grass which grows to a height of about 6 ft.

The narrow sand dune belt along the coast has a sparse cover of coarse grass.

Settlement

The unit of settlement is the small village, although there are some farm dwellings standing on their own.

There are two areas of settlement:—

(i) At the base of the upland slopes.
(ii) On the plateau.

The buildings at the base of the slopes are just above the valuable, flat land of the paddy fields. There are some small villages along the sides of the flat-bottomed valleys that cut back into the plateau slopes.

SUITABILITY FOR OPERATIONS

Cross-country movement

The main hindrance to ease of cross-country movement is the steepness of the slopes. There are comparatively easy ways up onto the plateau via the bigger valleys. The easiest ways are provided by using the valley from E-ko-a (RW 3972) on the north, and the valley east of Toen (RW 3255) on the south. The actual valley bottoms are paddy-covered, wet for most of the year, except just before and during the harvesting months of July and December. These fields usually end at the foot of the valley sides.

Foot movement up the plateau side is not likely to be impeded by the vegetation cover of broad-leaved trees, rough grassland and scrub. Across the slope the succession of spur and valley would add to the difficulty.

On the plateau the gently-undulating surface, extensively tea-covered, offers ease of movement in all directions.

The streams are not likely to be severe barriers as a rule, though after summer storms the lower courses are likely to present some difficulties for short periods.

Cover

Natural cover from air view is provided by the broad-leaved trees on the slopes. The scrub and rough grassland is expected to be up to 4 ft. high in places, while small patches of wavy bamboo grass grow to 6 ft. in height.

Paddy in the valleys and tea on the plateau surface give no cover.

Observation

From the treeless summit of Mount Kuan-im-sua (RW 4471) it should be possible to get observation out to sea, along the Tansui river and surrounding lowland, and across the plateau surface.

Suitability for airborne landings

The best conditions for airborne landings are provided by the gently-undulating, tea-covered plateau surface, which extends about 6 miles north to south by 2½ miles east to west. The tea bushes are arranged in rows and are about 2 ft. high.

There is a coastal area south-west of the mouth of the Tansui river, measuring 2 miles north-east to south-west by 1300 yds. north-west to south-east, that is quite flat, but is mainly under paddy cultivation.

SUITABILITY FOR LANDING-GROUNDS

The two areas delimited as possible for airborne landings also provide the only possibilities of sites for landing-grounds. They are both fairly difficult of access.

(i) RINKO PLATEAU SURFACE

Size. 6 miles north to south by 2½ miles east to west.

Altitude. About 750 ft.

Degree of flatness. Gently undulating.

Underground rocks. Permeable sandstone conglomerates and volcanic rocks.

Drainage. Normally no rivers on the plateau and no liability to flooding.

Soil. Probably gravelly with some lateritic covering.

Vegetation and land utilization. Mainly tea plantations.

Obstacles to air approach. Mount Kuan-im-sua, 2008 ft., is immediately to the north-east.

Landmarks. Tansui river and sea coast.

Local construction materials. Probably gravel.

Local labour. There are farming villages over the plateau.

Water supply. There are catchment irrigation ponds, but no surface rivers.

Ground approaches. Difficult roads up plateau side from coast in the north, and from Shinsho, across the river from Taihoku, in the south.

(ii) THE NARROW COASTAL BELT BETWEEN THE TANSUI MOUTH AND THE SEA COAST

Size. 2 miles north-east to south-west by 1300 yds. north-west to south-east.

Altitude. Just above sea level.

Degree of flatness. Flat.

Underground rocks. Probably sandy sedimentaries.

Drainage. Crossed by small upland streams draining to the sea. Not liable to extensive flooding.

Soil. Most of the area is irrigated paddy land.

Vegetation and land utilization. Mostly paddy, some broad-leaved trees; some villages.

Obstacles to air approach. High Mount Shichisei upland mass to the east and Mount Kuan-im-sua immediately to the south.

Landmarks. Mouth of Tansui river and the sea coast.

Local construction materials. Gravel from the stream beds.

Local labour. Some farming villages in the area.

Water supply. Ample from streams.

Ground approaches. A difficult road across the Rinko plateau from Shinsho.

III

THE TAIHOKU LOWLAND

(*Plans* 1, 2, 3, 16, 17; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 1, 5; *Japanese Maps* (1:50,000), *Sheets*: *Taihoku-Tobu, Taihoku-Seibu, Ozono* (*Toen*), *Shinten*; *photographs A*.6, 78, 84, 88-90)

DESCRIPTION OF COUNTRY

General

This is a flat lowland region centred about Taihoku and bounded on the north by the steep slopes of the Shichisei upland, on the west by the sharply rising side of the Rinko plateau, and on the south by the steep northern end of the main mountains of Formosa. There is a long narrow continuation of this

lowland eastwards, formed by the valley of the Keelung river, continued to the coast at Kirun, a shorter continuation south-westwards about the middle Tansui river, as far as Okaseki (RW 3751), and a short extension southwards into the uplands formed by the valley of the Shinten river, as far as Shinten (RW 5552).

An idea of the size of the area covered is given by these straight distances from Taihoku: to Kirun about 15 miles; to Okaseki about 12 miles; to Shinten about 6 miles; and to Kanto (RW 4870) about 6 miles.

The plain between Kanto (RW 4870) and Shirin (RW 5467) is very low-lying, being in the main between 4 and 12 ft. above sea level (*photograph A*.8).

Round Taihoku itself the general level is somewhat higher. Two low ridges project to within about a mile of the city on the north and south-east. Eastwards of Matsuyama (RW 5963) the Keelung valley is about 1200 yds. wide until Shiodome is reached, when hills close right in on the river. There is a narrow ridge and water divide between the Keelung

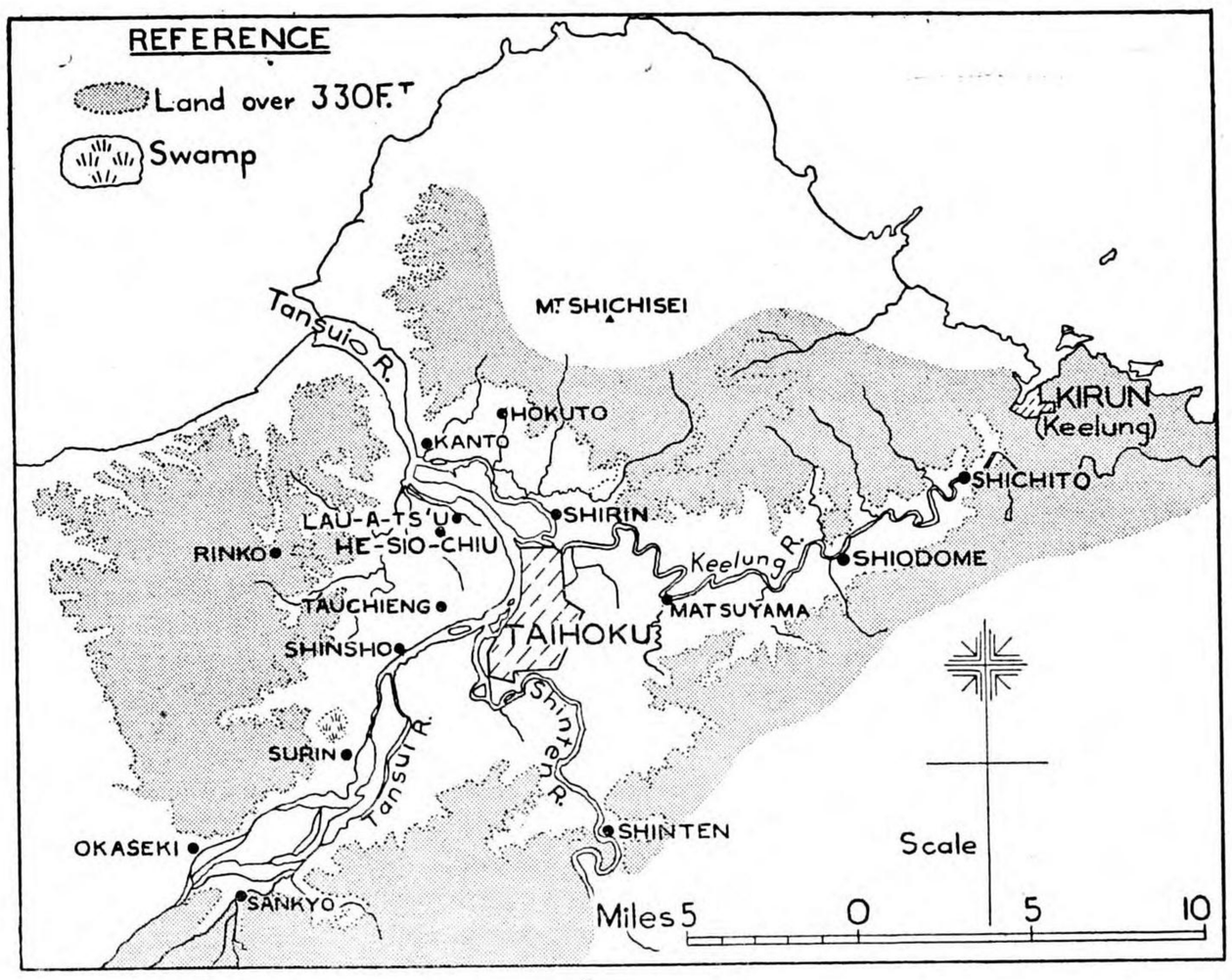


Fig. 6. Region III. The Taihoku lowland

Geology

This lowland is underlain chiefly by unconsolidated layers of sand and clay with some gravel. To the east, from Shichito to Kirun, sandstones and conglomerates occur. Similar rocks, with some shale, outcrop locally in other parts, while on the northern limits near Hokuto volcanic rocks may be found (*photograph A*.78). Overlying large areas around the periphery of the region and in the river beds are recent deposits of down-washed material, largely gravels. Recent gravel terraces may be expected bordering many of the present river courses. In areas where clay alluvium forms the surface layer permeability is poor; otherwise it is good.

Relief

Except in the Keelung valley east of Shiodome (RW 6764), where the hills close right down to the river side (*photograph A*.6), this region is a uniformly flat lowland, bounded by steep-sided upland areas, except for the narrow break of about 1¼ miles south of Okaseki (RW 3651), where the Tansui river enters the area. Within this lowland there are scattered slightly higher small areas, frequently used for the site of a grave, a threshing floor, or farm dwellings.

In the area between the Tansui river and the Rinko plateau slopes, there is, due north from Shinsho (RW 4660) a belt of very low ground, only about 4 to 5 ft. above sea level, which is probably an old bed of the Tansui river. Between this and the present river bed the surface level rises to about 20 ft. and this higher ground is marked by the sites of villages such as T'au-chieng (RW 4862) and He-sio-chiu (RW 4966).

The arm of the lowland reaching towards Okaseki is occupied mainly by the braided channels of the Tansui river, but between these the land rises on the islands to 105 ft. at its highest.

valley and the very small lowland of Kirun. Most of this lowland is occupied by the town of Kirun itself and hills rise steeply on the north, west and south, with a narrow coastal ledge eastwards and northwards.

Drainage

Although nearly all the subsoil is permeable, the surface mulch holds the water, which is fed by a network of irrigation ditches to the paddy fields that cover practically the whole of the lowland (*photographs A*.88, 89). There is one small area of swamp, measuring 1500 yds. north to south by 500 yds. east to west. This is north of Jurin (RW 4455).

The main river is the Tansui, one of the longest in Formosa. It has its headwaters at the northern end of Mount Tsugitaka range and flows northwards first in the mountains and then through the western foothills, frequently in braided channels, to Okaseki. Here it flows in many braided channels among the boulders and gravel it has brought down, completely occupying the low corridor between the Rinko upland and the main mountains, except for the island-like area of higher land south-east of Okaseki. By Shinsho the river runs in one main channel to the sea with sandbanks in its course (*photograph A*.11). From here onwards it is muddy and has some stretches of entrenched banks and some of gently-shelving sides until Kanto (RW 4870) is reached.

At the road bridge at the north of Taihoku (*photograph A*.11) the normal depth of water is about 16½ ft., but here it is at its narrowest, and lower down the depth varies between 9 ft. and 13 ft. Although the depth indicated on the map opposite to Lau-a-ts'u (RW 4966) is shown as 8 ft., it is reported that the river is fordable at this point.

From Kanto practically to its mouth the Tansui

flows between steep slopes rising to the uplands east and west of it (*photograph A*.9). Just near its actual mouth there are flat shelving banks on both sides.

At Shinto the river is about 600 yds. wide. It widens out but narrows at Taihoku bridge to about 350 yds. across. Below this the river widens again till an abrupt narrowing at Kanto to 430 yds. From here onwards it widens to over 1400 yds. opposite Tansui.

The Keelung river rises in the hills south of Kirun. As far as Shiodome (RW 6764) it follows a winding course between enclosing hill slopes (*photograph A*.6). Between Shiodome and Matsuyama (RW 5962) the valley floor widens to over 1000 yds., with the river entrenched in a winding bed within it. West of Matsuyama the river meanders across the northern edge of the Taihoku lowland, breaking through the end of the spur of highland from Shirin towards Taihoku to join the Tansui river at Kanto. One arm of the Keelung joins the Tansui just north of Taihoku. For most of this part of its course the river flows between banks which are reported to be up to 20 ft. high.

The Shinten river flows northwards through the upland to join the Tansui just south of Taihoku. Its flat valley north of Shinten (RW 5552) is nearly 2 miles wide. The river meanders northwards, frequently in an entrenched channel, and with islands in its course formed of gravel and boulders which it has brought down.

These rivers have most water and are liable to flooding in the months July to September after the summer typhoons. Rises up to 15 ft. on the Tansui are reported. A wall 10 ft. high, with a bund outside it, was built on the river-side of Taihoku to prevent flooding there. The low belt of land north of Shinsho is probably liable to flooding.

Short streams from the upland cross the plain to main rivers, but much of their water is tapped by irrigation channels.

Soil

The natural soils of this lowland region vary from light loamy to sandy. But these are everywhere overlain by the thick mulch, prepared and developed over a period of time, that holds the water for the paddy fields. This soft top-covering is usually over 1 ft. deep.

Natural vegetation and land utilization

The whole available land of this lowland is utilized for paddy cultivation (*photographs A*.7, 8, 88, 89). The individual fields vary in size but most are very small. The bunds between the fields are about 1 ft. high and 1 ft. wide, although occasional wider ones carry paths from one farm to another. Terraces, 2 to 3 ft. high, frequently continue the paddy cultivation over slight rises. Irrigation ditches of all sizes up to 6 ft. deep wind between the fields, frequently lined by small bushes.

Two crops of paddy are raised each year on practically all the fields. This means that they are almost continuously wet except for about six weeks before the harvesting in July and December.

Farms, usually surrounded by fruit trees and small dry gardens, occupy patches of slightly higher ground.

There is a covering of rough grassland on the gravelly deposits of the Tansui river in its braided course east of Okaseki.

Settlement

The biggest city of Formosa, Taihoku, is centrally situated in the widest part of the lowland, and Kirun, the biggest port, at the eastern end. Other large towns such as Hokuto, Shirin and Matsuyama are situated towards the edge of the lowland.

On the plain itself the unit of settlement is the small village or single farm among the paddy fields. These are usually on slightly higher ground and have a small dry garden and fruit trees (*photograph* 90).

SUITABILITY FOR OPERATIONS

Cross-country movement

Nearly everywhere cross-country movement means paddy-field conditions underfoot. As two crops are raised a year, the fields are always wet except for about six weeks before the harvest in July and December, and even then the ground does not become solidly hard. Among the paddy fields slightly higher and drier patches are indicated by being the sites of graves or farm-houses, usually surrounded by fruit trees.

The three main rivers are likely to prove barriers to movement along parts of their courses at least, on account of their depth and width. This applies to the Tansui below Shinsho, except for the possibility of the ford reported at Lau-a-ts'u (RW 4966), the Keelung, west of Matsuyama, which has the added difficulty of sheer banks up to 20 ft. high, and the Shinten above Kokan (RW 5557).

These rivers can be expected to have a considerably increased amount of water in the summer months, particularly after typhoons. Then they cannot be crossed for distances considerably farther upstream than the limits indicated above. The gravel and boulder areas between the braided streams of the Tansui east of Okaseki will be liable to become completely covered by the rushing river in time of spate.

The Tansui could be used for light boats to beyond Taihoku, but it has shifting sandbanks in its course and is silting up generally. Light vessels could also be used along the lower Keelung river.

Cover

On the flat lowland cover from view is not plentiful. The only features affording some degree of cover are the fruit trees about farms and villages. The open paddy fields over the lowland provide no cover.

Observation

Observation over the lowland can be maintained from the hills enclosing it. Within the flat plain itself no major feature presents itself as an observation post. Tall buildings in the bigger towns are likely to present the best coigns of vantage.

Suitability for airborne landings

Practically the only conditions for airborne landings presented in this region are those of the flat paddy fields. These are wet for most of the year, being dried only for about six weeks at a time before the harvests in July and December, when the ground does not get hard.

SUITABILITY FOR LANDING-GROUNDS

Most of this flat region should provide possibilities for the construction of landing-grounds except for two areas:—

(i) The Keelung valley east of Shiodome is too narrow to be readily used.

(ii) There is a narrow belt of low-lying land stretching from the Tansui river at Shinsho due north to the river again opposite Kanto. This is probably an old bed of the river and liable to flooding.

Although this region is used almost entirely for paddy fields, which are kept wet by irrigation, once the water-retaining surface mulch is removed there is a permeable subsoil.

Size. About 13 miles east to west by 12 miles north to south.

Altitude. Under 50 ft.

Degree of flatness. Flat.

Underground rocks. Probably permeable sandstones and impermeable shales.

Drainage. Drained by the Tansui, Shinten and Keelung rivers, and has a network of irrigation ditches. Except for the area north of Shinsho, noted above, it is not likely that it will be subject to flooding in normal years.

Soil. Sandy to loamy.

Vegetation and land utilization. Paddy fields, with villages and farms. There are several big towns in the area.

Obstacles to air approach. High mountains on all sides.

Landmarks. Tansui river and Taihoku city.

Local construction materials. Gravel from the rivers.

Local labour. Should be ample from the towns and farms.

Water supply. Ample from rivers.

Ground approaches. Rail and road connection with the port of Kirun to the east, and with the south-west of Formosa.

It is reported that the Japanese abandoned the idea of a seaplane alighting base at the mouth of the Tansui river on account of the speed of the river in flood and the snags brought down on the stream.

IV

THE CHUREKI LOW PLATEAU

(*Plans* 1, 2, 3, 15-17; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 1, 4, 5; *Japanese Maps* (1:50,000), *Sheets*: *Taihoku-Seibu, Ozono* (*To-en*), *Ozono* (*Dai-en*), *Chureki, Kyuko*; *photographs A*.12-16, 89)

DESCRIPTION OF COUNTRY

General

This region is a low plateau sloping gently westwards to the coast, and is roughly semi-circular in shape. The town of Chureki (RW 2351) has a fairly central position, and the most distinctive feature is the immense number of small irrigation storage ponds scattered over the surface.

On the east the boundary is formed by the steep western slopes of the Rinko upland, and, farther south, of the main mountain belt. The southern boundary is the northern slopes of the low hills that reach a line roughly from Koko (RW 0742) through Yobai (RW 1646) to Ryutan (RW 2241).

Thus the maximum distance north to south is about 20 miles, and east to west about 22 miles.

Geology

The southern extension of the plateau is the Taikei area (RW 3043), which is composed of young sedimentary sandstone and shale beds, covered by light sandy loams and sands. The remainder of the region consists of the dissected plateau gravels, sands and clays. These have a thin covering of sandy clay that varies in thickness from 4 ins. to 40 ins.

Relief

The surface forms a gently tilted plateau that slopes steadily, and almost without a break, from the entrenched middle valley of the Tansui river, at the foot of the uplands, north-westwards to sand dunes at the coast.

Opposite Taikei (RW 3043) the drop from the plateau surface to the bed of the Tansui river is 260 ft. in under 150 yds. (*photograph A*.12). It is steeper in parts to the south of this, where the top of the slope is cliff-like. Further north the slope is well-marked but not so steep, and it is farther back from the river bed.

The plateau surface is usually about 600 ft. above the Tansui, and it slopes steadily down towards the coast where the sand dunes are between 15 ft. to 120 ft. in height. The one noticeable break of the slope is provided by an escarpment extending for about $1\frac{3}{4}$ miles north of the village of Po-sim (RW 1947) and 2 miles west. This escarpment is against the direction of the general slope of the land and is about 150 ft. high, steepest at Po-sim, getting gentler northwards and westwards. Its line is marked by a belt of broad-leaved trees.

Drainage

The drainage pattern is a simple one. At the south-east boundary the entrenched middle valley of the Tansui river runs south-west to north-east. On the plateau the rivers follow a fairly straight course from the higher ground to the south and south-east north-westwards to the coast.

Typical of the bigger streams is the river that rises west of Ryutan (RW 1942), flows through Chureki (RW 2351), and reaches the coast north-west of Taien (RW 2163). South of Chureki the stream is in a narrow entrenched channel.

North of this town and across the plateau to

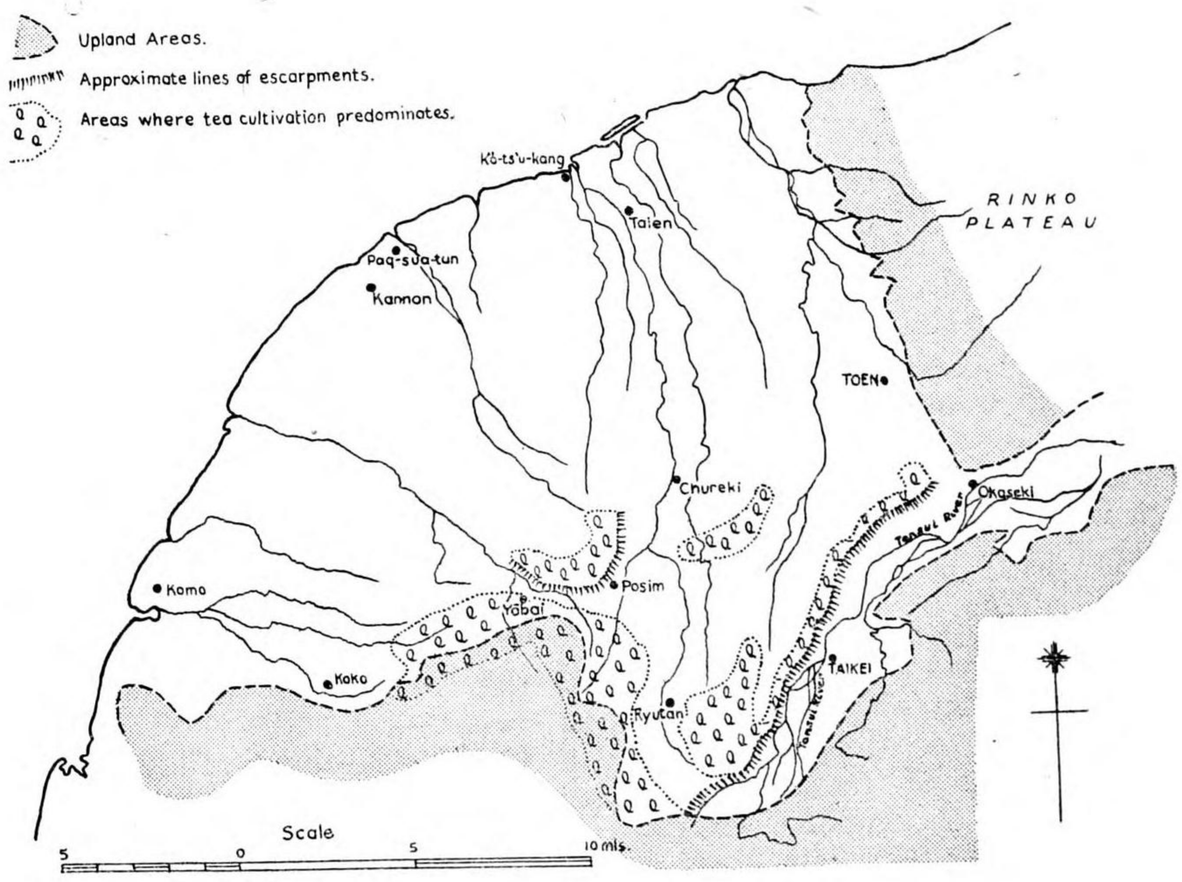


Fig. 7. Region IV. The Chureki low plateau

Taien the river flows in braided channels among the gravel- and boulder-strewn flood-bed, mostly between steep-sided or vertical banks. These banks are usually about 50 yds. apart. There are occasional stretches where the slope is more gentle down to the river bed. Between Taien and the sea the river flows in a fairly open channel, and crosses the sand dune belt to the sea.

Some of the smaller streams seem to peter out as they flow across the plateau. This is no doubt due to their water being tapped to help supply the irrigation storage ponds. These storage ponds are the dominating feature of the landscape. There are thousands of them, scattered over the surface of the whole area. Most of them are roughly oval in shape, and in general the larger ones are towards the coast. Some are small, but the largest measure up to 500 yds. across. Many of these storage ponds have steep embankments enclosing them, usually at the other end, but sometimes all round. These embankments reach up to 24 ft. in height. The ponds may have little water in them, leaving their mud bottom exposed.

The middle Tansui flows north-east in a braided channel at the foot of the main mountains, in an entrenched valley that is bounded on the north-west by an escarped edge of the Chureki plateau.

Normally the braided channels flow among a pebble- and boulder-strewn flood-bed that varies in width from just over 100 yds. at Taikei (*photograph A*.12) to about 1100 yds. The main channel is about 3 to 5 ft. deep along that part of its course. In flood-time the whole flood-bed will be filled with rushing water.

The rivers are most likely to be in spate for three to four days at a stretch after the typhoon, that comes as a rule between July and September.

Soil

The soils of this plateau are naturally thin, gravelly, and permeable; but long periods of intense paddy cultivation with irrigation has resulted in the production of a surface mulch, that is probably up to a foot in thickness and is water-retaining (*photograph A*.89).

Natural vegetation and land utilization

The predominating cultivation is paddy. The fields are small and usually rectangular.

There is a network of irrigation ditches through the paddy areas. Practically the whole of the paddy is double cropped. This means that the fields are kept under water except for about six weeks before the harvests in July and December. There are occasional fields growing young bamboo among the paddy.

Where the degree of surface slope is slightly steeper the land is utilized for tea plantations. From the air the tea areas are characterized by an arrangement of long narrow fields, with the low bushes arranged in long lines, and by an absence of irrigation reservoirs. The bushes are usually about 2 ft. high. Rows of broad-leaved trees are found through the tea plantations (*photographs A*.15, 16).

The main tea plantation areas are:—

(i) Along the slopes leading up to the hills, limiting the region in the south and south-east from east of Koko (RW 0742), through Yobai (RW 1646), extending south-east, to the foot-hill area west and south-west of Ryutan (RW 2241).

(ii) An extensive area south and east of Ryutan, roughly rectangular in shape, measuring over $1\frac{1}{2}$ miles north to south and $1\frac{1}{2}$ miles east to west, with an extension north-eastwards.

(iii) Extending north-eastwards from south-east of the Ryutan area a belt usually about 1300 yds. wide along the plateau edge above the Tansui valley.

(iv) A belt roughly 2 miles east of Chureki (RW 2351) round to 2 miles south of the town. There are some paddy fields between the plantations.

(v) To the south-east, bounded by the escarpment stretching north and west from Po-sim (RW 1947). There are also paddy fields between the plantations.

The villages and farm-houses have small dry gardens, growing sweet potatoes and with clumps of fruit trees.

The few areas left under natural vegetation are mainly broad-leaved trees and rough grasslands. Broad-leaved trees are along the escarpment on the north-western side of the Tansui valley, and along the escarpments stretching north and west from Po-sim (RW 1947). Rough grassland covers the sand dunes along the coast (*photograph A*.14) and scattered patches along the flood-bed of the Tansui.

Settlement

Apart from towns such as Toen and Chureki and a few villages, most of the settlement is in separate farms, which are more numerous in the paddy than in the tea-growing area. They are frequently adjoining an irrigation reservoir and are surrounded with a small dry garden, growing such crops as sweet potatoes, and with fruit trees.

SUITABILITY FOR OPERATIONS

Cross-country movement

The most serious hindrance to cross-country movement is provided by the almost continuously wet paddy fields. These are kept flooded by irrigation, except for about six weeks before harvesting in July and December, and then the ground is not really hard.

The rivers are not likely to prove difficult obstacles in their entrenched valleys, except when in spate for two or three days after typhoons, which can be expected from July to September. Their stony flood-beds, in fact, provide a dry way between wet paddy fields.

The Tansui valley in the south-east, with its wide, gravelly flood-plain provides a way to the Taihoku lowland beyond Okaseki (RW 3651). But the whole of this flood-channel is liable to be water-covered when the river is in spate.

The areas of easiest movement are provided by the tea plantation areas, which are mainly along the southern and eastern sides of this region. The bushes are about 2 ft. high, with clear ground between the rows, and with occasional lines of broad-leaved trees, and some individual trees.

Cover

There is not much natural cover. Among the paddy fields some cover for individuals might be obtained round the farms with their fruit trees, and on the steep banks round the water storage ponds. There are some rows of broad-leaved trees among the tea plantations of the south and south-east.

Apart from these there are two narrow belts of broad-leaved trees. There is a fairly continuous belt covering the steep escarpment that limits the valley of the Tansui on the north-western side almost as far north as Okaseki (RW 3651) (*photograph A*.12). The other belt covers the steep slopes stretching north and west from Po-sim (RW 1947).

Observation

Observation across much of this region can be maintained from the steep-sided upland on the east and south-east and from the two escarpments. That limiting the Tansui valley would provide observation posts to cover the whole of the valley within this region, that near Po-sim (RW 1947) observation posts covering the country south and east.

Short distance observation could be provided by using the top of the banks around the water storage ponds. Some of these banks are up to 24 ft. high.

Suitability for airborne landings

The tea plantations in the south and east provide facilities for airborne landings. The most suitable of these appear to be:—

(i) South and east of Ryutan (RW 2241). An area measuring over 1½ miles east to west by 3 miles north to south on the eastern side, and bordered by paddy in a valley immediately east of Ryutan.

(ii) Extending north from the south-eastern corner of (i) above, a belt of tea plantation on gently sloping land along the plateau edge above the Tansui valley. This is about 8 miles long and usually about 1300 yds. wide. On the east it is bounded by the steep wooded escarpment down to the Tansui valley.

(iii) North-west of Po-sim (RW 1947), limited on the south and east by a wooded escarpment, and measuring about 1000 yds. north to south by 1800 yds. east to west.

The tea-growing area, from east of Koko (RW 0742) to Yobai (RW 1646) and eastwards, is not so suitable on account of the hilly nature of the surface, and that east and south of Chureki (RW 2351) on account of paddy fields in lower ground among the tea.

Airborne landings might also be made in the coastal sand dune belt. This is at its widest, 1¼ miles, between K'o-ts'u-kang (RW 1865) and Paq-sua-tun (RW 1062), but some of these dunes are quite hilly. They are flatter farther east but narrow down to 1200 yds.

Landings might be effected in the gravel flood-bed of the Tansui river out of flood periods (*photograph A*.13). Its average width is 1000 to 1300 yds., except near Taikei (RW 3043) where the flood-bed narrows.

SUITABILITY FOR LANDING-GROUNDS

Practically the whole of this region provides conditions suitable for the construction of landing-grounds. The surface has a fairly flat general slope to the north-west, with gravelly subsoil beneath the foot or so of surface mulch of the paddy fields.

Size. About 20 miles north to south and 20 miles east to west.

Altitude. From about 600 ft. in the south-east above the Tansui valley to sea level at the coast.

Degree of flatness. Usually flat with general surface tilt to the north-west. Local obstacles are provided by the steep embankments (up to 24 ft. high) round the numerous irrigation storage ponds.

Underground rocks. Nearly all permeable plateau gravels.

Drainage. A naturally well-drained area, with flooding confined to the entrenched flood-beds of the rivers.

Soil. Over all the paddy area a water-retaining surface mulch about a foot thick; elsewhere a sandy loam.

Vegetation and land utilization. Mostly paddy fields, with farms with a few fruit trees. Some tea plantations to the south and east.

Obstacles to air approach. None within the area. Steep-sided mountain range to the south-east.

Landmarks. The river valleys crossing the area to the coast, and towns such as Toen and Chureki.

Local construction material. Gravel.

Local labour. Many agricultural workers.

Water supply. Abundant from the rivers. Wells should prove productive at medium depth in most places.

Ground approaches. Main road and railway from Taihoku to the south-west of Formosa, with roads and push-car lines stretching north-west and south-east from them.

V

THE SHINCHIKU-TAICHU COASTAL HILL REGION

(*Plans* 1, 2, 3, 15, 17; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 4, 5; *Japanese Maps* (1:50,000), *Sheets*: *Kyuko, Chureki, Shinchiku, Chikuto, Hakushaton, Byoritsu, Daiko, Taiko, Tolatsukutsu, Taiwan-Toyohara, Tosei, Rokuko, Taichu, Kokusei*; *photographs A*.14-17, 83)

DESCRIPTION OF COUNTRY

General

This region extends from just north of the Hong-sua-k'e in the north to the valley of the Taito river in the south, a distance of about 60 miles. In the north the inland limit is about 17 miles from the coast, but south of the Hozan valley it narrows to about 10 miles wide, to open out to 20 miles in the south about the middle valleys of the Taian and Taiko rivers.

It is, mostly, highly dissected and hilly, rising to over 1500 ft. in parts, and crossed by steep-sided river valleys terminating in wide detrital deltas. The nature of the country changes south of the Taiko valley where a plateau, with a steep western edge rising to just over 1000 ft. at its highest, runs parallel to the coast, emphasizing the roughly north-south alignment of the features.

Geology

Most of this region consists of permeable, old terrace gravels forming the hills with alluvial sands, gravels and boulders in the river valleys (*photograph A*.83).

North-east of the Hozan valley the gravel hills have a covering of laterite earth. South of Shinchiku there are deposits of clay among the terrace gravels, which will not drain so well as the gravel. Along the eastern boundary there are sandstone and shale hills, which extend south-westwards towards the coast north of Koryu (RV 8013).

Permeable recent gravels and sands extend 35 to 40 miles inland from the coast up the Au-lieng-k'e valley. The hills between the Au-lieng-k'e and the Taian river are of gravel and clay, covered with lateritic earth.

The valleys of the Taian and Taiko rivers and the country between are covered with alluvial sands and gravels and are plentifully strewn with boulders.

South of the Taiko river alluvial deposits predominate. The coastal strip is silty and sometimes muddy, giving impermeable conditions. The higher ground inland, however, is formed of fairly permeable terrace gravels and clays, with a capping of lateritic earth on the north-south plateau that rises steeply from the coastal plain and slopes gently east to the Hogen-Taichu depression.

There is a belt of sand dunes stretching along the coast from north of Chuko (RV 8720) to the north side of the Taian delta. These dunes vary in width from 1300 yds. in the north to about 100 yds. (*photograph A*.14).

Relief

This is a dissected hilly region, mainly under 1500 ft. The hills rise either from the coast or from a narrow coastal lowland, and eventually merge with the main mountains of the interior. These hills are cut across by the flat-bottomed valleys of the rivers Hong-sua-k'e, Hozan, Tiong-kang-k'e, Au-lieng-k'e, Taian, Taiko, and several smaller valleys such as the Obai-k'e. Near their mouths these valleys form coastal lowland areas.

In the north there is a narrow coastal strip about 400 yds. wide south of Shinchiku (RV 9834). From this strip low hills rise quite steeply and the general level gets higher inland, to over 1500 ft. north-east of the Hozan valley. The whole of this area is dissected by many small valleys, and is cut across by the steep-sided and flat-bottomed valleys of the Hong-sua-k'e and the Hozan rivers.

There is a flat coastal area roughly 4 miles square about Chikunan (RV 8921), near the mouth of the Tiong-kang-k'e river. This lowland is separated from the Au-lieng-k'e valley further south by hills rising to 400 ft. The flat valley of the Au-lieng-k'e is about 3½ miles wide between Dora (WA 8099) and

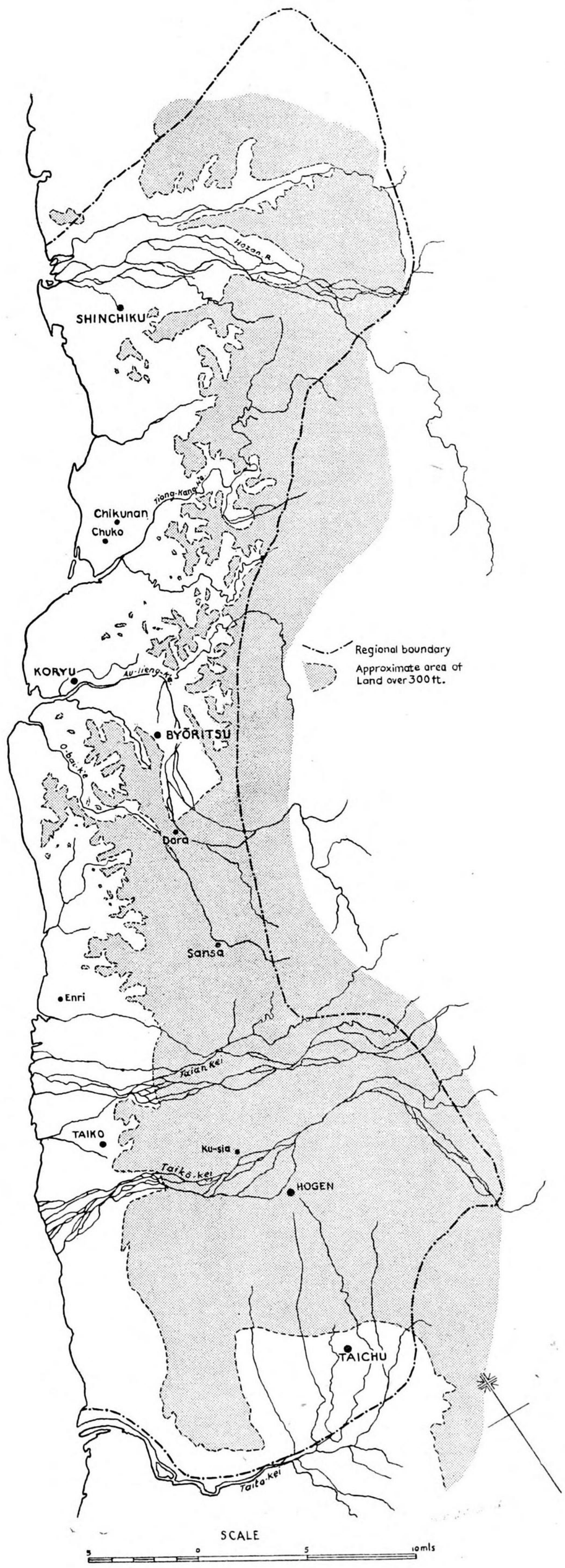


Fig. 8. Region V. The Shinchiku-Taichu coastal hill region

Byoritsu (RV 8306) before it turns west to the lowland behind the sand dunes north of Koryu (RV 8012).

Between the mouths of the Au-lieng-k'e and the Taian rivers very deeply dissected hills rise quite steeply to over 1500 ft. from a very narrow, flat coastal strip that is usually under 500 yds. wide. Inland these hills slope down fairly steeply to the valley of the Au-lieng-k'e, and south of Dora to the middle Obai-k'e valley, which continues the line of the Au-lieng-k'e valley, extending through Sansa (WA 7991) to the Taian valley. The main mountains of the interior rise steeply to the east of this lower belt.

The Taian-Taiko delta area forms the most extensive lowland (*photograph A*.17). It is about 9 miles across from north to south and is flat in the

deltas and gently undulating away from them, except for a steep-sided hill that rises abruptly to over 600 ft., 1½ miles north-east of Taiko (wA 6483).

Between the Taiko and Taito rivers the relief features have a north-south alignment. There is a flat coastal strip about 2½ miles wide, from which rise the steep slopes of a plateau rising to 1000 ft. This slopes down gently eastwards to a belt of gently undulating country from Hogen (wA 7372) to Taichu (wA 7161), which is bounded on the east by a steep-sided and intensely-dissected, hilly area rising to over 1500 ft. This merges into the main interior mountains, except in the north where the steep-sided middle Taiko valley runs north and south.

Drainage

The prevailing line of the drainage is north-westwards to the coast. An exception is the Hogen-Taichu depression that drains southwards to the Taito river. There are many short streams from the coastal hills flowing straight to the sea, while the region is cut across by six bigger rivers that rise in the interior mountains. These are the Hong-sua-k'e, the Hozan, the Tiong-kang-k'e, the Au-lieng-k'e, the Taian and the Taiko, and they are all fairly similar in character. They have steep-sided, flat-bottomed valleys in the hills, with braided channels between the down-washed gravel and boulders that form the valley bottom. Through the low hills near the coast the sides of the flood-bed are frequently vertical and up to 75 ft. in height, as near Ku-sia (wA 7277) on the north side of the Taiko river. Lower down in the actual deltas of the Taian and Taiko rivers the sides of some of the stream channels in the detritus are vertical in places, but probably under 30 ft. in height. In the lower stretches of most of the main valleys long boulder walls have been constructed to restrict the flood-water. These are frequently up to 30 ft. high.

Normally there is little water in these rivers. The flood-beds present a dismal appearance of small streams flowing through an expanse of boulders and pebbles, with occasional silt areas. But from May to September flood conditions can be expected for several days at a time, particularly after storms and typhoons in the mountains. Then the whole of the boulder-strewn flood-bed becomes a rushing torrent.

None of these stream channels is navigable, except possibly for native bamboo rafts, and, apart from flood-times, they are not likely to be considerable barriers to movement on account of their depth or width.

Soil

The soils of the gravel hills are well-drained and sandy in nature. In the areas with lateritic capping the soils are heavier and hold the water to a greater extent.

The alluvial sands and gravels of the river valleys are permeable, but a water-retaining mulch has been created as a cover over the paddy fields, and this is almost always wet.

Natural vegetation and land utilization

The natural vegetation of the hills is coarse grass with scrub and broad-leaved trees. The steep slopes particularly are tree-covered.

In two areas of the hills the natural cover has been cleared for tea cultivation. The more extensive is on the gentler slopes north-east of the Hozan valley where there are considerable areas of tea cultivation. There are small areas of tea-growing in the hills between Enri (wA 6794) and Sansa (wA 7991). The bushes are arranged in lines and are about 2 ft. high. Lines of broad-leaved trees and individual trees are found throughout the tea plantations (*photographs A*.15, 16).

Paddy fields predominate in the flat valley bottoms, on the small coastal plains, and on some terraced lower slopes of the hills. Two crops a year are grown, the harvests being in July and December, which means that the fields are kept wet all the time except about six weeks before harvesting. The fields are small and rectangular on the flat areas, but on sloping ground are long, narrow and shaped along the contours. The most continuous areas of paddy cultivation are the lowland north of Shinchiku, on the Taian-Taiko delta area, along the coastal belt south of the Taiko, and in the Hogen-Taichu depression.

In the flood-beds of the rivers there are some patches of rough grass, and there is rough grass on the coastal sand dunes (*photograph A*.14).

Settlement

This region has several big towns, all situated on one of the two main road and railway routes of the west coast. They are Shinchiku, Koryu, Taiko, Byoritsu, Hogen and Taichu. Apart from these the unit of settlement is the small village and individual farm.

In the hilly areas settlement is almost entirely in the valleys. Villages and some individual farms are found on the side of the valleys on ground above the possible flood level.

In the paddy areas in the river deltas, along the coast, and in the Hogen-Taichu depression single farm-houses predominate, each surrounded by its patch of dry garden, growing vegetables and a few fruit trees, the whole being frequently surrounded, completely or partially, by a live bamboo fence.

SUITABILITY FOR OPERATIONS

Cross-country movement

In general this is a difficult area for cross-country movement on account of the dissected nature of the wooded hills and because much of the flat areas is kept almost permanently wet under paddy cultivation, being drained off for about six weeks only before the harvests in July and December. South of the Taiko river the general surface is not so dissected, and, apart from the steep western edge of the upland rising from the coastal plain, conditions are easier.

The rivers may be expected to be in flood for several days at a time from May to September and will then be definite barriers. When not in flood these river valleys with their small braided stream channels would provide easy ways along their pebble and boulder beds.

There are two north to south lines of possible movement, both indicated fairly closely by the two branches of the main west coast railway lines.

The first follows the coast; but this coastal strip is very narrow in parts, particularly south of Shinchiku and between Koryu and Enri, and, moreover, behind the sand dunes most of it is under paddy cultivation.

The second line is inland from Koryu to Taichu, along the middle Au-lieng-k'e valley, continued in the middle Obai-k'e valley, thence to the Taian-Taiko lowland. South of this it follows the Hogen-Taichu depression to the Taito valley.

Cover

There is a marked contrast between vegetational cover on the hills and that on the lowland. On the hills broad-leaved tree cover is usually available, although there are many areas of scrub and grassland among the trees, and, north-east of the Hozan valley, the extensive tea plantations on the gentler slopes have only isolated lines of trees.

On the lowlands of the river valleys and coastal strips, utilized almost entirely for paddy cultivation, there is practically no tree cover, apart from sparse fruit trees and bamboo hedges round the farms.

Suitability for airborne landings

This is not a region presenting good opportunities for airborne landings. The hills are highly dissected and much wooded, and the flat lowland is under paddy cultivation with the fields kept wet all the year, except

for about six weeks before the harvests in July and December.

Possible landing areas are two coastal sand dune belts, and the stony flood-beds of the rivers out of flood-time.

The dune areas are:—

(i) West of Chuko (RV 8820) measuring 3¾ miles north to south by 1500 yds.

(ii) Between the mouths of the Tiong-kang-k'e and Au-lieng-k'e rivers, which measures 5 miles north to south by about 800 yds.

The bigger river beds provide opportunities for landings on the boulder and pebble bottoms out of flood-time. Floods can be expected between May and September.

Difficult parachute landings might be made on the gentler slopes of the tea plantation country north-east of the Hozan valley.

SUITABILITY FOR LANDING-GROUNDS

Reconnaissance can be directed to most of the non-hilly country with a view to the possibility of construction of airfields.

There are two areas that are flat and have permeable gravel soils. These are about Shinchiku, extending up the Hozan valley, and the middle Au-lieng-k'e valley extending to north of Koryu. A more extensive area, where some sites are possible on an undulating surface with a general semi-permeable sub-soil, stretches from the north to south plateau between the Taiko and Taito rivers eastwards to the Hogen-Taichu depression. In it can be included the flat coastal strip between the plateau and the sea. The Taian-Taiko delta, particularly the slightly higher ground between the two valleys, provides a small, flat and semi-permeable area where airfields might be constructed.

(i) THE SHINCHIKU-LOWER HOZAN VALLEY AREA

Size. A roughly triangular area measuring 5 miles north to south by 8 miles east to west.

Altitude. From sea level to 100 ft.

Degree of flatness. Flat.

Underground rocks. Alluvial gravels and sands. Very permeable.

Drainage. The northern part is crossed by the braided distributaries of the Hozan river, which are liable to flooding for periods between May and September. Much of the area is under paddy, the fields being kept flooded for most of the year.

Soil. Apart from pebbles of Hozan flood-bed a surface water-retaining mulch, about a foot thick, covers the alluvial gravels for paddy cultivation.

Vegetation and land utilization. Mainly paddy fields.

Obstacles to air approach. None.

Landmarks. The coast, the Hozan valley and the town of Shinchiku.

Local construction materials. Gravel.

Local labour available. Probably ample from agricultural area and Shinchiku.

Water supply. Ample from river Hozan and from medium depth wells.

Ground approaches. The main west coast road and railway.

(ii) THE MIDDLE AU-LIENG-K'E VALLEY AND KORYU AREA

Size. The middle Au-lieng-k'e valley is about 9 miles north to south and about 2½ miles wide. The Koryu area is roughly 3 miles north to south by 4 miles east to west.

Altitude. From sea level to 350 ft.

Degree of flatness. Gently undulating.

Underground rocks. Permeable gravels.

Drainage. The Au-lieng-k'e is liable to flooding within the limits of its own flood-bed for periods between May and September.

Soil. A surface water-retaining mulch, about a foot thick, covers most of the area.

Vegetation and land utilization. Mostly under paddy.

Obstacles to air approach. Uplands rising to 2000 ft. immediately to the east; lower hills to the west.

Landmarks. Au-lieng-k'e valley and the towns of Byoritsu and Koryu.

Local construction materials. Gravel.

Local labour. Probably ample from the agricultural area and from Byoritsu and Koryu.

Water supply. Abundant from rivers and medium wells.

Ground approaches. One branch of the main west coast road and railway.

(iii) BETWEEN THE TAIKO AND TAITO RIVERS

Size. About 12 miles north to south by about 13 miles east to west.

Altitude. Between sea level and 1000 ft.

Degree of flatness. Some flat and some undulating; the area is crossed north to south by a steep escarpment above the coastal strips.

Underground rocks. Mainly permeable to semi-permeable terrace gravels and clays, with a lateritic capping to the plateau surface. The low coastal strip has finer alluvium.

Drainage. The flat coastal strip is crossed by short entrenched streams. The plateau and Hogen-Taichu depression is drained southwards to the Taito by many small streams.

Soil. The coastal strip has a water-retaining surface mulch; the whole of this part is under paddy. The plateau surface has a covering of lateritic earth. The Hogen-Taichu depression has patches of sandy loam and clayey soils.

Vegetation and land utilization. Coastal strip is entirely under paddy. The rest has some paddy, some dry fields with bamboo and fruit trees, with broad-leaved trees on the steeper slopes.

Obstacles to air approach. The western side of the plateau is an escarpment, generally about 700 ft. high, rising from the coastal strip.

Landmarks. The Taian-Taiko delta in the north and the Taito river to the south. The city of Taichu is quite extensive.

Local construction materials. Gravel.

Local labour. Ample from the agricultural areas and from Taichu and the bigger towns.

Water supply. Abundant from surface streams and medium wells.

Ground approaches. The main west coast roads and railways.

(iv) THE TAIAN-TAIKO DELTA AREA

Size. A roughly triangular area about 10 miles north to south by 12 miles east to west.

Altitude. Sea level to 600 ft.

Degree of flatness. Flat to undulating.

Underground rocks. Permeable gravels.

Drainage. This area is crossed by the distributary streams of the Taian and Taiko rivers, which flow among the wide pebble-strewn flood-beds of these rivers. They are liable to flooding from May to September. The ground between the two rivers and to the north and south of them is well above possible flood-level.

Soil. Gravelly, with a surface mulch in parts for paddy cultivation.

Obstacles to air approach. None.

Landmarks. The coast and deltas of the Taian and Taiko rivers.

Local construction materials. Gravel.

Local labour. Probably abundant from the agricultural country and from the town of Taiko.

Water supply. Abundant from the rivers.

Ground approaches. The main west coast roads and railways cross the delta.

Observation

Any slight eminence on the lowland would give a reasonably wide view over the surrounding country.

From the edges of the uplands the plains below could be observed.

VI

THE SEIRA PLAIN

(*Plans* 1, 2, 3, 14, 15; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 4 *and* 11; *Japanese Maps* (1:50,000), *Sheets*: *Tokatsukutsu, Kobi, Taiwan, Toyohara, Toruku, Rokuko, Suirin, Taichu, Hokko, Sairakeiko, Takezaki, Tanshu, Bokushi, Nanto, Kagi, Kaiko*; *photographs A*.18, 21-24)

DESCRIPTION OF COUNTRY

General

This region extends for about 50 miles north and south between the Pak-kang-k'e and the Taito-kei, and has an average width of about 25 miles. Topographically it forms a link between Regions V and VII, with which it has similar characteristics. South of the Seira river it has almost the same north-to-south parallel bands of terrain as in Region VII, while to the north, the plateau of older alluvium becomes detached from the upland region to the east and gives a relief comparable to that of Region V.

Geology, relief, and drainage

The region falls into three parts:—

(i) A broad, low, alluvial coastal plain, narrowing towards the Taito river.

(ii) A dissected plateau and ridges lying east of the coastal plain, and separated from the mountains by

(iii) the upper valleys of the Taito and Seira rivers.

The coastal plain is built up of recent materials, which include sands, gravels, clays and silts; in general the relief is flat to gently undulating. Sand dunes have developed along the coast, particularly south of the Seira river mouth (wA 2828). This dune formation gives a definite pattern to the landscape of dry rolling dune alternating with damp hollows. The dunes lie roughly north and south and are discontinuous. They extend for some 2 to 3 miles inland from the coast, between the Pak-kang-k'e (wF 1591) and the Taito rivers, while behind them, remnants of the higher drier dunes remain as isolated small hummocks, rising 10 to 15 ft., above the general level of the plain.

Away from the coast the drainage pattern supplies the key to the main outlines of the relief. The Seira and its southern parallel east-to-west channel, the Sin-ho-bue-k'e (wA 2323), break through the older alluvial ridge at the Pi-a-t'au gap (wA 6721). From this gap all the other main rivers fan out to the north-west and south-west and meander across the coastal plain. The rivers are normally confined to a few channels amid the piles of sands and gravels which are carried down in the flood periods. During these periods the rivers fill the bed and frequently overflow over a considerable area on both sides.

Between the rivers the ground rises gradually to form gently sloping, round-topped, inter-stream rises. Tributary streams of the north-west and south-west flowing rivers have cut deeply into these rises, many of which are believed to be relatively dry even during the wet season (May to October).

There would appear to be higher ground along the banks of the Seira and the Sin-ho-bue-k'e. The banks rise fairly steeply from the broad river bed, and then drop slightly between the rivers.

Near the Seira and the Sin-ho-bue-k'e there appear to be large areas of almost flat ground; many of these are parallel to the rivers, of which they are probably old beds. Such areas may be subject to flooding and may be damp at all seasons, except at the period of greatest dryness and low water.

Along the inter-stream areas there are smaller streams which run parallel to the main streams. Many of these have been led off from the upper courses of the larger rivers and are used for irrigation. In order to maintain their original level as long as possible, they flow between high banks and generally at a higher level than the surrounding country.

Where the rivers debouch into the coastal plain from the eastern hills they have built up broad, semi-circular fans of coarser material, with a steeper slope than the rest of the plain. It is particularly noticeable to the west of the Pi-a-t'au gap (wA 6721), where the Seira river has built up a fan extending about 9 miles west and attaining a greatest width of about 10 miles. Smaller fans of similar type have been built out of the left bank tributaries of the Pak-kang-k'e, which have their rise in the hills on the south-east border of the region.

Small lakes and ponds are found chiefly within 6 to 9 miles of the coast and on the slightly undulating, higher ground east of the Pak-kang-k'e. These pools rarely exceed a $\frac{1}{4}$ mile in length and are generally much smaller.

The dissected plateaux and ridges, which form the eastern boundary of the coastal plain, rise abruptly. South of the Seira the ridge is about 3 miles wide and attains an average peak elevation of about 1000 ft. The whole ridge is cut up by innumerable narrow, steep-sided valleys, which are probably occupied by running water only during the wet season (May to October). Gullying of the soft materials would seem to be the normal type of valley terrain.

North of the Seira this high ground occupies a greater area and extends for 20 miles in a north-north-west direction to Shoka (wA 5654). Its width is variable, being about 6 miles in the south, about $2\frac{3}{4}$ miles in the centre, and widening in the north to about $4\frac{1}{2}$ miles.

In general slopes are steep along the western, northern and southern sides, and more gentle to the east towards the Nanto (wA 7135) plain. Crest levels reach just over 1300 ft. in the southern part, where there is a narrow flat top with its greatest extent from north to south. North of the narrowest part the flat tops disappear, and crest levels are lower and average about 750 ft. Both western and eastern slopes are cut deeply by wet weather rills which have made narrow steep-sided valleys or ravines.

A narrow north-to-south valley lies in the east of these hills; the first steep slopes of the mountain mass rise along its eastern side; the permanent streams from this mountain mass are the chief source of water supply to the valley rivers. These streams, which flow westwards, have pushed out fans of material from their valley beds, which tend to push the main longitudinal stream to the western side of the valley. Where the longitudinal stream meanders to the east it has cut into these fans, and steep banks are the normal feature of its meanders.

The Seira enters this valley area just south of Nama (wA 7227) and appears to divide and send a small tributary northward to the Nanto valley. At the point of its debouchment an embankment limits the Seira to one channel, but it immediately breaks out into innumerable braided channels across the head of the southern valley.

Across the north of the Nanto valley the O-k'e flows in from the eastern mountains and, splitting up into several channels, flows across its wide north-westward sloping fan to join the Taito river. From this point to the sea the Taito flows in a wide braided bed between relatively high banks, and its lower course flows roughly north-west, separated from the sea by an area consisting mostly of sand dunes.

Natural vegetation and land utilization

The natural vegetation is of two types. Along the coast, rough country consisting of coarse grass and bushes is found among the sand dunes and marshy hollows, aligned north and south. In the higher ridges to the east, forests of deciduous trees, intermingled with clumps of dense undergrowth, occupy most of the slopes and gullies.

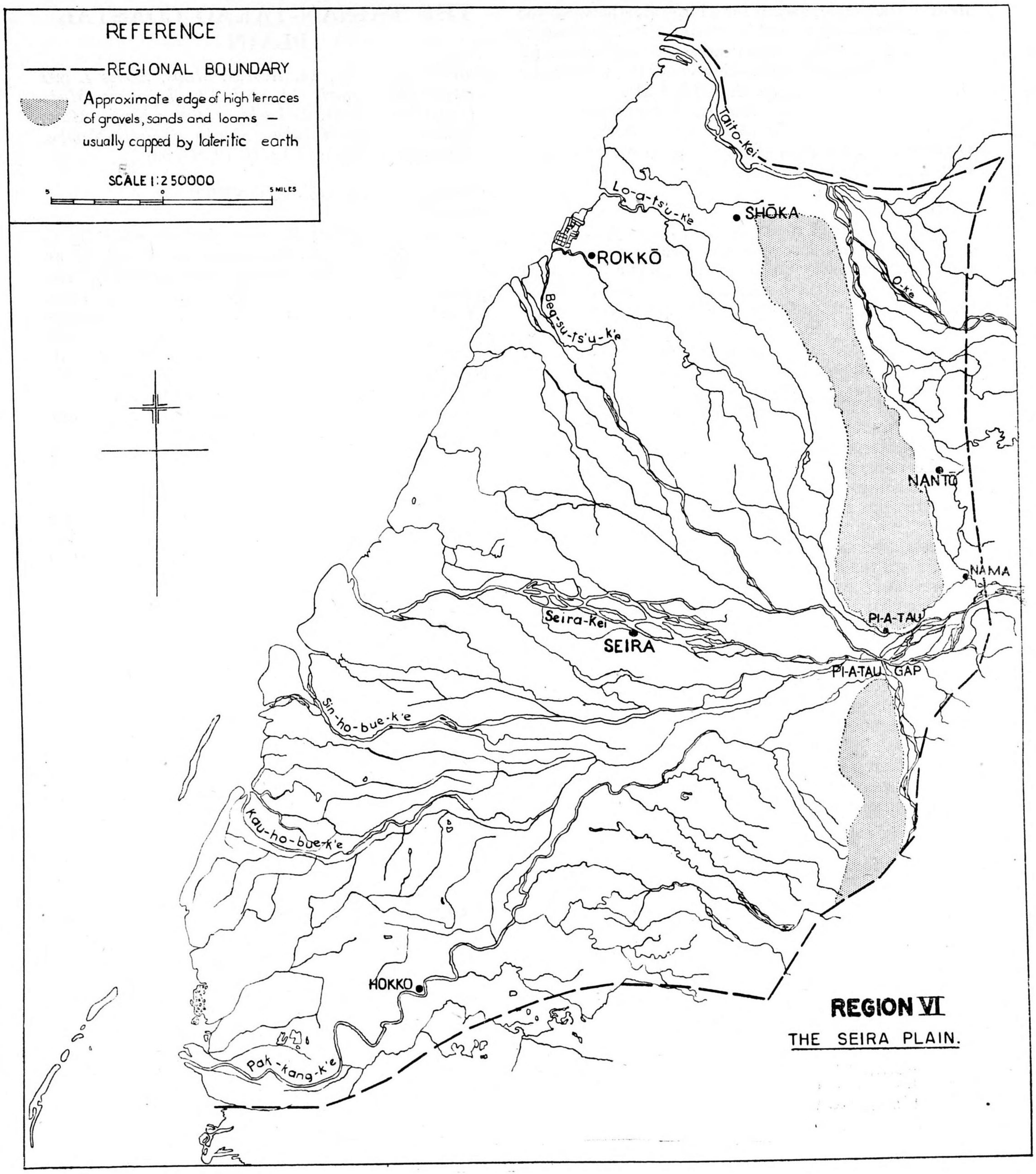


Fig. 9. Region VI. The Seira plain

Bamboo clumps, 10 to 20 ft. high and of considerable density, surround the villages and isolated houses; scattered clumps of trees appear to be common. Rough grass and bushes usually occupy the fans of coarse material along the eastern edge of the coastal plain and of the north-to-south valley.

In the wet season (May to October) rice occupies most of the region, except for a large area between the Seira and the Pak-kang-k'e; during the dry season it is probable that the paddy areas are cultivated for vegetable crops, when irrigation water from pools and ditches would be used (*photograph A*.21).

Sugar cane is grown along the low ground adjoining the Sin-ho-bue-k'e (*photographs A*.18, 22-24). Orchards and mulberry appear to be grown to a small extent throughout the region.

Settlement

Settlement is of the compact village type, though there are several large towns. South of the Seira, villages are generally about 2 miles apart and situated well away from the main rivers. There is a tendency for the villages to be smaller and further apart as one nears the coast. North of the Seira, settlement becomes denser and scattered farms take the place of the nucleated village pattern.

SUITABILITY FOR OPERATIONS

Cross-country movement

The chief obstacles to cross-country movement are the dissected ridges on the east, and the large rivers, when in flood. Other obstacles are: the gullies made by the streams cutting into the inter-stream rises; the embankments of the many ditches and channels which run east and west; and the coarse boulder-strewn fan areas in the eastern north-to-south valley, and west of the Pi-aut'au gap. It is probable that the coastal sand dunes and marsh land would form an obstacle to east-to-west movement.

Cover

Except for the forest-covered ridge country, cover from ground and air observation would probably be poor throughout.

Observation

The crests of the eastern ridges would provide excellent observation posts over the coastal plain and the north-to-south valley.

Suitability for airborne landings

Except for the forested ridges it is probable that almost the whole region would present many possibilities for airborne landings. The main obstacles would be the bends and ditches about the paddy fields (*photograph A*.19), the gullies and the scattered lakes.

SUITABILITY FOR LANDING-GROUNDS

The whole of the coastal plain would appear to offer good possibilities for the construction of landing-grounds.

Altitude. Generally below 100 ft.

Degree of flatness. Gently undulating to flat, though embanked channels and gullied areas to east might be obstacles to construction.

Underground rocks. Thick cover of recent alluvium, of unconsolidated sands, gravels, clays and silts.

Drainage. Probably poor along coast, but generally good to east.

Soil. Thick permeable sands and gravels, with impermeable clays and silts.

Vegetation and land utilization. Some paddy and sugar cane; orchards with rough pasture on the poorer soils.

Obstacles to air approach. None.

Landmarks. The various large rivers.

Local construction materials. Gravels and sands from the river beds, and the eastern hills.

Local labour. Probably plentiful.

Water supply. Available from rivers, but wells would probably give good supply.

Ground approaches. Rail and road network covers plain.

VII

THE TAINAN-TAKAO COASTAL PLAIN

(*Plans* 1, 2, 3, 13, 14; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 11 *and* 13; *Japanese Maps* (1:50,000), *Sheets*: *Bokushi, Hokko, Kagi, Mato, Shinei, Tainan-Hokubu, Shinka, Tainan-Nambu, Kizan*; *photographs A*.19-37, 79, 87, 93)

DESCRIPTION OF COUNTRY

General

This region, about 60 miles north to south by 15 miles east to west, is backed on its eastern side by an almost continuous line of steep hills, in which there appears to be only one break, just east of Hosan (wL 3993), connecting with the Heito plain (*Region VIII*). Its most characteristic features are (*a*) the large area of lagoon coast, bordered by off-shore spits and sand banks, (*b*) the gently undulating coastal plain, backing the lagoon belt and crossed from east to west by the wide beds of many short rivers, and (*c*) the slightly higher, gently undulating but dissected ground, lying at the base of the eastern hills.

Geology and relief

The coastal lagoon area extends almost continuously along the whole length of the region, and the only break in its continuity is made by Ape hill, 3 miles long, north of Takao. It falls into two parts, the relatively narrow, simple, spit and lagoon form south of the Dzi-tsan-hang-k'e (Nisoko river; mouth at wF 2024) and the broader and more complex type north of the Dzi-tsan-hang-k'e.

The southern part averages about 1 mile wide. It has a narrow, off-shore sand spit, enclosing a shallow salt-water lagoon, of which the shallower parts are broken up by low embankments to form small compartments. These are probably utilized as salt-pans or fish hatcheries (*photograph A*.30).

The sand dunes rise steeply from the shore, but slope more gently on the landward side, averaging about 120 yds. wide (*photograph A*.27). The lagoons behind the spits are shallow, and many short streams flow into them making the landward side of the lagoon muddier than the seaward side.

The northern part is more irregular in its outline and characteristics. The off-lying spit is discontinuous and is seen as a line of sand banks, lying up to 3 miles from the coast.

Larger and bigger rivers, such as the Sobun (wF 1042), bring down large quantities of material, which is deposited in wide deltaic formations, frequently extending out to sea to join with the off-shore spits and bars. The result is that on either side of the larger river mouths there is a much broader area of salt-pans, fish hatcheries and tidal flats. About the Sobun river the coastal belt has a depth of some 6 miles, narrowing to the north and south of the main river mouth. No other river bearing an equivalent quantity of material flows out north of the Sobun; the remainder of the coastal belt never exceeds 3 miles in width and has an average width of about 1½ miles.

On the seaward side there are sand dunes, which attain considerable heights (*photograph A*.27); but the most prominent features are the earth banks, which cut the tidal areas into small rectangles. These banks or bunds vary in height from 6 to 13 ft. above the surrounding flat country. Their width is not known, but they are probably very wide on the seaward side, and their width will of course vary with their height. The areas so surrounded are utilized as evaporating tanks for sea water (salt-pans) and as

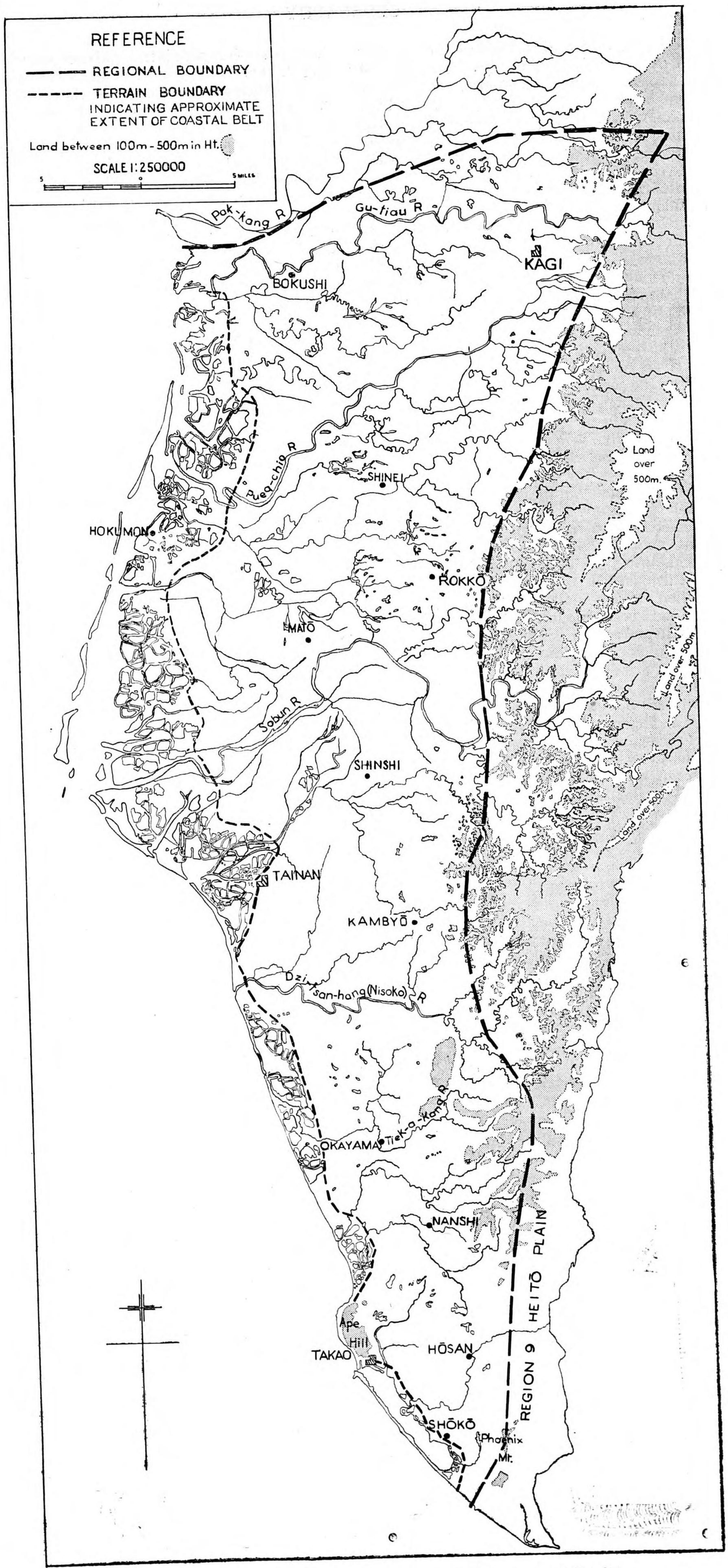


Fig. 10. Region VII. The Tainan-Takao coastal plain

fish hatcheries, and for this purpose are further divided up by low, narrow walls (*photographs A*.29, 30). The coastal fringe, therefore, consists of almost permanently wet lands, divided up by high, narrow banks, with a possibly drier sandy dune strip along its coastal edge. The whole area is cut across from east to west by the rivers and streams, which are dyked to control their flow to the sea.

Behind this coastal fringe the land rises very gently above the tidal level towards the eastern hills. South of the latitude of Tainan, in the Takao plain, there would appear to be a different terrain pattern from the country to the north. From the information available old belts of dunes or higher sandy country would seem to run parallel to the coast and some 4 to 5 miles from it. These slightly higher belts of country, rising to nearly 100 ft. above the local level, cut across the east to west lines of the main drainage pattern. Many of the smaller rivers run parallel with the coast for some distance along the eastern side of this rising ground, before cutting through to the sea.

Other variations in the terrain are the small areas of coral limestone hills, which stick out prominently from the general level of the plain. These are seen at the following points:

(i) Ape hill (Monkey hill) (wL 2995), north of Takao (*photograph A*.36).

(ii) The north-south ridge of Phoenix mountain, along easting wL 42, lying to the south-east of Hosan, which forms the boundary between the Takao and Heito plains.

(iii) Smaller scattered hills, lying between Takao and the Dzi-tsan-hang-k'e (probably wF 2708, wF 3613 and wF 3818) (*photograph A*.34).

All these hills appear to rise steeply from the surrounding country and to be cut up into a confused pinnacle and basin pattern.

The remainder of the terrain is of low elevation and is gently undulating to flat.

The rivers which meander across the plain in broad flat valleys have strongly influenced the topography, particularly north of the Dzi-tsan-hang-k'e. The rivers, which have their sources in the highlands to the east, debouch onto the plains from narrow gorges, and, their flow being checked, they have deposited large quantities of material. In general the coarser materials have been laid down close to the highland zone, while the finer materials lie to the west.

The rivers meander through the material they have deposited in wide flat beds. They become torrents in the wet season (May to October) but are reduced to braided narrow channels in a boulder, sand and gravel bed in the dry season. During the floods they spread over a large area of the surrounding country and deposit a light film of fine material.

In order to retain the flood-waters within the river bed, dykes and bunds have been raised, and there is often the distance of a mile or more between the dykes on either bank of any large river. These bunds vary in height from about 3 ft. to 12 ft.

Away from the river beds, bounded by their embankments, the ground slopes up very gently to the inter-stream rise, which rarely reaches a height of 50 ft.

Throughout the eastern side of this area finger-like, narrow valleys, with steep sides, appear to have been dammed to form narrow lakes. Farther west, on the flatter part of the plain, shallow rectangular ponds are the most characteristic interruption of the relief.

Along the eastern edge of the region, the inter-stream rises are more deeply cut by innumerable small streams, and the gently undulating upper surfaces are interrupted by ponds and pools of various shapes and sizes (*photograph A*.31).

Drainage

The chief rivers meander across the coastal plain from east to west, though there is a tendency in the rivers north of Tainan to flow towards the south-west. The normal depth of the main rivers varies between 1½ ft. and 5 ft., and the flow is said to be rapid, though the Dzi-tsan-hang-k'e is tranquil except during the flood period. The beds of most of the streams are usually covered with gravels and sands, though it is probable that the materials become much finer towards the coastal area.

In the east the rivers have cut deeply into the slightly higher ground and all minor streams run in ravine-valleys. The large rivers, which have their sources outside the region, attain a considerable width, though they are normally shallow, with wide expanse of flood areas on either side. The banks of these rivers are usually high on the outer curves of meanders, and banks of 7 ft. above normal water level are common. Old banks left by the outer meander curves occur on both sides of the large rivers (*photographs A*.26, 35).

There are also said to have been considerable irrigation works constructed north of the Sobun river. The work undertaken appears to have involved impounding the water at the junction of the eastern hills and the plain, and distributing it by a north to south canal along the higher, eastern part of the plain. The water is then distributed by east to west channels along the tops of the inter-stream rises. These works may have provided difficult water obstacles.

Soils

Coarse sands and gravels probably predominate along the east. Finer silts and clays are probably more important towards the west. Sands again occur along the coastal belt.

Natural vegetation and land utilization

The greater part of the region is under cultivation and the only natural vegetation would appear to be the scrub-covered, coral limestone hills, which stand up above the plain level south of the Dzi-tsan-hang-k'e. Hedgerow timber and giant bamboo, 10 to 12 ins. thick and 30 to 50 ft. high, which are found about the villages and buildings, would look like large woods.

The chief crops are rice, sugar-cane, sweet potatoes, pineapples and fruit trees (*photographs A*.19-25). Rice is grown throughout; there are two crops a year on the flatter areas, to the west of the higher broken ground along the eastern side of the region. In the higher area of the east the fields are probably too dry for rice outside the wet season (May to October), and crops such as sweet potatoes, peanuts, soya and vegetables are then grown. Terracing of the rice fields occurs on the steeper slopes.

Sugar-cane is grown on the lower well-watered ground and generally close to the large towns where a refinery is situated, such as Kagi, Tainan, Takao, etc. Bananas and pineapples occupy comparatively little ground (*photograph A*.91).

The normal field pattern is a narrow rectangle without any boundary fence or hedge. Sugar-cane fields are usually very large and all fields may have ditches along their edge.

Settlement

The general type of settlement is the nucleated small village, situated on the higher drier ground above flood-level and averaging about 1 mile long. The normal house is brick-built (dried mud and bamboo), and is whitewashed, with red or yellow tiled roofs. In general settlement avoids the damp coastal belt of dunes and lagoons.

SUITABILITY FOR OPERATIONS

Cross-country movement

The chief obstacles to cross-country movement are the damp coastal belt of dunes, lagoons and salt-pans, and the ravined and broken higher ground along the east of the region. Elsewhere the east to west rivers, drainage and irrigation channels, and the high banks cut by some of the rivers would form obstacles, but they are probably not too long to be circumvented.

Cover

In general cover from air and ground observation is scanty. It is poor along the coastal area and over the paddy fields inland, though it is probable that the bunds might give some cover from ground view. It is probably excellent on the isolated, wooded, coral limestone hills south of the Dzi-tsan-hang-k'e, and about most of the settlements, which are surrounded by bamboo. The ravines on the east would provide good cover from ground observation.

Observation

It is probable that any slight eminence above the general level would provide an excellent observation post over a wide area, though hedgerow timber and clumps of mulberry and bamboo might restrict this. The spurs of the hills to the east would provide many points commanding wide views over the plain.

Suitability for airborne landings

Apart from the broken topography of the coral limestone hills south of the Dzi-tsan-hang-k'e, it is believed that most of the region would be suitable for parachute and glider landings.

Possible obstacles are the small ditches and bunds in the rice-growing areas, and the narrow ravines in the higher areas of the east.

SUITABILITY FOR LANDING-GROUNDS

The whole region offers good possibilities for the construction of airfields. The damp coastal strip, the broken topography of the eastern edge, and the coral limestone hills south of the Dzi-tsan-hang-k'e would naturally limit the area to be reconnoitred.

The rest of the region is rarely more than 60 ft. high and is gently undulating, the only obstacles being ravines in the slightly higher ground, embankments and steep banks of rivers.

The underground rocks are a thick covering of loose, recent alluvium of unconsolidated sands, gravels, clays and silts. The water table is generally well below the surface in the dry season (November to April) particularly towards the east, but probably large areas are flooded during the wet season.

Except for the Takao plain, where sandy loams predominate, clayey soils are general. Much of the region is under paddy, two crops a year being common on the lower western areas. On the higher ground vegetables replace rice in the dry season.

There are no obstacles to air approach and the longer rivers provide many landmarks.

Local construction materials include sands and gravels from river beds, and limestone from the coral limestone hills to the south.

Local labour is probably plentiful. Roads and railways of various gauges form a close net over the whole region.

VIII

THE HEITO PLAIN

(*Plans* 1, 2, 3, 13; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheet* 13; *Japanese Maps* (1:50,000), *Sheets*: *Mino, Sai-kua-hui, Lamtua-bu-sua, Kisan*; *photographs A*.38-41)

DESCRIPTION OF COUNTRY

General

The Heito plain is a generally flat to gently undulating lowland, lying west of the main mountain range, and south of the low spurs of the Morrison and Arisan ranges. In the west it is bounded by the low plateaux which lie along the right bank of the E-tam-tsui (Shimotamsui). The plain extends 30 miles north and south, and averages about 15 miles wide.

Ryukyu-sho

This island lies about 9 miles south-south-west of Toko. It is roughly oval in shape, the major axis being oriented north-east to south-west, and is about 3 miles long by about 1 mile wide. It is said to be composed of young coral limestone, which gives a sandy soil. The island is rather flat with an average elevation of about 250 ft., and a low cliff coast is probably the predominant shore line. There is some agriculture on the northern plain, but the chief occupation of the inhabitants is fishing.

Geology

The characteristic rock is sandy and gravelly alluvium. Along the eastern boundary there are low hills and spurs of the clay-slates and sandstones of the main mountain mass; to the west an old gravel plateau continues the line of the Arisan range. Shales, sandstones, and pebble beds form the rock of the spurs bounding the northern edge of the area. Along the coast sand dunes and silts form spits which enclose the lagoons south-east of Toko (wL 4875).

Relief and drainage

The area is essentially a series of fan-shaped aprons of alluvium spread by the westward-flowing streams upon entering the plain. These alluvial fans cover a wide area and join up one with the other along the base of the main range, which rises abruptly along the eastern boundary of the region (*photograph A*.41). At the base of the alluvial fans the main rivers have a north to south course; the wide-braided channel of the E-tam-tsui (*photographs A*.38, 39) is the most important topographical feature of the western side of the region. Along its right bank it is bounded by two hills which form the western side of the plain.

Much of the coastal portion is composed of low sand dunes, which enclose shallow lagoons. This type of coastline has its greatest development south-east of the mouth of the E-tam-tsui. Here a narrow sand spit, about six miles long, encloses a series of lagoons. To the south-east of this lagoon area the coastal fringe would appear to be sandy dunes, probably backed by a narrow area of swamp, where the dunes have diverted the small streams in this sector.

North of the coastal fringe the ground rises very gently to the north, and reaches a height of about 130 ft. in the area about Kisan (wF 5222); in addition, there is a general rise over the alluvial fans to the base of the mountains to the east. Heights of about 1000 ft. are reached at the base of the mountain slopes. It is this greater rise to the east which has a strong influence on the character of the drainage in the area.

The streams and rivers debouch onto the plain from the main range through narrow gorges (*photograph A*.41). During the south-west monsoon season the rivers are raging torrents, and carry down from the mountains great quantities of material. On flowing into the plain there is little constriction of these waters, which spread over wide areas in many channels, dropping first their coarser material and, farther west, the finer material. The resultant fans of this debris have spread out over wide areas in great amphitheatres. Their slopes are gentle near the mountain edge, become more steep, and further out become more gentle again.

At the edge of these amphitheatres the rivers tend to turn southwards with the general slope of the land, and flow parallel to the E-tam-tsui to the sea. The terrain along the eastern side of the plain and as far west as the point where the east to west rivers turn southwards, exhibits certain characteristics which differentiate it from the rest of the region. The northern edge of this eastern part of the plain is formed by the valley of the Lau-long (Rono) river. The flood plain which is about 1 mile wide exhibits all the usual characteristics of the rivers in Formosa: it is normally a wide expanse of gravels, sands and silts, interspersed with large boulders, through which the river flows in narrow braided channels during the dry season (November to April). In the wet season (May to October), the whole flood plain is frequently under water, some portions being only a few inches deep. Along its

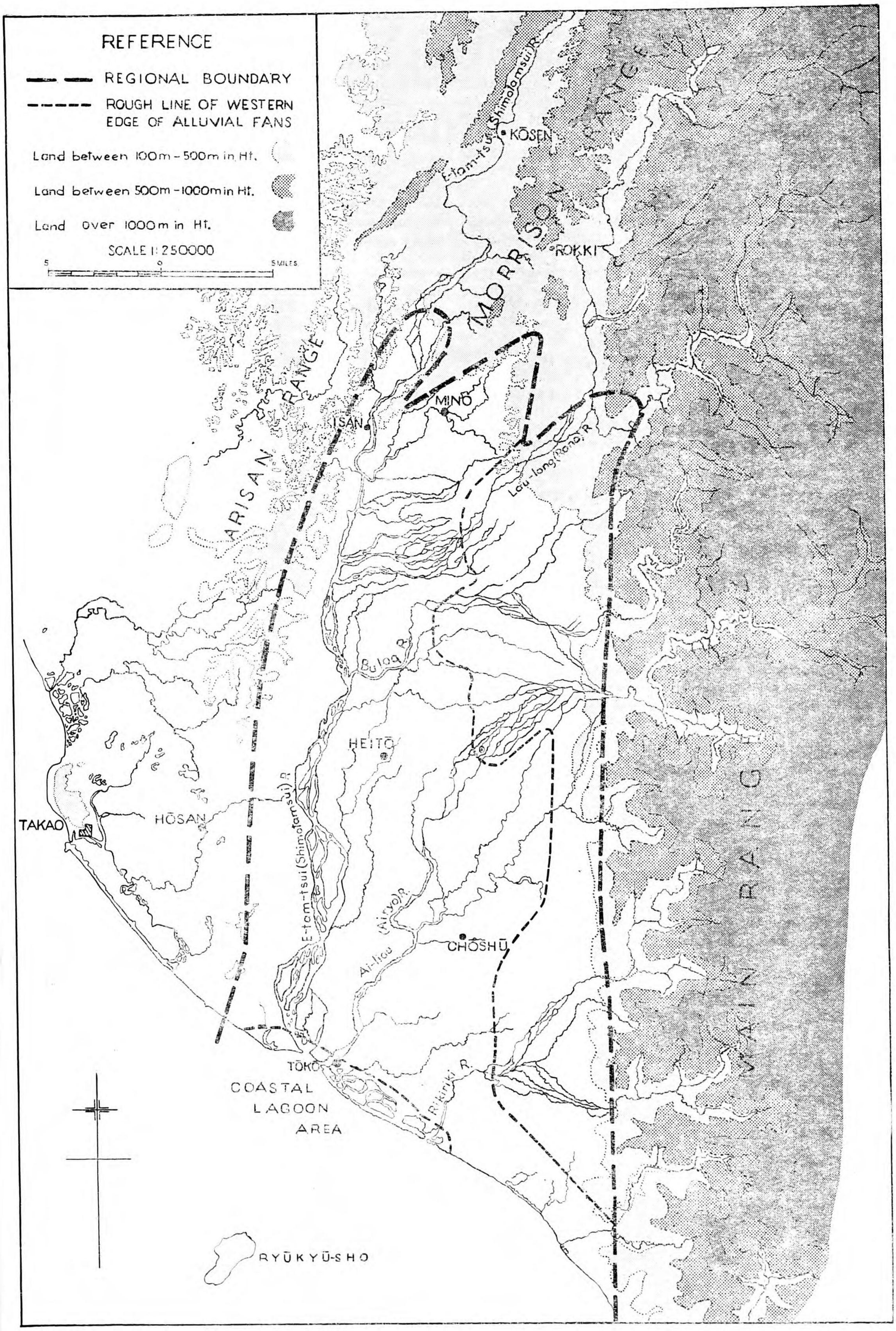


Fig. II. Region VIII. The Heito plain

northern side the river has undercut the steep slopes of the lower spurs of the Morrison range, and there are frequent cliffs over 200 ft. high.

At the point where the Lau-long enters the plain (wF 6017) a north-south embankment has been built, about 1 mile long, and at one point 10 ft. high. This embankment diverts the Lau-long and prevents it from inundating the cultivated lowland, which lies westwards towards Kisan. The river runs in a series of channels, which link up one with another across the generally flat flood-plain. During the dry season the majority of these channels are seldom more than 2 or 3 ft. deep.

To the south of the Lau-long lies an area about 1 mile wide, oriented parallel to the river and rising very slightly above the level of the main river bed. Probably it is only covered by shallow water during the period of greatest floods, and only the finest silt is deposited. To the south of this area and extending for over 10 miles, lie the joint fans of the Ai-liau-k'e (Airyo) and Bu-loq-k'e.

Coarse deposits of gravels and sands extend westward for about 8 miles from the base of the main range, and the rivers follow braided courses within the wide gravel- and boulder-strewn flood-plains, which in the case of the Ai-liau-k'e average about 2 miles in width.

South of the Ai-liau-k'e is an area of finer deposits. This is cut up by innumerable small streams with a general north-east to south-west orientation; in the south, approximately south of Choshu (wL 5884), the great fan of coarse deposits of the Rikiriki spreads out across the plain.

The whole of this eastern part of the plain has thus two distinct patterns of terrain. The great fans of coarse debris are usually arid, gently rolling surfaces interspersed with the changing, shallow channels of the westward-flowing stream. Between the fans lie limited areas of slightly undulating damper ground, criss-crossed by many small streams and irrigation and drainage ditches, with a general orientation from north-east to south-west.

West of the point where the rivers from the eastern mountains turn southwards there is another landscape extending to the western boundary of the region. Between the great rivers the surface deposits would appear to be finer, though the river beds are wide and are compos ed of sands and gravels and interspersed with boulders. The surface is gently undulating or flat, with frequently low sharp slopes down to the broad river beds. In the north drainage is oriented west to east towards the E-tam-tsui; but south of Heito the characteristic drainage pattern is north to south with minor east to west streams.

The E-tam-tsui (*photographs A*.38, 39) has a braided course in the dry season, in a bed over a mile wide and some 20 ft. below the general plain level, west of Heito. It is believed these braided channels are rarely more than a few feet deep, and it is said that only native craft with very shallow draught can navigate along this river.

In the west of the E-tam-tsui the plain has only a limited extent, but exhibits the same characteristics as the area immediately to the east of the river. Within a short distance of the right bank rise the steep slopes of the deeply eroded, flat-topped, gravel hills. These hills appear to run almost continuously southward from the southern tip of the Arisan range west of Kisan to a point on the coast (wL 3880). The low hills, said to reach about 700 ft. above sea level, would appear to form a considerable barrier between the Heito and Takao plains. Air photographs show that there are several breaks in the continuity of these hills south of northing wL 94.

The regime of the rivers follows the monsoon. From May to September the south-west monsoon brings heavy rain, and with the violent thunderstorms and typhoons of this season, causes violent fluctuations in the wet season level of the waters. From October to April very little rain falls and the rivers contract to small, shallow-braided channels.

The violent floods, which may cover large areas for a few days, cause a wide distribution of coarse and fine materials, which the flood-waters spread over the plain. In some cases large areas may be rendered sterile by a covering of coarse gravels and sands; in others the fine silts may act as a fertilizing agent and be welcomed by the farmer.

It is in these areas of the silts and finer deposits that irrigation schemes have been carried out and, though definite information is lacking, it is thought that the areas which would have irrigation schemes would be those lying to the west of the alluvial fans, and east of the E-tam-tsui. Other projects which have topographical expression are the control schemes to prevent the various rivers from flooding the valuable agricultural land. These projects involve embankments and dykes. *Photograph A*.39 shows a training wall of boulders, which is believed to be north of the railway bridge west of Heito. Owing to lack of up-to-date maps and incomplete air photographic cover, more definite statements on the irrigation and drainage cannot be made.

Soils

Sandy and gravelly permeable soils predominate throughout the region, though there are some clays. The coarser deposits lie along the eastern side and along the beds of the main streams and rivers. The hills which form the boundary along the west are believed to be capped with laterites.

Natural vegetation

The broad alluvial fans, that spread out from the base of the main range, and the great areas of gravels, which form the dry beds of the large rivers, have only a scanty cover of coarse hummocky grass with an occasional bush. Woods of a deciduous type occupy the steep-sided valleys of the low hills which form the western boundary. Elsewhere bamboos in small clumps about villages, and trees, forming windbreaks, occupy very limited areas.

Land utilization

The lagoons along the coastal strips are said to be used for salt-pans or fish hatcheries. Throughout the rest of the region two crops predominate, sugar-cane (*photograph A*.40) and paddy. Sugar-cane occupies a large area of the inter-river rise between the E-tam-tsui and the Ai-liau-k'e about Heito. Rice is found over much of the rest of the cultivable area and is in the fields all the year round. In the first period (planting February to March, harvesting June to July) only about half the possible paddy land is under cultivation. In the second period (planting July to August, harvesting November to December) all the paddy land is used. Sweet potatoes, vegetables and soya beans are other important crops.

Field pattern is of two types, the large rectangular fields of sugar-cane, separated one from another by irrigation ditches, and the smaller multi-shaped fields of the other crops. The latter are more closely aligned to the slope of the land.

Settlement

Settlement is of the nucleated type, probably on higher ground, above ordinary flood-levels. In the cultivable areas villages and towns are set thickly among the intensively cultivated fields. Settlement is therefore densest to the west of the alluvial fans, on which there are few settlements.

SUITABILITY FOR OPERATIONS

Cross-country movement

The chief obstacles to cross-country movement are the broad river beds and the broad fans of coarse materials along the eastern edge. Here the boulders and the large stones in the dry season, and the flood-waters in the wet season would form consider-

able obstacles. The lagoons along the coastal strip would present serious difficulties, and the western boundary ridge, with its steep-sided, narrow wooded valleys would also form a considerable though discontinuous obstacle.

Cover

Cover from air and ground observation would be scanty, except on the wooded valleys of the western hills where it would be good. Cover from ground view could also be obtained in the sugar-cane and other growing crops, and in all the ditches below the banks of the streams and rivers.

Observation

Observation over much of the plain could be maintained from the higher eastern and western edges, and from the top of any prominent building on the plain itself.

Suitability for airborne landings

It is thought that apart from the built-up areas, coastal lagoons, and the hills along the western boundary, the whole region would be suitable for airborne landings. It is probable, however, that during the flood periods large areas about the rivers would be inundated to a considerable depth, and this would be a limiting factor during the months May to September.

SUITABILITY FOR LANDING-GROUNDS

Except for the damp coastal lagoon and the hilly ground of the western border, most of the region offers excellent possibilities for the construction of landing-grounds.

There are insufficient large-scale maps and air photographs to give definite information as to the most suitable areas. It is possible, however, that the best would be found along the eastern alluvial fans and along the tops of the interstream rises. The general characteristics of these areas are listed below:—

Size. Of whole area 30 miles north to south, by about 15 miles east to west.

Altitude. Generally below 500 ft.

Flatness. Gently undulating. Obstacles are stream beds, irrigation ditches, and dykes.

Underground rocks. Generally permeable gravels and sands, though some clays.

Water supply. Generally well below the surface, though varies with the season.

Soil. Sands, clays and gravels.

Vegetation and land utilization. Scrubby growth in alluvial fans and river beds. Sugar-cane, rice and other crops on the cultivated land.

Obstacles to air approach. None.

Landmarks. The E-tam-tsui would be important.

Local construction materials. Gravels from rivers and terraces of western boundary.

Water supply. Surface water and some springs in the hills and terraces. Wells may have to be sunk to some depth in the lowlands.

Ground approaches. Road and railway enter the plain from the west and cross the E-tam-tsui west of Heito. Close road net in west of plain.

IX

THE MOUNTAINS

(*Plans* 1, 2, 3, 12-19; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 1, 4, 5, 11, 12, 13, 14, 15; *Japanese Maps* (1:50,000), *Sheets*: *Taihoku-Tobu, Ozono* (*To-en*), *Shinten, Tokai, Chikuto, Kakupanzan, Giran, Rato, Byoritsu, Goshizan, Bobonyaha, Dakusui, Su-o, Taiko, Mankutaizan, Butasha, Nan-o, Taiwan-Toyohara, Tosei, Tabito, Gukutsu, Taichu, Kokusei, Gokanzan, Shinjo, Hori, Bandai, Notakayama, Karenko, Toroku, Shushu, Horin, Taezaki, Arisan, Busshi, Kagi, Chuho, Niidaka-Yama, Tamazatoyama, Tomazato, Taiho, Koko, Kasa-wan, Shinka, Kosen, Riro, Mino, Toranzan, Kendowru-Yama, Taito, Tamari, Odaki, Taijurinzan, Kanobana, Koshibitoke*; *photographs A*.42-60, 71, 75, 77, 80)

DESCRIPTION OF COUNTRY

General

This region of the main Formosan mountain belt occupies approximately the eastern two-thirds of the island, extending from the extreme southern end to Kirun in the north.

Much of it is unknown in detail and has been left by the Japanese to the so-called 'savages'. Tracks have been cut across the mountains, and posts have been established for policing purposes (*photograph A*.48).

This mountain region is mostly over 3000 ft., and rises at its highest to Mount Morrison, about 13,000 ft. The whole surface is strongly dissected by numerous steep-sided river valleys, with occasional small cultivated basins.

Most of the lower slopes have a cover of broad-leaved trees with some extensive areas of rough grassland. This gives place to conifers, usually between 7000 to 8000 ft., whilst above this scanty grass and bare rock conditions prevail.

As a whole it can be described as a partially-known, barrier region.

Geology and relief

The strata forming this mountain region follows a north-north-east trend from the extreme south of the island to about the latitude of the southern boundary of the Giran lowland, about 24°40′N., and then trends first north-east and then east-north-east.

The western foothills consist of young sedimentary rocks. From the coast south of Kirun to the Tansui river there are coarse, free-draining sandstones and conglomerates. From the Tansui to about the latitude of Kagi sandstones and shales predominate, with some small areas of volcanic rocks. This gives a variety of conditions, from coarse-grained, free-draining rocks to fine clays. Southwards to the northern and western limits of the lower E-tam-tsui (Shimotamsui) river, soft shales predominate with some sandstones.

East of these foothills the mountain slopes are composed of fairly soft clay-slates, succeeded by harder clay-slates with inter-bedded and strongly folded limestone and quartzite beds. From these much rock-rubble accumulates at the base of the steep slopes. The Hori basin (wA 9941) is formed of free-draining, old terrace gravels, with sandstones and shales outcropping in the middle.

The eastern slopes, in a belt extending from the east coast just south of the Giran plain to the west of the Taito plain, is formed of hard and heavily folded and faulted schists with a hard core of crystalline limestone extending through most of its length.

South of a line roughly from Horyo (wL 6363) to Daibu (wL 9563) the rocks are young sedimentaries. On the west there is a coarse, gravelly conglomerate, with sandstones and finer shales to the east. At the southern end of the peninsula, particularly around Garambi (wL 9012), there are many coral limestone deposits, which frequently give rise to cliffs, fringing the coasts (*photograph A*.80). West of Koshun (wL 7924) there is a 6 to 7 mile long ridge, running north and south, composed of old terrace gravels. There is a narrow belt of recent alluvium, varying in texture from sandy to clayey, along the east and west coasts south of the Horyo-Daibu line.

This mountain region is made up for the most part of steep-sided ranges cut into and divided by deeply incised valleys, with many vertical, broken-rock stretches in the upper slopes and accumulation of rock-rubble in the valleys below. Most of this region is over 3000 ft. rising to its greatest height in Mount Morrison (wA 9986) to about 13,000 ft. (*photograph A*.71). On the western side the mountains rise steeply from the main western lowland. On the east the slopes are even steeper to the sea coast or the Karenko-Taito

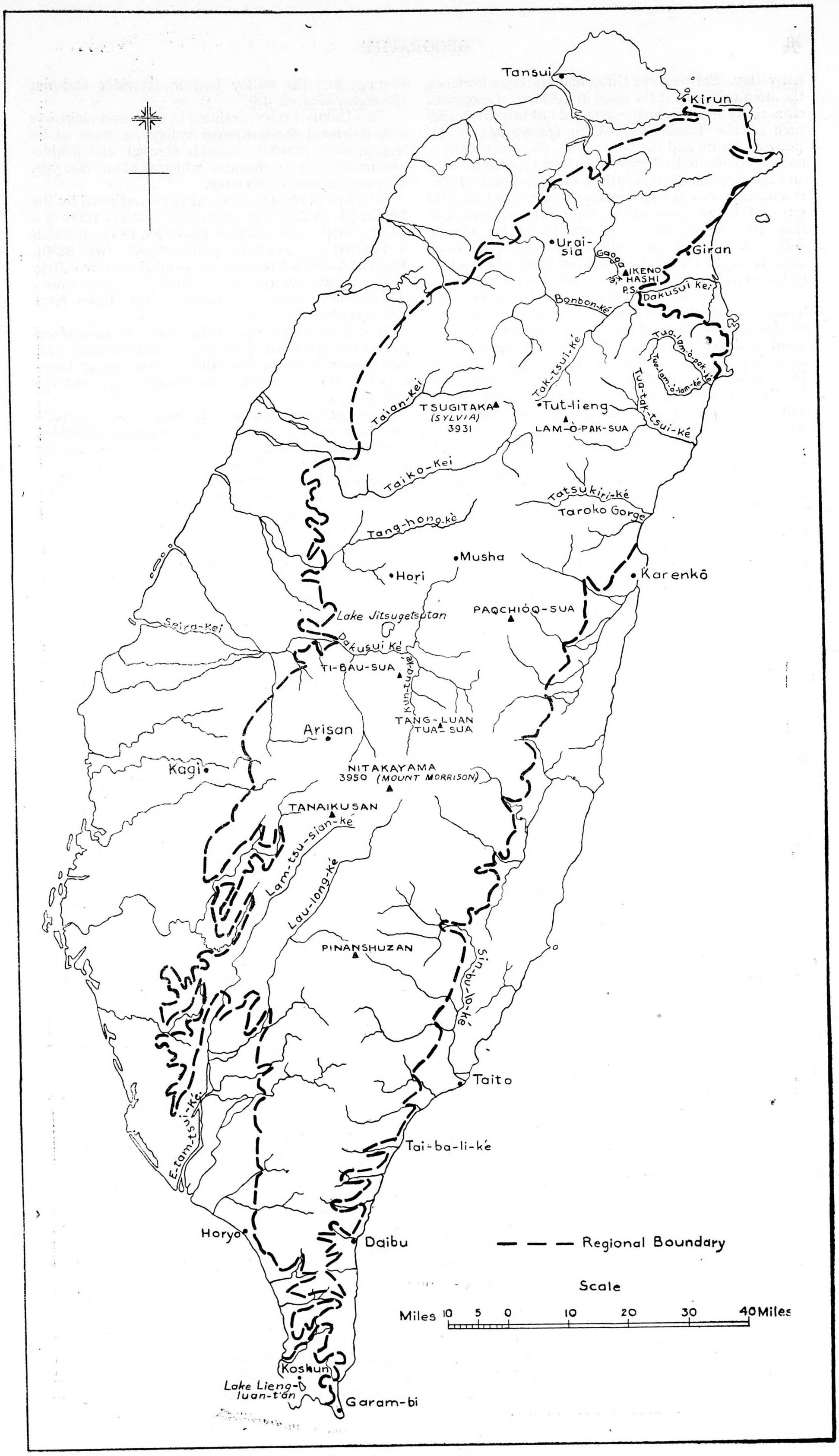


Fig. 12. Region IX. The Mountains

rift valley. Between the Giran and Karenko lowlands the mountains end at the coast in the form of enormous cliffs rising sheer from the sea, and cut into by gorges such as the Taroko (wB 6960) (*photograph A*.75). Between Kirun and the Giran plain there is usually a narrow coastal ledge between the steep mountain edge and the sea. Similarly, south of the Taito plain, there is a narrow coastal belt, usually between 100 and 300 yds. wide between the mountains and the sea, although there are low cliffs in some places. The region is lower and the slopes are not so steep towards the southern end. Roughly south of a line from Horyo (wL 6363) to Daibu (wL 9563) the hills are under 3000 ft.

The trend of the main crest line is north-north-east to south-south-west for most of its length, changing to north-east to south-west just at its northern end. This trend is shown in the steeply incised valleys of the upper Dakusui, draining to the Giran plain, the upper Tua-kaq-k'e, the upper Tang-hong-k'e, the Kun-tua-k'e, the Lam-tsu-sian-k'e and the Lau-long-k'e. Many short valleys, however, cut back between subsidiary divides at right angles to this main line.

The highest peaks, all well over 9000 ft., are found along four main crest lines:—

(i) North-east to south-west through Mount Tsugitaka (wB 2587) for most of its length (*photograph A*.49). This crest line marks the boundary between the Shinchiku-shu and Taichu-shu.

(ii) Separated from (i) by the upper Dakusui and Tua-kaq-k'e valleys. The crest line runs north-north-east to south-south-west from Lam-o-pak-sua (wB 4688) to Paq-chiok-sua (wB 3135), and is followed by the boundary between Taichu-shu and Karenko-shu.

(iii) Further south the Mount Morrison mass extends north and south between Ti-bau-sua (wB 0117) and Tanaiku-san (wF 8076). This highland area extends westward to include the slightly lower mount Arisan area.

(iv) Separated from (iii) by the Kun-tua-k'e and Lau-long-k'e valleys. The crest line winds north-north east to south-south-west extending from Tang-luan-tua-sua (wB 1105) to Pinanshuzan (wF 9240). It marks the boundary between the Takao-shu on the west and the Karenk-cho and Taito-cho on the east.

The highest slopes will probably be snow-covered in winter, and cloud-enveloped at any time of the year, particularly in the morning and late afternoon.

The only basin area, more or less enclosed, in the mountains is the Hori basin (wA 9941). It is about 6 miles north to south by 5 miles east to west, and is enclosed roughly by the 500 metre (about 1650 ft.) contour. It is drained westward by the Lam-kang-k'e though a steep-sided, narrow valley to the Taito river.

Drainage

This mountain region is cut into by numerous river valleys. Most of these are deeply incised with steep sides making possible frequent land-slides (*photograph A*.47). The larger rivers are flat-bottomed with pebbly and boulder-strewn valley bottoms, e.g. upper Dakusui (*photograph A*.60), upper Tansui (*photographs A*.42, 44), and Tak-tsui-k'e (*photograph A*.47). Many of the smaller streams have narrow and gorge-like valleys, especially where they cut through resistant rock formations, e.g. Tatsukiri through gneiss and crystalline limestone (*photographs A*.58, 59). The principal river valleys are in the line of the main trend of the mountains, roughly north-north-east to south-south-west, as the upper Tansui and Dakusui valleys to the north and the Lam-tsu-sian-k'e and Lau-long-k'e valleys to the south.

The headwaters of the Tansui are in the northern end of the Tsugitaka group, with a set of tributaries draining through the Gaoga-k'e from the east, towards the Bon-bon-k'e tributary to the Dakusui. Between these two stream valleys there is a fairly gentle saddle on which is situated the Ikeno Hashi police station (RW 4918). The Tansui flows in a narrow, gorge-like valley as far as the right-angular bend just west of Urai-sia (RW 3934); below that, the sides are steeply sloping, but the valley bottom is wider and flat (*photographs A*.42, 43).

The Dakusui river, draining to the Giran plain, has a well-defined flat-bottomed valley for most of its length, with braided channels through the pebble- and boulder-strewn bottom, which is about 600 yds. wide not far below its source.

The line of the Dakusui valley is continued by the Tua-kaq-k'e valley. Between these valleys there is a fairly gently saddle, 6400 ft. above sea level, on which is situated the Tut-lieng police station (wB 3890). The Tua-kak-k'e flows in a steep-sided narrow valley, frequently with vertical rock walls in its upper course. It eventually flows westwards to the Taiko river (*photograph A*.48).

The general direction of the valleys is maintained farther south towards the Mount Morrison mass, with high ground between the valleys of the upper Tang-hong-k'e, the Tak-tsui-k'e (*photograph A*.47) and the Kun-tua-k'e.

South of Mount Morrison the long Lam-tsu-sian-k'e and Lau-long-k'e rivers have parallel steep-sided valleys. They flow south-south-west and eventually join to form the E-tam-tsui.

None of these rivers is navigable, but their valleys give possible access to the interior.

There are many short, swift streams draining east and west, roughly at right angles to the main mountain trend. These have steep-sided, frequently gorge-like valleys, e.g. Tatsukiri-k'e (*photographs A*.57, 59), but are sometimes followed by tracks into the interior. The steepness of their valleys sides is the main obstacle to crossing them; but on the east coast four rivers on small coastal 'fans' may have sufficient water to make their crossing difficult. These are the joint mouths of the Tua-lam-o-pak-k'e and Tua-lam-o-lam-k'e (wB 8596), the Tua-tak-tsui-k'e (wB 8081), the Tatsukiri-k'e (wB 6962) (*photograph A*.57), and the Tai-ba-li-k'e (M 0589) (*photograph A*.56).

All the rivers are liable to great fluctuation of flow. Sudden and considerable rises of the water level can be expected after the violent storms that occur in the mountains between June to September. Then the whole pebble and boulder area of the valley bottoms and coastal fans is under a raging torrent. Out of flood most of the rivers present little difficulty for crossing (*photographs A*.42, 47, 56, 60).

There are two small lakes in this region, lake Jitsugetsutan among the main highlands (wA 9529) and Lieng-laun-t'an in the extreme south of Formosa.

Lake Jitsugetsutan is at an altitude of 2413 ft.; its greatest depth is shown as 44½ ft., but it is reported to have an average depth of about 12 ft. The outlets on the west and north-west have been dammed and the water used by a power station. There is a distance of about 2 miles north to south on the western arm of the lake, and of just under 2½ miles east to west. Wooded hill slopes come down fairly steeply to the lake side, except for one or two small areas of cultivated flat ground (*photograph A*.50).

Lake Lieng-luan-t'an, among the low hills at the south-west extremity of Formosa, has swampy banks. It is 46 ft. above sea level, and measures about 1 mile north-west to south-east, by 800 yds. north-east to south-west. A small stream drains it in a north-west direction.

Soil

The soils are generally thin. There is much bare rock on the higher slopes (*photographs A*.49, 51, 52), and on many steep lower slopes landslides have exposed the rock face and rubble has accumulated at their base.

The foothills and lower slopes on the western side, the sandstone and pebble belt, have well-drained, sandy and gravel soils.

Natural vegetation and land utilization

Forest is the predominant vegetation up to about 7500 or 8000 ft. (*photograph A*.53), above which

height grasses, creeping pines and other stunted plants are common. On the lowest slopes the forest is dense, of a mixed deciduous type, containing oak, cypress, cedar and camphor trees with a thick undergrowth of vines, palms, banyans and bamboo groves, changing gradually to a more open undergrowth of rhododendrons. At about 6000 ft. conifers take the place of the deciduous trees and there is no undergrowth. Open grassy slopes appear to be common about settlements or in districts where timber extraction has taken place.

Cultivation is limited to favourable valley bottoms and sides, and there are small areas of terraced rice and tea gardens. The shifting cultivation of the 'aborigines' has chequered some of the slopes. These are cleared of natural vegetation, cultivated for about three years and then left fallow for about ten years, when they are probably recultivated (*photograph A*.45). Sweet potatoes and upland rice are the chief crops of these rather stony fields.

Settlement

Settlement is scanty and is mainly confined to the many valleys, which penetrate from the west some distance. The nucleated settlement set in the midst of its area of cultivation is the normal pattern. Hori (wA 9941) is the largest town.

SUITABILITY FOR OPERATIONS

Cross-country movement

The steep slopes, forest cover, and boulder-strewn river beds make cross-country movement very difficult. The tracks, which run east to west across the mountains, are normally only usable by pedestrians.

Cover

Cover from air and ground view is good in the forested areas, but scanty in the river beds and on the more open higher ground.

Observation

Most of the valleys are easily overlooked for long distances from the surrounding high ground. However, although there are many high open ridge tops, the tumbled mass of mountains restrict observation to the facing hill-sides.

Suitability for airborne landings

Little of the region is suitable for airborne landings because of the steep slope and heavy forest cover. It is probable that the Hori and Hiti plains are most suitable, though some of the river valleys, which penetrate into the mountains, might be utilized.

SUITABILITY FOR LANDING-GROUNDS

THE HORI PLAIN alone would appear to offer possibilities for the construction of landing-grounds. The most likely part is a triangular area lying to the north of Hori (wA 9941).

Size. Equilateral triangle with a side of about 3600 yds. Eastern side running north-north-eastwards from Hori.

Altitude. Average height about 1440 ft.

Degree of flatness. A rise between two rivers which join at the western end of the Hori plain. General slope to the west, with probable steep drop to northern river bed.

Underground rocks. Probably clay-slates and sandstones.

Water table. Probably well below surface.

Soil. Thick covering of permeable gravels and sands.

Vegetation and land utilization. Some paddy, and probably vegetables or maize.

Obstacles to air approach. Hills of about 2000 ft. within ½ mile of the north-western side of area, and within 1 mile of south-western side; within 1¾ miles of east and north sides, elevation of 3800 ft.

Landmarks. Jitsugetsutan lake, 8 miles to the south.

Local construction materials. Gravels and sands, also from river beds.

Local labour. Probably ample.

Water supply. Probably ample from local rivers and springs.

Ground approaches. Road and railway to Hori from Nama (wA 7227) via Hiti (wA 9634).

Suitability for seaplane alighting.

Lake Jitsugetsutan may be suitable for seaplane alighting, but it has the following disadvantages:—

(i) It is surrounded by hills rising in some places to 2000 ft. above lake level, within one mile of the shore.
(ii) It is 2413 ft. above sea level.
(iii) One of the tourist attractions are the 'floating islands'. These are apparently large log rafts, upon which people live and even cultivate a small patch.

It has, however, the following advantages:—

(i) There are stretches of open water over 1 mile long.
(ii) Depth in the middle is about 45 ft.
(iii) As it is a famous tourist resort there is fair road communication to the lake side.

Note: There is said to be a scheme connected with the development of electric power, which involved considerable changes in the depth of water.

X
THE GIRAN LOWLAND

(*Plans* 1, 2, 3, 17; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheet* 5; *Japanese Maps* (1:50,000), *Sheets*: *Giran, Dakusui, Tokai, Rato, Suo*; *photographs A*.61-63)

DESCRIPTION OF COUNTRY

General

This region is a triangular-shaped, alluvial lowland on the north-east coast enclosed by steep-sided slopes of the main mountain belt. It is crossed by the lower Dakusui, one of the biggest rivers in Formosa, and several smaller rivers.

The lowland measures roughly 18 miles north to south and 13 miles east to west at its widest.

Seven land miles off the coast of the northern end of the lowland is the island of Kizan. It is just over a square mile in area and entirely hilly, rising to over 1300 ft.

Geology

This region is a recently raised submarine platform covered by alluvium and numerous gravel fans washed down from the mountains, especially by the Dakusui river. Although the alluvial deposits away from the flood-beds of the rivers are much finer in texture, they are all permeable and the whole lowland is, by nature, well drained, although a water-retaining surface mulch has been developed over most of the area for paddy cultivation.

The whole coast-line is fringed with sand dunes, usually about 300 yds. wide, but twice that width in some places.

Relief

This roughly triangular lowland is enclosed by the steeply rising slopes of the main Formosan mountains (*photograph A*.63). The foot of these slopes is about 100 ft. above sea level in the north, rising to 300 ft. in the south. The lowland slopes gently and evenly down to the line of railway passing through Giran (RW 7731) and Rato (RW 7921). East of this, until the coastal sand dunes are reached, the surface is perfectly flat and usually below 10 ft. above sea level.

The coastal sand dune belt, usually about 300 yds. wide, is twice that width two or three miles north of the Dakusui river. The dunes are usually 20 to 30 ft. high, but reach 60 ft. midway between the mouths of the Tau-ui-ts'ui and Dakusui rivers.

Just beyond the southern limit of the region is the small undulating lowland behind Suo (RW 8813), measuring under 1 mile square. This is reached from the Giran plain through a narrow low pass in the surrounding hills.

Drainage

This is a well-drained lowland, crossed by the Dakusui, one of the biggest rivers in Formosa, and by several smaller rivers.

The Dakusui river issues from its steep-sided and pebbly bed in the mountains onto the south-west of the lowland. In the mountain valley it flows in a single channel, but on the plain it branches into many small braided channels flowing among the pebbles and boulders, which, when in flood, it has spread over an area over 2 miles across in places. There are areas of higher cultivated ground between the pebble stretches. About 4 miles from the coast, just west of the road and railway bridge between Giran and Rato (RW 7925), the river becomes confined between two steep-sided low banks into a single stream bed, about 800 to 900 yds. wide. Normally the main channel winds among pebble banks to the sea within these limits. The river is tidal to the Giran-Rato bridge and the depth is given as about 6 ft. from this point to the sea (*photograph A*.61).

At its mouth the Dakusui is joined from the south by the short but deep river Tang-sua-tsui, that flows roughly parallel to the coast from the slopes south-west of Tozan (RW 8217). This river, unlike most in Formosa, appears to have a single channel with no braidings. It is tidal to the bridge at Li-tiek-kan (RW 8520), where the river is 80 yds. wide and shown as having a depth of 10 ft.; it widens to about 200 yds. near its mouth, with a depth of over 12 ft.

At the mouth on the north side the Dakusui is joined by the Giran river. This is really a branch of the Dakusui that describes an arc northwards round Giran and is joined by several mountain streams on its way. Most of its course is between well-marked banks up to 10 ft. in height. Below Giran these banks are about 100 yds. apart.

At the northern end of the plain the Tau-ui-ts'ui river flows across from the mountain slopes, and has a wide channel where it flows northwards behind the sand dunes for about a mile before reaching its mouth.

At the southern part of the lowland the river Bu-lau-k'e-k'e is confined between well-marked banks for most of its course from the mountains to the coast. The wide river behind the sand dunes, shown on the map as joining the Bu-lau-k'e-k'e near its mouth, now breaks through the sand dunes near Chit-tse-nia (RW 8814) and drains to the sea.

While the Dakusui and Giran rivers are normally small braided streams, they can be expected to be in flood in September and October, and for a few days at a time after heavy storms in the mountains, which are most likely to occur in June to September. In flood these rivers become raging torrents covering most of the pebble 'spread' areas.

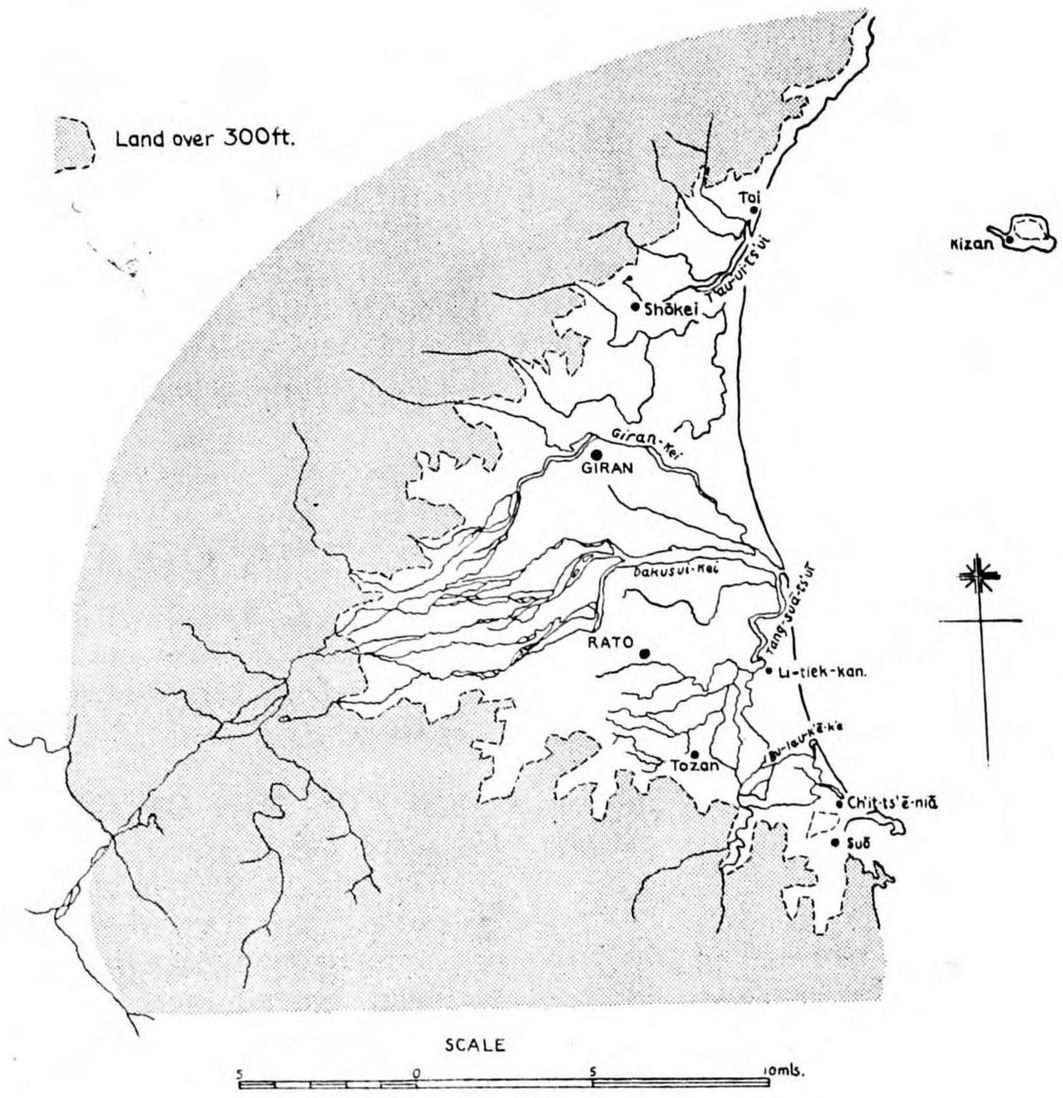


Fig. 13. Region X. The Giran lowland

Soil

The soil is mainly sandy loams. There are areas of silts and clays, and, within the limits of the river flood, 'spreads' of gravels. As a whole the soil is well-drained. A water-retaining surface mulch has been developed over the paddy-growing areas.

Natural vegetation and land utilization

Most of this lowland is occupied with paddy cultivation. The only areas where paddy is not grown are the gravel and pebble 'spreads' of the rivers debouching from the uplands, and the coastal sand dunes. The paddy field pattern is rectangular, with most of the fields long and narrow. Two crops are grown on most of the fields, harvested in July and December. This means that apart from periods of about six weeks before the harvests the fields are permanently under water.

Some sugar is grown: this does not appear to be concentrated into continuous stretches of sugar plantation, but is cultivated in separate fields among the paddy. From the limited air photographic cover available it would seem that most of the sugar cultivation is around Rato. The crop takes about 18 months to grow, and reaches over 9 ft. in height.

There is very little tall growth on the main part of the lowland. But on some of the higher ground between the river braidings there are broad-leaved trees.

Much of the pebble 'spread' of the rivers has a sparse covering of coarse grass.

The slopes enclosing the lowland have a covering of broad-leaved trees with some patches of bush and scrub (*photograph A*.63). These trees extend to a small area of the lowland to the west of Giran.

The coastal sand dune belt has a covering of sparse rough grass.

Settlement

Apart from the towns of Giran and Rato most of the settlement is in small agricultural villages and single farm-houses.

These single farms are distributed quite close together all over the paddy-growing areas. They consist of a single farm-house surrounded by a small patch of dry garden supporting a few fruit trees, all surrounded by a bamboo hedge (*photograph A*.62).

SUITABILITY FOR OPERATIONS

Cross-country movement

This is not a region of easy cross-country movement. The main hindrances are the almost continuously wet paddy fields and the entrenched lower courses of the rivers. The deep Tang-sua-tsui, the wide and embanked lower Dakusui and the entrenched Giran are all likely to hinder movement in normal times, and form definite barriers when in flood; this is most likely in September and October, with possibility of flooding for a few days at any time after storms from June to September. The gravel 'spread' area where the river Dakusui flows in braided channels after leaving the upland is likely to be a barrier only in times of flood.

Movement along the sandy beach and coastal sand dunes would be interrupted by the mouths of the rivers Tau-ui-tsui, Dakusui, and Bu-lau-k'e-k'e.

Cover

Cover is scanty. The farm-houses in the paddy, with their bamboo hedges and few fruit trees, provide some cover (*photograph A*.62), and also the full-grown sugar in the fields round Rato, but these fields are not continuous.

Observation

Observation can be maintained from the heights surrounding the plain. In the lowland itself there are no outstanding natural eminences to provide observation posts. The low coastal sand dunes provide an opportunity for short distance views across the seaward side of the lowland.

Suitability for airborne landings

This region does not present good conditions for airborne landings. The most extensive possibility is provided by the flat wet paddy fields that are drained off for harvesting in July and December. Dry conditions are presented by the sugar fields round Rato, but these are not extensive.

Out of the season of floods, which can be expected from June to October, airborne landings might be made on the gravel 'spread' where the Dakusui river emerges onto the lowland from its mountain valley. The conditions are a gently sloping surface of pebbles and boulders, with many shallow stream channels flowing through.

The sandy beach and coastal sand dunes provide a dropping zone, usually about 300 yds. wide.

SUITABILITY FOR LANDING-GROUNDS

Apart from the flood-bed of the Dakusui river, the whole of this region provides opportunity for the construction of landing-grounds, being flat, and, when the surface mulch of the paddy is removed, permeable and well-drained.

Size. A roughly triangular area about 18 miles north to south and 13 miles east to west at its widest.

Altitude. From sea level to 300 ft.

Degree of flatness. From gently sloping to flat.

Underground rocks. Mainly permeable gravels.

Drainage. This is a well-drained area crossed by the rivers Tau-ui-tsui, Giran, Dakusui, Tang-sua-tsui, and Bu-lau-k'e-k'e. An artificial surface mulch retains the water in paddy fields.

Soil. Mainly sandy loams.

Vegetation and land utilization. This area is mainly under paddy, but there is some sugar cultivation round Rato.

Obstacles to air approach. This lowland is enclosed on the north, west and south by steep-sided upland rising to over 3000 ft.

Landmarks. The sea coast, the Dakusui river, and the steep side of the enclosing upland. Within the lowland the towns of Giran and Rato.

Local construction material. Gravel.

Local labour available. Should be ample from the agricultural lowland and from the towns of Giran and Rato.

Water supply. Ample from the river-springs at the foot of the hills and from wells in the lowland.

Ground approaches. There is rail and road connection through difficult country with the Kirun-Taihoku area.

XI

THE KARENKO-TAITO VALLEY

(*Plans* 1, 2, 3, 17, 18, 19; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 5, 12, 14; *Japanese Maps* (1:50,000), *Sheets*: *Shinjo, Karenko, Suirenbi, Notakayama, Horin, Busshi, Tamazato, Kaso-wan, Shinko, Koho, Riro, Toranzan, Taito*; *photographs A*.22-24, 64-70, 73, 82, 85, 86, 92)

DESCRIPTION OF COUNTRY

General

This region comprises a long narrow rift valley about 4 miles wide for much of its length, with the small coastal plain of Karenko at its northern end and that of Taito at its southern. This gives a distance of about 110 miles in north-east to south-west direction.

Geology

Practically the whole of the bottom of this rift valley is covered with detritus washed down from the mountains by the short, swift rivers draining to the valley and the two coastal plains. This detritus is permeable and free-draining. Finer clayey deposits may occur near the rivers on the Karenko and Taito plains.

The precipitous valley walls are composed of schists, slates, quartzites and limestones on the west, shales, conglomerates and sandstones on the east.

Relief

The Karenko plain in the north is about 4 miles across at its widest. A narrow belt of lowland just over 1000 yds. wide extends northward to join with the limited lowland about the lower Tatsukiri river. The Karenko plain is quite flat (*photographs A*.64, 65), sloping gently down from the base of the steep-sided enclosing hills, at a height of about 100 ft., to the narrow coastal dune belt, that rises to 60 ft. in some parts. A hump-backed ridge just north of Karenko is the only significant interruption to the flatness of this plain. This ridge is about 1 mile long from north to south and rises to 350 ft.

The rift valley itself is for the most part flat-bottomed and enclosed by steep mountain slopes. The lower slopes are often precipitous, particularly on the eastern side where a river bed is at the base of the slope (*photographs A*.66, 67). The valley bottom is usually between 2 and 4 miles across, but there are small extensions up the valleys on the west, e.g. west of Mizuho (wG 4389) where the east to west distance reaches 5 miles. The most violent breaks of slopes in the valley bed are made by the edges of the flood-bed of the rivers; these may have a vertical slope of about 20 ft.

South of Pai-a-pai (wG 1822) there is a line of steep-sided hills rising to over 1400 ft. running along the middle of the valley, leaving two narrow valleys on either side. That on the east is followed by the river and is about 750 yds. wide (*photograph A*.69); on the western side there is just a narrow gorge at the northern end, opening to about 1000 yds. farther south.

The Taito plain at the southern end of the rift valley is about 7 miles across at its widest. It is flat, sloping steadily down from about 300 ft. at the base of the enclosing steep slopes to a low sand dune belt along the coast. There is a small wooded hill immediately west of Taito overlooking the town. It is about 800 yds. north-west to south-east and 300 yds. across, rising to 247 ft. On the western side the base of this hill is precipitous.

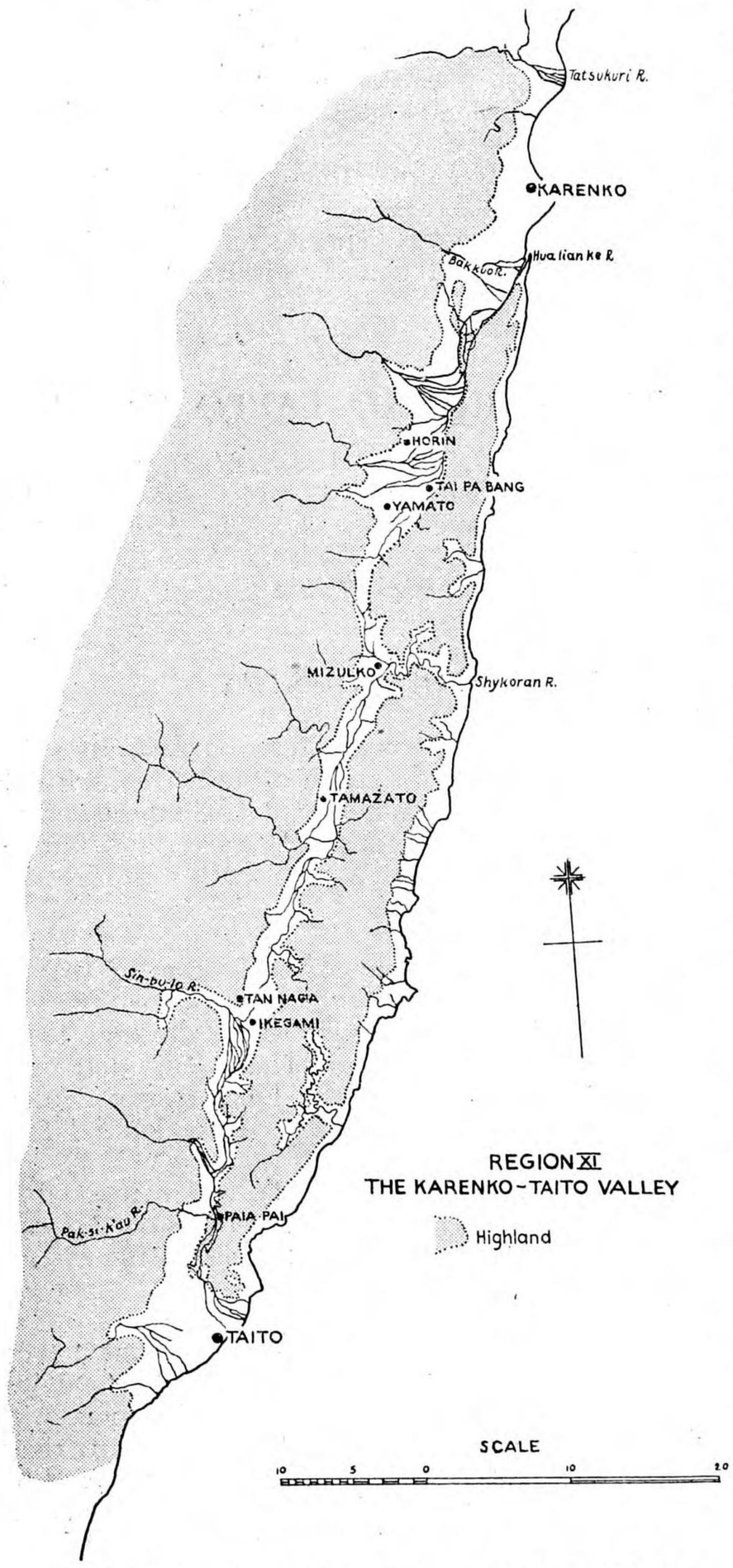


Fig. 14. Region XI. The Karenko-Taito valley

Drainage

The rivers flow in braided channels in the flood-bed of pebbles and sand that they have brought down in flood.

At the northern end of the Karenko plain the Tatsukiri river has spread a fan of gravel right across to the coast. This flood-bed has precipitous sides about 20 ft. deep on the north and south. Lagoons have been left in the gravel behind the sand dunes at the coast and elsewhere on the plain. North-east of Karenko there is a small marshy area at the northern end of one of these lakes.

On the southern part of the Karenko plain the Bak-kuo river has spread right across the lowland a gravel fan, which has pushed the channel of the Hua-lian-k'e river to the eastern side of its valley, so that it is flowing at the base of the steep slopes of the valley's eastern wall. Along the whole length of the rift valley the tributaries from the west spread more or less across the valleys and force the rivers draining along the length of the valley towards the eastern side.

Within the valley there are two watersheds, one near Yamato (wB 4302) at 580 ft., the other near Ikegami (wG 2648) at 920 ft.

North of Yamato the Hua-lian-k'e river drains north to the sea at the Karenko plain. The main channel normally has 2 to 3 ft. of water. Many of the stream beds in the detrital fans of the tributaries from the western side are quite deeply entrenched.

The drainage between Yamato and Ikegami reaches the sea through the Shykoran river, which cuts through the mountains on the east in a deep gorge. In this part of the valley the Shykoran is not joined by such violent tributaries from the west as is the Hua-lian-k'e, and hence keeps a more central channel in the valley. The main channel is normally 2 to 3 ft. deep. In many parts the pebble flood-bed is limited by a sheer side up to 12 ft. high. Boulder walls have been built where some of the side valleys debouch from the mountains. The biggest of these is just east of Tan-na-sia (wG 2651), which is 131 ft. high. At the divide, just east of Ikegami (wG 2648) is a small lake, about 1600 yds. north to south and 600 yds. east to west, with a bordering edge of swamp on the west and north-western sides. It is 16 ft. deep.

The Sin-bu-lo-k'e river drains southwards from this divide, its braided channels in the entrenched flood-bed being usually well to the east side of the valley. There is normally 2 to 3 ft. of water in the main channel. This river, also called the Pinan near its mouth, eventually drains to the sea just to the north-east of Taito (wG 2007) across a wide pebble 'spread', through a long lagoon stretching north and south behind the coastal sand dunes (*photograph A*.70). The Tua-lam-k'e river has spread a gravel fan across the southern part of the Taito plain, in which its water is normally lost before reaching the coast.

In normal times the rivers are just streams flowing in pebbly beds, but, in flood-times, they spread up to the limits of their flood-beds in rushing torrents, bringing down detritus from the mountains. These conditions can be expected for days at a time during the autumn, particularly in September and October, and after storms in the adjoining mountains.

Soil

Much of the soil is coarse and well-drained. The flood-beds of the river, which constitute a good proportion of the surface, are boulder- and pebble-strewn. Finer alluvial silts occur in isolated patches both on the Karenko and Taito plains and in the rift valley. These are usually indicated by being used for paddy cultivation.

Natural vegetation and land utilization

Much of this region is still under its natural vegetation cover of coarse grass and some broad-leaved trees and bushes. This cover exists particularly between the braided channels of the rivers, on the coarse gravelly soils of the rift valley, and on much of the Taito plain (*photograph A*.66).

On the Karenko and Taito plains, and in the valley at the base of the steep-enclosing slopes between the detrital fans of tributary streams (*photograph A*.67), there are limited areas of paddy cultiva-

tion, most of which produce two crops harvested in July and December.

There are also some areas of sugar cultivation, which are usually characterized by having a rectangular pattern of roads. Such areas are found west of Karenko (wB 6543), measuring 3 miles by 2 miles; north of Horin (wB 4917), 3 miles by 2 miles; south-east of Yamato (wB 4302), 1 mile square; and north-west of Pai-a-pai (wG 1822), 1 mile by 2 miles. Sugar takes eighteen months from its planting in furrowed fields to its harvesting, when it has reached a height of 12 ft. or more (*photographs A*.22, 23, 24, 92).

There are also small areas of tobacco and pineapple cultivation but the exact location of these crops is not known (*photograph A*.65). They are low crops offering no cover.

Settlement

Apart from the towns of Karenko and Taito, practically all the settlement is in fairly well nucleated villages, consisting of small dwellings surrounded by gardens with a few fruit trees and vegetables. There are usually paddy fields in the vicinity of the villages. In the rift valley the villages are along the sides at the base of the slopes and off the detrital spreads.

SUITABILITY FOR OPERATIONS

Cross-country movement

Cross-country movement should not be difficult out of flood-time. The rivers can be expected to be in flood during September and October, and possibly for some days at a time in the late summer after storms in the mountains. Both across the Karenko and Taito plains and along the rift valley there are mainly well-drained detrital gravels underfoot, with occasional shallow streams, 1 or 2 ft. deep (*photograph A*.70).

In the valley north of T'-ai-pa-bang (wB 4908) the tributaries from the western side cross the valley bottom in many channels to the main river draining north, whose channel is pushed against the eastern wall. Farther south the stream channels are more in the line of the valley, which means that movement along it does not involve so many stream crossings. In many places both on the plain and in the valley, the flood-beds have vertical sides up to 20 or 30 ft. high (*photograph A*.69), and in the valley there are some boulder walls to divert tributary streams, up to 130 ft. high.

At the foot of the slopes enclosing the valley there are areas under paddy cultivation, which are wet for most of the year.

Cover

There is not much natural cover. The coarse gravelly soil of most of the Karenko and Taito plains and of most of the rift valley has a covering of rough grass, usually with some few, scattered, broad-leaved trees (*photograph A*.66).

The areas of sugar cultivation west of Karenko (wB 6543), north of Horin (wB 4917), south-east of Yamato (wB 4302), and north-west of Pai-a-pai (wG 1822) would give cover to individuals, but it must be remembered that a proportion of these areas are always bare fields, or with just a cover of young short canes. When full grown the canes reach over 12 ft. high.

The enclosing slopes of this lowland have a cover of grass, bushes and broad-leaved trees.

Observation

Within the lowland there are no natural eminences to provide good observation posts, but the whole of it is overlooked by the enclosing highland.

Suitability for airborne landings

Most of this region is suitable for airborne landings except during the flood periods of late summer and the months of September and October. The most widespread conditions are fairly level, gravel-covered areas with coarse grass and occasional broad-leaved trees. The Karenko and Taito plains, 4 and 7 miles across respectively, present better opportunities than the enclosed valley with its steep sides.

SUITABILITY FOR LANDING-GROUNDS

The two most suitable areas for the construction of landing-grounds are the Karenko and Taito plains, both fairly flat and well-drained.

KARENKO PLAIN

Size. About 5 miles north to south by 4 miles east to west.

Altitude. From 40 to 200 ft.

Degree of flatness. Flat. Gently sloping from mountains to coastal dunes.

Underground rocks. Mainly free-draining alluvial gravels.

Drainage. Around Karenko are irrigated paddy fields, which are kept wet all the year except for harvesting in July and December. The rest of the surface is well drained.

Soil. Alluvial, varying from sandy to patches of fine silt.

Vegetation and land utilization. Some paddy, sugar and tobacco cultivation, with areas of coarse grass or coarse soil.

Obstacles to air approach. Steep-sided mountains rising to 4000 ft. immediately to the west.

Landmarks. The coast and steep mountain edge. The town of Karenko.

Local construction material. Gravel.

Local labour available. Probably sufficient from Karenko and agricultural villages.

Water supply. Ample from rivers and wells.

Ground approaches. Railway and road from Taito to the south. Difficult coastal road northward to Giran lowland.

TAITO PLAIN

Size. About 5 miles north to south by 7 miles east to west.

Altitude. Sea level to 300 ft.

Degree of flatness. Flat. Sloping from base of mountains to the coast.

Underground rocks. Mainly free-draining alluvial gravel.

Drainage. The surface is well drained apart from limited areas around Taito, which are irrigated to be kept wet for paddy cultivation, being drained for harvests in July and December.

Soil. Alluvial, mainly sandy, with scattered small areas of fine silt.

Vegation and land utilization. Mainly rough grass with some scattered broad-leaved trees. Some paddy round Karenko.

Obstacles to air approach. Steep-sided mountains on the west and north.

Landmarks. The sea coast and edge of the mountains. The town of Taito.

Local construction materials. Gravel.

Local labour available. Some available from Taito and Baran.

Water supply. Sufficient from rivers to north and south, and from wells.

Ground approaches. Railway and road north to Karenko.

XII

THE EAST COASTAL RANGE

(*Plans* 1, 2, 3, 18, 19; *A.M.S. Maps, Series L* 592 (1:250,000), *Sheets* 12, 14; *Japanese Maps* (1:50,000), *Sheets*: *Karenko, Suirenbi, Horin, Busshi, Kasho-to, Koto-sho, Tamazato, Byoko, Kaso-wan, Shinko, Riro, Babukutsu, Toranzan, Taito*; *photographs A*.74, 81)

DESCRIPTION OF COUNTRY

General

From a military point of view this is a barrier region on the east coast, separated from the main

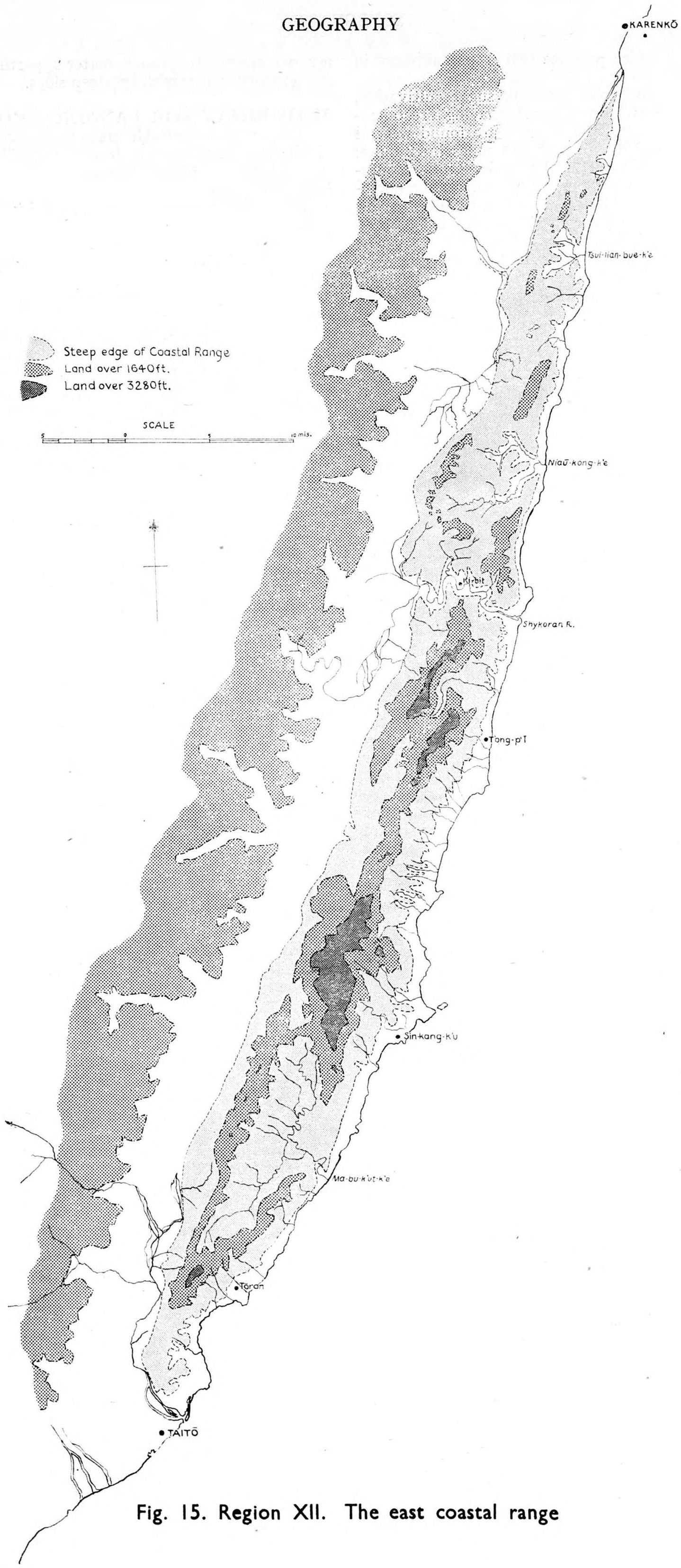


Fig. 15. Region XII. The east coastal range

mountain belt of Formosa by the narrow Karenko-Taito rift valley. This coastal range varies between 4 and 9 miles wide and extends between Karenko to Taito for just over 80 miles.

The Islands of Kasho-to (wM 5597) and Koto-sho (wM 6230)

Both these islands have very broken relief, with chiefly cliff coasts and little or no flat ground. They lie off the south-east coast of the mainland.

KASHO-TO

This island lies about 20 miles east of Taito (wG 2107). Its longest axis, about 4 miles, is aligned north-west to south-east and it is about three miles across at its widest part. Practically the whole of the island is hilly, and only along its northern side does there appear any considerable area of flat land. The south-western side is a high ridge attaining 923 ft. at its highest point, from which a ridge runs north-eastward, which has a peak level of 902 ft. The land falls away steeply from the rounded tops, and on the south and east ends in a cliff coast.

Soils are probably thin, and like those found in the mountain region. The drainage appears to be wet weather streams which have cut steep-sided valleys. The hill slopes are everywhere covered with forest, while coconuts and a little rice appear to be cultivated on the narrow coastal strip along the north and west, where there are also found the small native villages.

KOTO-SHO

This is the larger of the two islands and its major axis, 8 miles long, is aligned north-west to south-east. It has an average width of 2 miles and is nearly 4 miles wide at its broadest. It lies just over 50 miles south-east of Taito.

The whole island is bound by an extremely rocky coast, backed by steep slopes. The narrow, south-eastern part of the island is joined to the broader north-western part by a low col. The southern part rises to 1574 ft., while crest levels of 1797 ft. and 1620 ft. are attained in some peaks in the northern part. Streams have cut deep ravine valleys into the hills, and there are only narrow areas of flat ground along the north coast, and on either side of the 'waist' of the island.

Forests of broad-leaved trees and poor shrubs cover the slopes, and some small areas of rice cultivation are carried on along the flat coastal strips.

Settlement is confined to small villages scattered along the northern, eastern and western coastal fringe.

Geology

The east coast range consists mainly of folded sandstone with areas of hard volcanic rocks and some shales.

Along the coast south of the Shykoran river there is a narrow belt of sandy alluvium with some patches of heavier clays.

Relief

This range is steep-sided, with frequent bare rock precipices among the higher slopes. Most of it is above 1500 ft., with the higher peaks up to 5250 ft.

On the west there is a steep rise from the Karenko-Taito rift valley. The eastern slopes generally rise directly from the coast north of the mouth of the Shykoran river (wG 5487), with an occasional stretch of flat coastal ledge about 100 yds. wide. South of the Shykoran there is a belt of flat or gently rising land, which is usually about ¼ mile wide, between the sea and the steep slopes, and slightly more extensive about the mouths of the small river valleys. The gentler slopes are widest around Tong-pi (wG 5174) and Toran (wG 2721), where the steep slopes are about 1 mile back from the coast.

The Shykoran valley makes the one break right across this range from the rift valley to the sea. This valley is steep-sided for all of its length, and gorge-like in some stretches.

Drainage

The steeply sloping surface is well drained by many short and violent mountain streams flowing down to the rift valley or the sea. The valleys have steep, frequently precipitous sides. Near the coast some of the valleys are slightly wider and have a flat gravel valley bottom, e.g. Niau-kong-k'e river (wB 5602).

The one river to break right across the mountain range is the Shykoran. This flows at the bottom of precipitous valley walls, usually close together, but in the bed near Ki-bit (wG 4990) there is a small flat area of gravel in the valley bottom. There is usually under 3 ft. of water in the river, although near its mouth, where it widens to form a small lagoon behind its very narrow outlet to the sea, a depth of 6 ft. is shown.

The river Ma-bu-kut-k'e (wG 3632), which is parallel to the coast for most of its middle course, has a steep winding valley through the mountains.

Soil

The soil on the steep slopes is thin and mainly stony. On the narrow coastal ledges sandy soils can be expected with some limited areas of heavier soils.

Natural vegetation and land utilization

The natural cover is broad-leaved trees, with areas of scrub with coarse grass and bushes. Along the coastal ledge the sandy soils support only rough grass. On the slightly wider coastal areas, where settlement has been possible, paddy fields are cultivated and some bamboo grown, e.g. round Toran (wG 2721).

Settlement

The sparse population is settled in small villages scattered along the coast. These villages are frequently sheltered from the strong on-shore winds behind small local rises in the ground and are not right on the sea shore, e.g. Niau-kong (wB 5601).

SUITABILITY FOR OPERATIONS

Cross-country movement

This is a difficult region for cross-country movement. The coastal ledge is not continuous in the north, although south of the Shykoran river it is wider and movement along it is possible.

The one break giving a difficult way across the range without having to climb over the watershed is provided by the narrow and precipitously sided Shykoran river. Tracks follow several of the stream valleys from the coast across the mountains, such as those up the Tsui-lian-bue-k'e (wB 6022), Niau-kong-k'e (wB 5602), and Ma-bu-k'ut-k'e (wG 3632).

Cover

Ample cover is available in this range with its natural vegetation of broad-leaved trees.

Observation

While the tree cover does not make the whole of the mountain slopes suitable for observation over the rift valley or the sea coast, there are many areas of rough grass on the mountains from which uninterrupted views can be obtained.

Suitability for airborne landings

This is not a region suitable for airborne landings. Three limited and isolated areas do present the difficult conditions of fairly gentle slopes down to the coast covered with rough pasture, some dry cultivation and a little paddy. These are:—

(i) 3 miles north to south by 1 mile east to west round Tong-pi (wB 5175).
(ii) 2 miles by 1 mile round Sin-kang-k'u (wG 4346).
(iii) 3 miles by 1 mile round Toran (wG 2721).

SUITABILITY FOR LANDING-GROUNDS

There is no area suitable for airfield construction.

(3) NOTES ON SUITABILITY FOR THE RAPID CONSTRUCTION OF AIRFIELDS

(*Plan* 3)

TOPOGRAPHY

See *Plan* 3, and (2) *Topography* under the heading '*Suitability for landing-grounds*', for each region, *pp*. 8, 9, 11, 14, 17, 20, 23, 26, 29, 31, 33, 35.

SOILS

Soils have been graded into four groups, selected chiefly on consideration of porosity so as to provide an index to soil drainage. These groups and the soils included are:—

Group 1. Permeable (sands and gravels)

(*a*) The old gravel terrace soils.

(*b*) Known sandy or gravelly areas in the Young Sediments.

(*c*) The sandy Heito plain.

(*d*) The down-washed gravels of the Taito gorge.

(*e*) The down-washed sands and gravels on the Giran, Karenko and Taito plains.

(*f*) Areas of coral sand.

Group 2. Semi-permeable (loams)

(*a*) All mountain soils.

(*b*) Mount Daiton volcanic soils.

(*c*) Mixed sandy and shaly soils from the Young Sediments.

(*d*) Alluvial soil where not sandy, gravelly or clayey.

Group 3. Impermeable (clays)

(*a*) Shaly soils from the Young Sediments.

(*b*) Alluvial soils along most of the west coast.

Group 4. Waterlogged

Areas of marsh and swamp.

METEOROLOGY

For a detailed report on the climate of Formosa see *B.R.* 877 *Q*/1.

The probable maximum amount of rainfall in 24 hours

Although rainfall amounts of 10 ins. or 15 ins. in 24 hours occur on some occasions in May, June, July, August and September (mostly during the passage of typhoons), such heavy falls are not common. A more usual amount to occur in 24 hours during the south-west monsoon is 5-7 ins., and such amounts or more must be expected to occur in almost every year. In bad months, falls as big as 7 ins. or more have been recorded in April and October, but during the height of the north-east monsoon a fall of 2 ins. or more in 24 hours is the exception.

It is noteworthy that these broad generalizations are true both of the east side and the west.

Spells of rain

During the north-east monsoon season there are comparatively few days without some rain at Kirun (Keelung), though the rain is usually light. All along the east coast as far south as Karenko, the rainfall in a very bad north-east monsoon season is persistent rather than heavy; but in the average type of north-east monsoon there are many fair days, and the rainfall occurs in spells of 3 or 4 days, after which the weather clears.

During the south-west monsoon and at exposed places such as Tainan, there are very considerable spells of fair weather even in months when the rainfall is heavy. The characteristic is a week to 10 days of very considerable falls with a number of days of fair weather on either side.

Local notes (including surface winds)

(*a*) Giran to Suo plain

This area is subject to much rain at all seasons and to frequent spells of low cloud, accompanied by drizzle or light rain, particularly from October to March. At Kirun 50 or 60 per cent of winds are from the north or north-east during those months; of these probably two-thirds are more than force 3 and nearly half are more than force 5. In other months winds are much lighter and more variable in direction.

Further inland winds are not so strong but on the whole the most common directions of moderate or strong winds are expected to be north-north-east and south-south-west throughout the year, except between Rato and Suo, where the effects of topography are likely to produce a deflection of the stronger winds to north-north-west and south-south-east. There is a notable decrease in rainfall between Sokei and Suo during the north-east monsoon.

(*b*) Karenko

This area is subject to heavy rain at times in April to September, and to low cloud and drizzle or light rain in October to March. Moderate and strong winds are frequent from October to March, mostly from the north-north-east over the valley to the south-south-west of Karenko. In that valley, during the year as a whole, winds are probably mainly north-north-east and south-south-west.

(*c*) Taito

This area is subject to heavy rain at times in April to September, low cloud and drizzle or light rain in October to March.

Moderate and strong winds are frequent from October to March, mostly from the north-north-east in the valley between Koho and Hokusikyu, and from the north-east around Taito. At other seasons winds are usually light, though in summer, sea breezes are likely to be important during the afternoon within 10 or 20 miles of the coast.

(*d*) West coast plain south of Kagi

This area is subject to very heavy showery rain at times in May to September, with occasional periods of low cloud and poor visibility. Winter winds are mainly northerly at Tainan, 60 per cent in December to February being from the north and 40 per cent being more than force 2 from that direction. In summer winds are much more variable and the moderate or strong winds are most often from the south-south-west. Rainfall is worst in the south and near the hills.

(*e*) West coast plain, Kagi to Shinchiku

This area is subject to very heavy showery rain at times in May to September, with occasional periods of low cloud and poor visibility. Rainfall increases from the coast to the hills. Winter winds are mainly northerly or north-easterly (more northerly near the hills) and are often more than force 3. In summer they are more variable and sea breezes are a feature of the coast area.

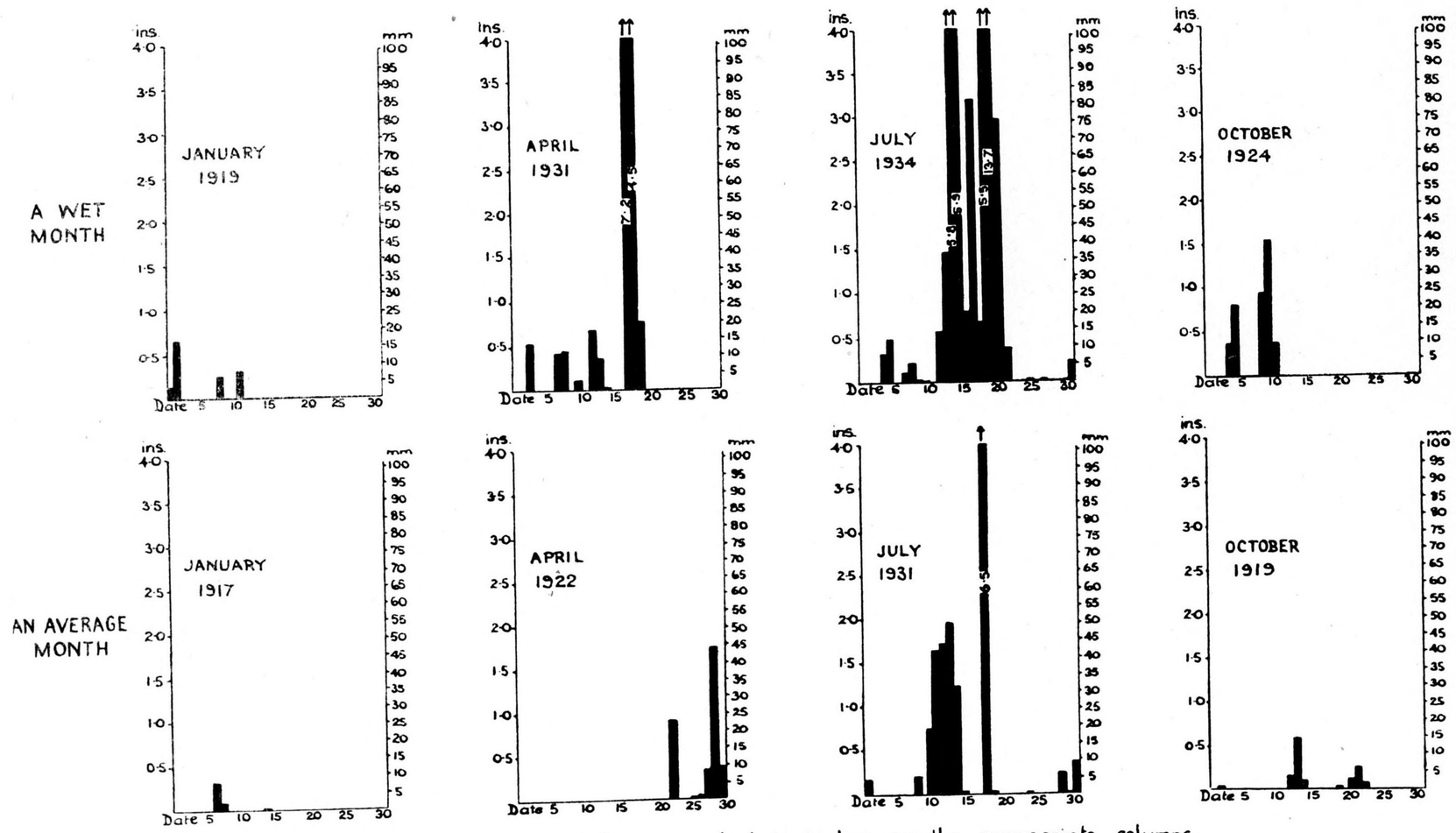
(*f*) West coast plain, Shinchiku to Taihoku

This area is subject to heavy showery rain at times in May to September, frequent drizzle and light rain during other months. Rainfall amounts increase rapidly from the coast to the hills.

Winds at Taihoku are mainly easterly. On winter afternoons one-third to a quarter of the winds are more than force 3 from that direction; in the mornings winds are lighter but still mostly easterly. In summer the stronger winds are usually either east or west.

West of Taihoku winds are likely to be more often east-north-east than east.

TYPICAL DAILY RAINFALLS IN CERTAIN MONTHS AT TAINAN, 23° 00′ N, 120° 13′ E.



Days of very heavy rainfall are marked in inches on the appropriate columns.

The months have been chosen to give examples of a wet month in each season and an average month. They show the type of rainy spells which occurs. The heavy rainfall of July 1934 was due to a typhoon which passed over Formosa, but not that of April 1931 nor July 1931.

Fig. 16

NOTICE. The following list gives the negative number corresponding to the photographs in this report.

Any demands for copies of individual photographs from this report should quote the report number and negative number, and be submitted through the proper channels to the Director of Naval Intelligence (Section XI), Admiralty.

Photo. No.	*Neg. No.*	*Photo. No.*	*Neg. No.*	*Photo. No.*	*Neg. No.*
A.1	430019	A.33	439801	A.65	439795
A.2	180497	A.34	439807	A.66	430078
A.3	430020	A.35	430066	A.67	432496
A.4	430283	A.36	62038	A.68	430084
A.5	430042	A.37	438383	A.69	430018
A.6	430043	A.38	19195	A.70	430030
A.7	430282	A.39	438372	A.71	19203
A.8	430045	A.40	333535	A.72	333988
A.9	434472	A.41	439806	A.73	97684
A.10	361344	A.42	432453	A.74	333989
A.11	432439	A.43	438380	A.75	158712
A.12	430050	A.44	438367	A.76	333867
A.13	430023	A.45	439771	A.77	333857
A.14	420581	A.46	439772	A.78	432430
A.15	434479	A.47	430057	A.79	443805
A.16	434477	A.48	334015	A.80	430287
A.17	439753	A.49	439765	A.81	430086
A.18	439794	A.50	381680	A.82	432422
A.19	430278	A.51	439754	A.83	443167
A.20	434485	A.52	97691	A.84	183409
A.21	430259	A.53	439767	A.85	420578
A.22	434482	A.54	434488	A.86	430263
A.23	434467	A.55	430072	A.87	430027
A.24	434480	A.56	430022	A.88	443115
A.25	439802	A.57	333993	A.89	443116
A.26	430060	A.58	333862	A.90	443117
A.27	439781	A.59	430260	A.91	443114
A.28	439790	A.60	430014	A.92	443112
A.29	430028	A.61	432421	A.93	443120
A.30	334005	A.62	169876	A.94	443113
A.31	430059	A.63	169874	A.95	443118
A.32	43447	A.64	430263		

INDEX TO PHOTOGRAPHS

Subject	*Photo. No.*
Agriculture	A.4, 8, 15-18, 20-25, 40, 62, 65, 88-91, 94
Airyo (Al-Liau) valley	A.41
Anpin, near	A.30
Arisan forest	A.53
Banana	A.90, 91
Cape Garambi	A.80
Chikushi-ko, near	A.4
Clay-slate series	A.71, 72, 76, 77
Coral reef	A.82
Daibu, near	A.54
Daihasen Mt.	A.72
Daiton	A.5
Daiton Mt.	A.3, 4
Dakusui (Giran) river	A.45, 60, 61
Dakusui (Sera) valley	A.47
Farms	A.62, 90
Geology	A.71-79, 82-84
Giran. *See* Dakusui	A.62, 63
Goto coal mine	A.6
Hattsukwan, near	A.76
Heito, near	A.38, 41
Hodai-Yama, Takao	A.79
Hokuto	A.78
Hozan, near	A.25, 87
Irrigation ditch	A.19, 21, 87, 88
Jitsugetsutan	A.50
Kagi, near	A.32
Kanan irrigation scheme	A.31
Kakpansua (Kappanzan)	A.42, 44
Kareian plain	A.86
Karenko. *See also* Suo	A.64, 65, 85
Karenko, near	A.75, 86
Kasho island	A.81
Kiirun (Keelung) river	A.6
Kizan	A.40
Kobi, near	A.18
Komo, near	A.13
Kyoshito	A.33
Limestone, coral	A.79, 80
Mareppa	A.46
Monkey Hill	A.36
Morrison Mt.	A.71
Musha, near	A.47
Niitaka Mt.	A.51
Okayama, near	A.34
Oyster beds	A.28
Paddy fields	A.4, 8, 15, 17, 20, 21, 62, 88, 89
Pinan river valley	A.69, 70
Pineapple field	A.25
Piyahausia, near	A.77
Rakuraku waterfall	A.76
Rice harvesting	A.20
Rokko (Rokuko), near	A.28, 29
Salt beds	A.29, 30
Sand dunes	A.13, 14, 27
Schists	A.73-75
Sekimon	A.82
Settlements. 'Savage'	A.45
Shichisei-zan	A.1, 2
Shiju river valley	A.55
Shikayausia	A.48
Shikikun	A.45, 60
Shimotansui river	A.38
Shinkaienko	A.68
Shinshiku, near	A.14, 16
Shinshiku province	A.15
Shirin, near	A.8
Shukoran Mt.	A.52
Sobun river	A.26
Sozan	A.1
Sugar	A.18, 21-24, 40, 92
Suiseisi (Taichu)	A.83
Sulphur	A.3, 78
Suo-Karenko road	A.73
Taian river	A.17
Taihoku	A.7, 8, 11
Taihoku, near	A.84, 88
Taikei	A.12
Taiko river valley	A.46, 48
Tainan-Anpin canal	A.37, 93
Tainan province	A.22
Taito plain	A.69
Takao	A.35, 36
Takkiri river	A.57, 58
Tamari river	A.54
Tamazato, near	A.66, 67
Tamazato-Suiriko track	A.52
Tansui river valley	A.5, 8-13, 42-44, 84
Taroko gorge	A.58, 59, 75
Tea plantations	A.15, 16
Tobacco	A.65
Tomari (Daimari) river	A.56
Tsugitaka Mt.	A.48, 49
Yoshino	A.65
Young Sediments	A.12, 83, 84
Vegetation, tree fern	A.95
Volcano, mud	A.33
Zenka, near	A.26

INTER-SERVICE TOPOGRAPHICAL DEPARTMENT

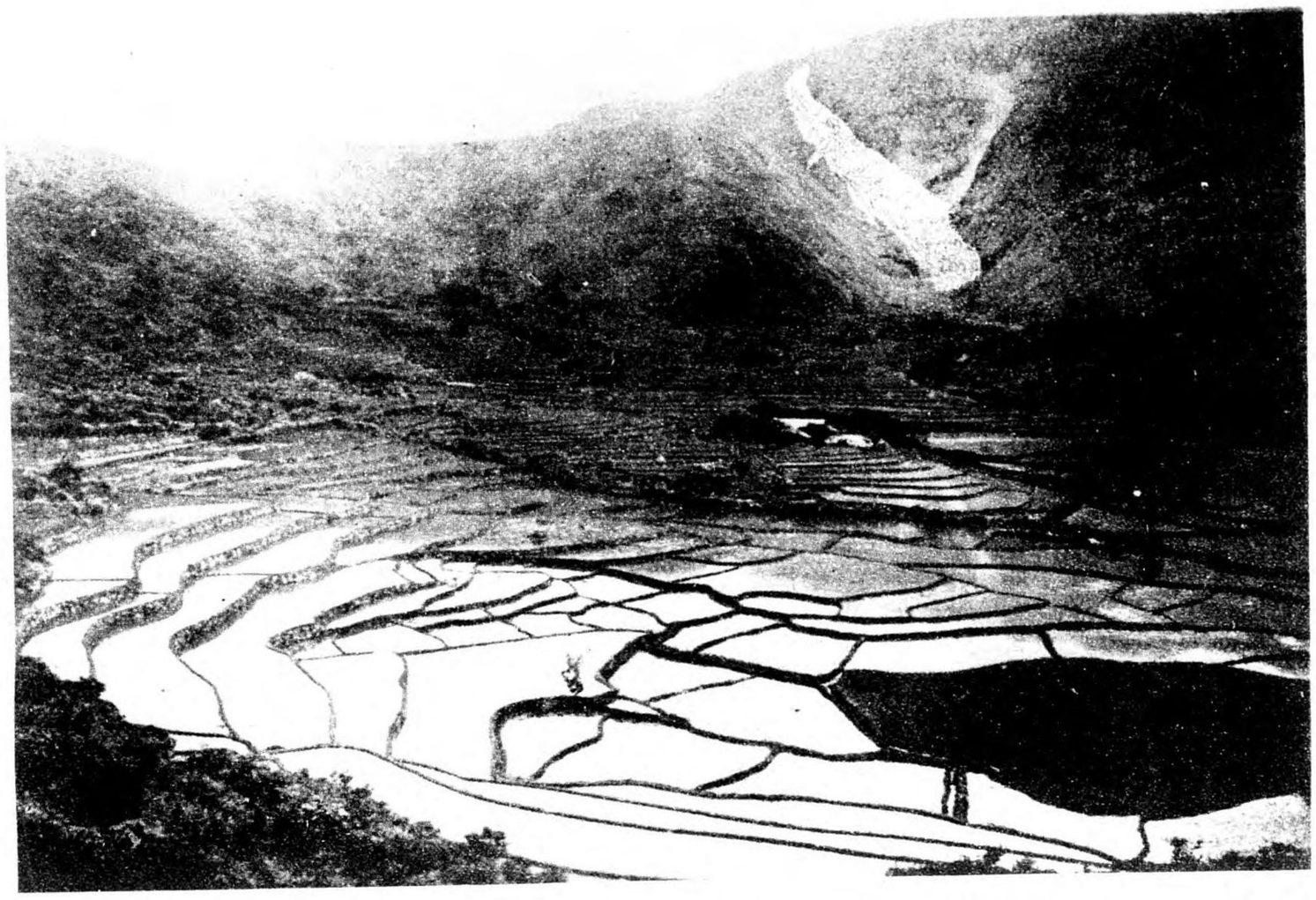
November 1944

A.1. View of Sozan, with hill south of Shichisei-zan in background.

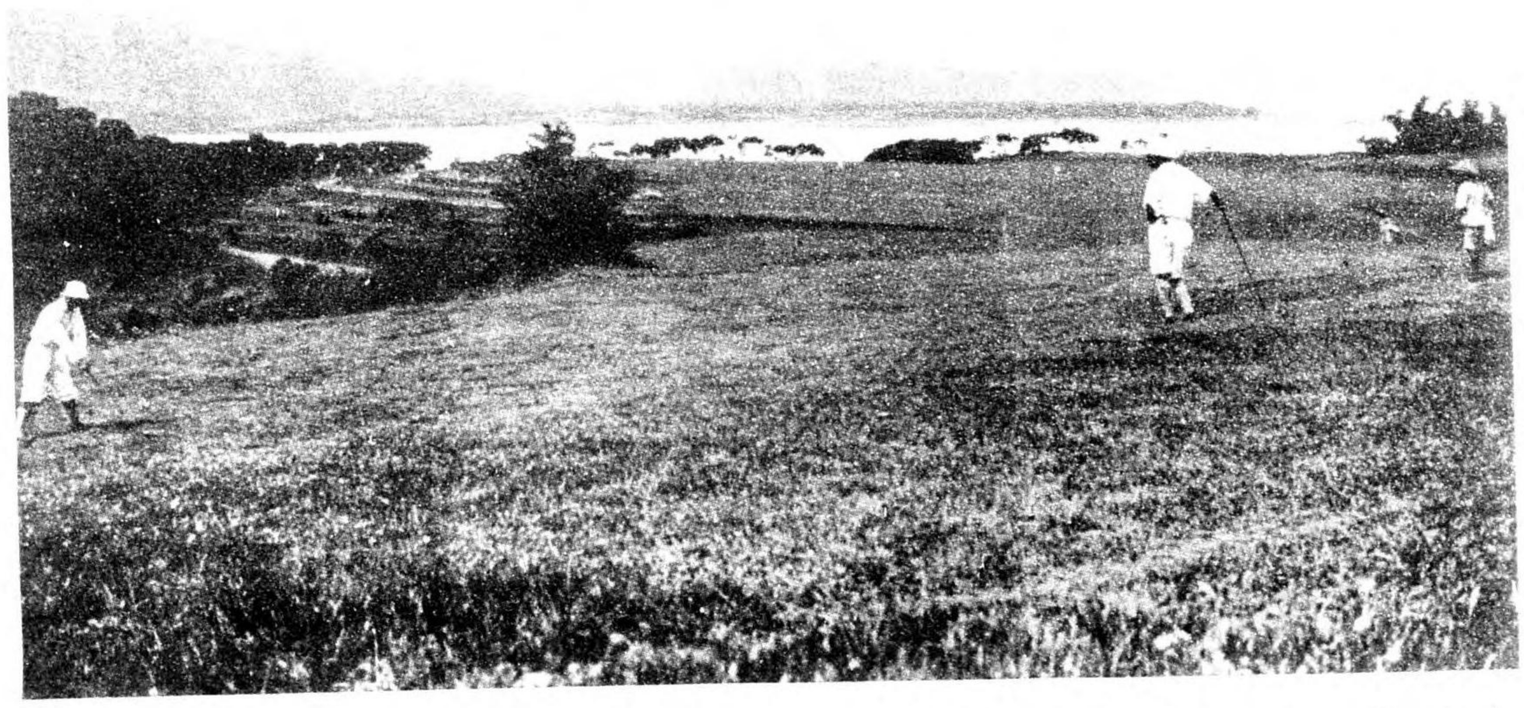
A.2. View of hill south of Shichisei-zan from Sozan.

A.3. Sulphur springs near the foot of Mt. Daiton.

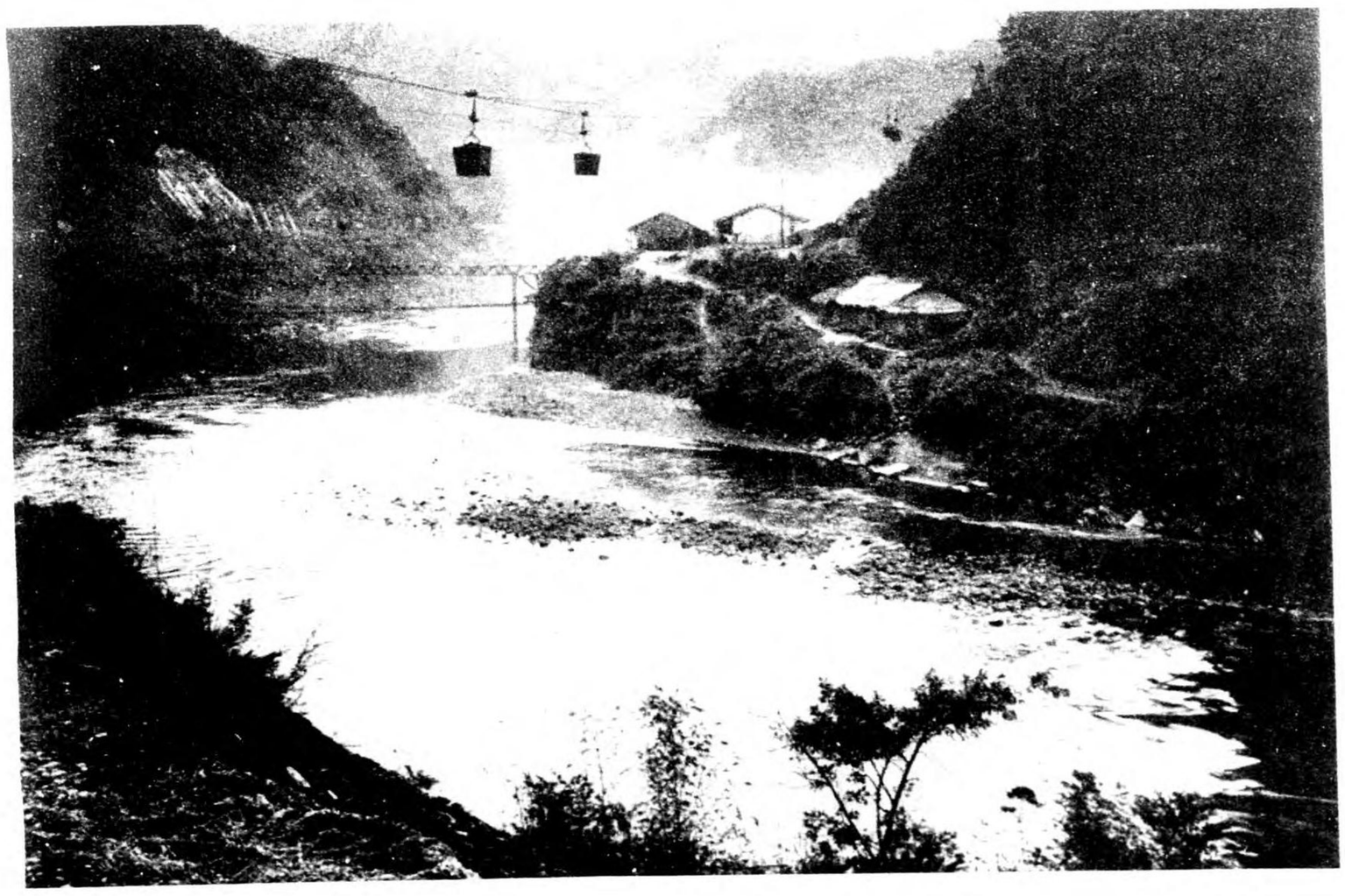
877(G) F/383



A.4. Terraced paddy fields on lower eastern slopes of Mt. Daiton, near Chikushi-ko.

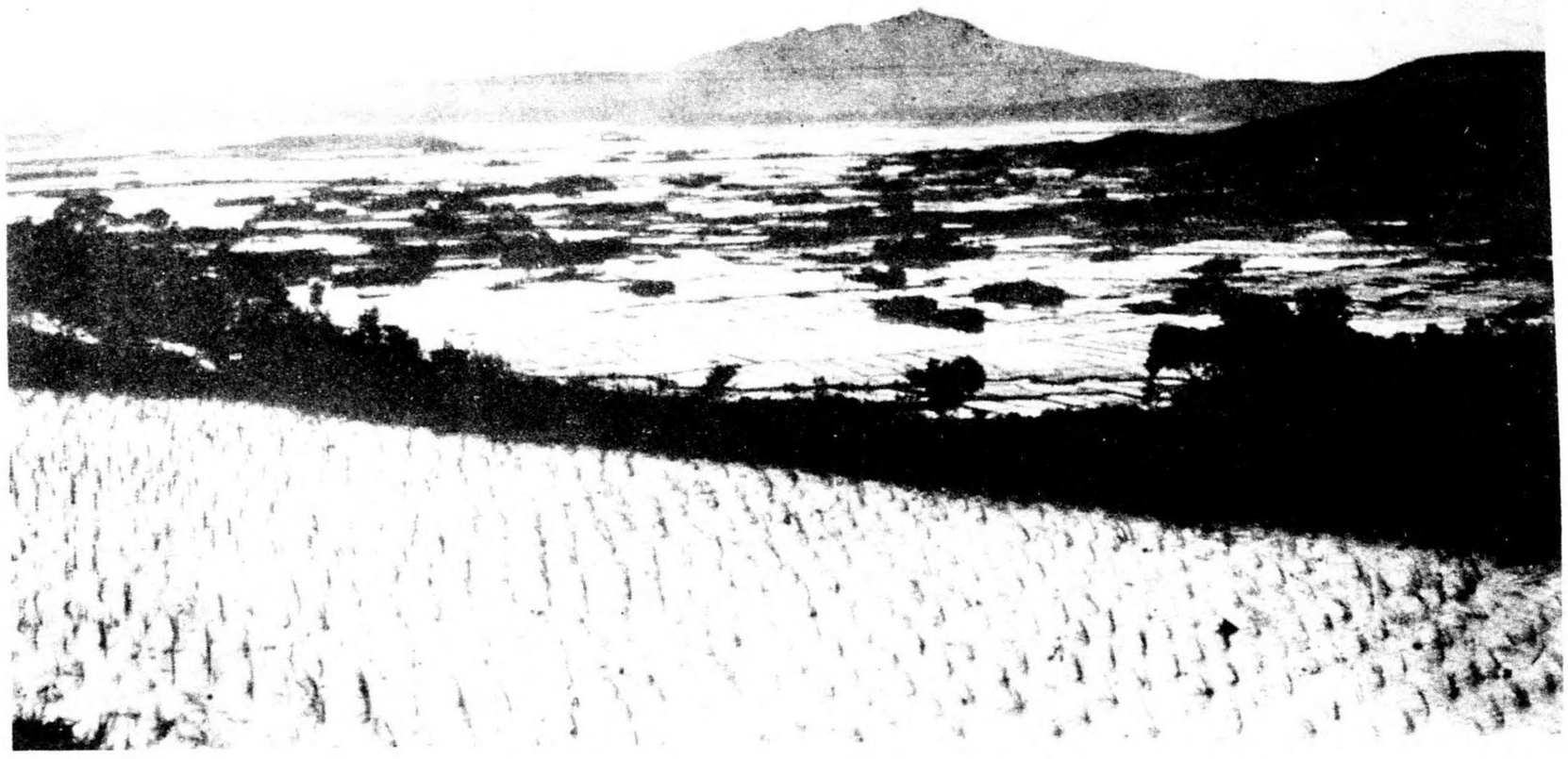


A.5. Golf links at base of Daiton upland, near Tansui. Tansui river in background.

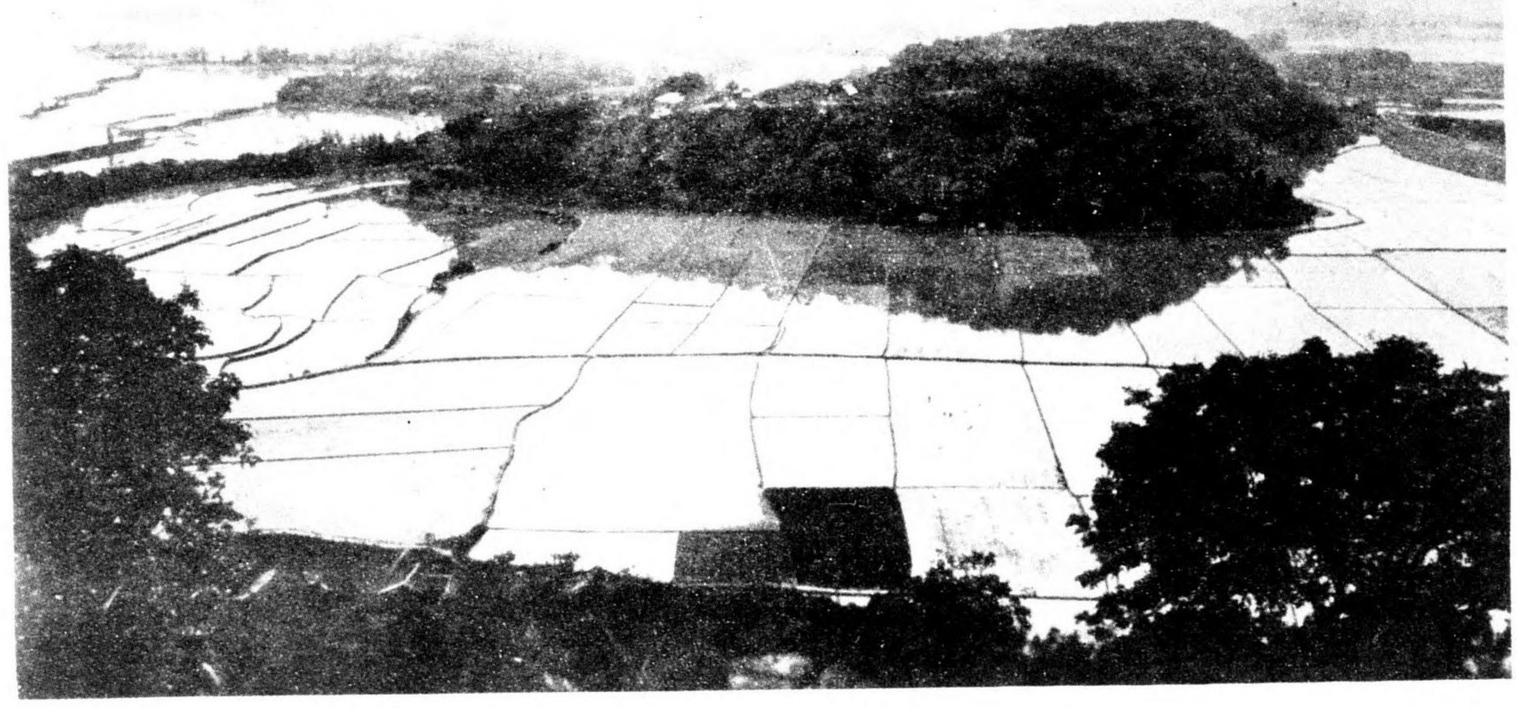


A.6. Keelung river at Goto coal mine.

877(C) F/383



A.7. Looking south across northern part of Taihoku lowland from Sozan.

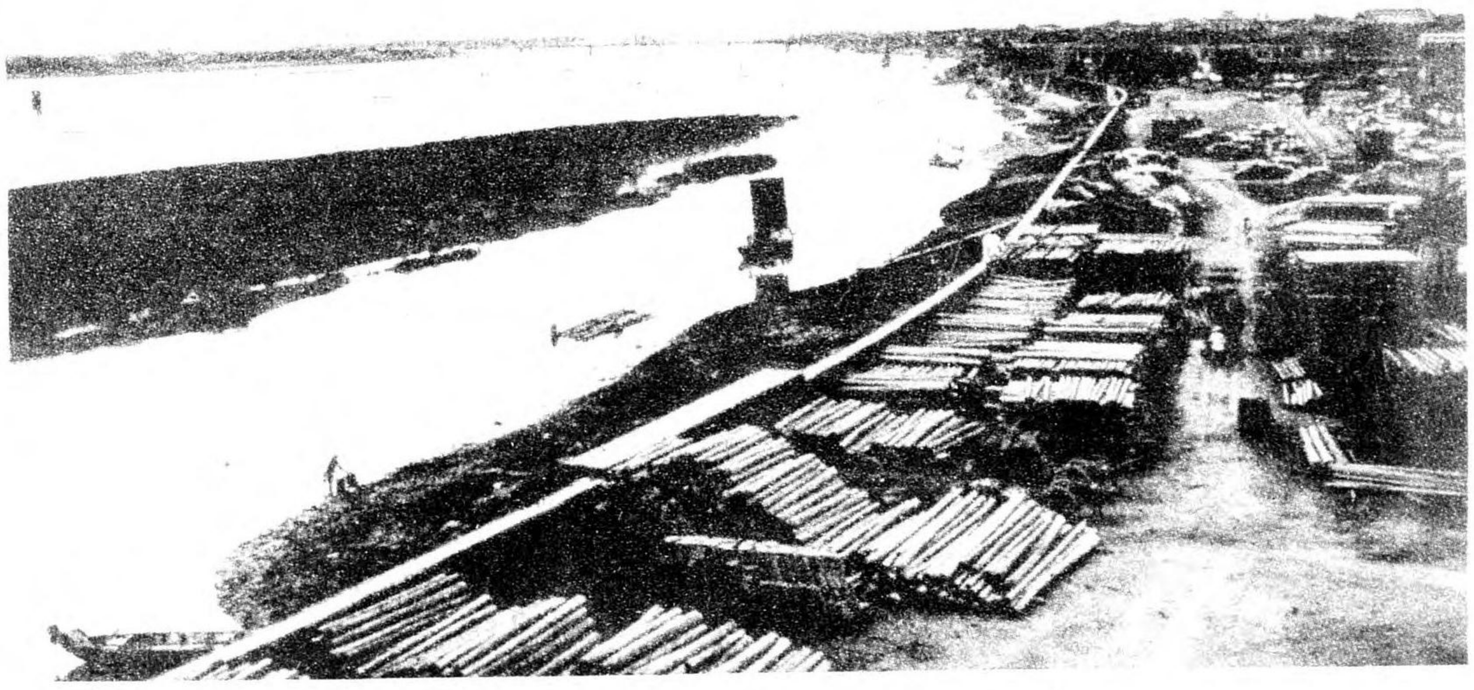


A.8. Wet paddy fields on recent alluvium in Taihoku lowland near Shirin. Tansui river in background.

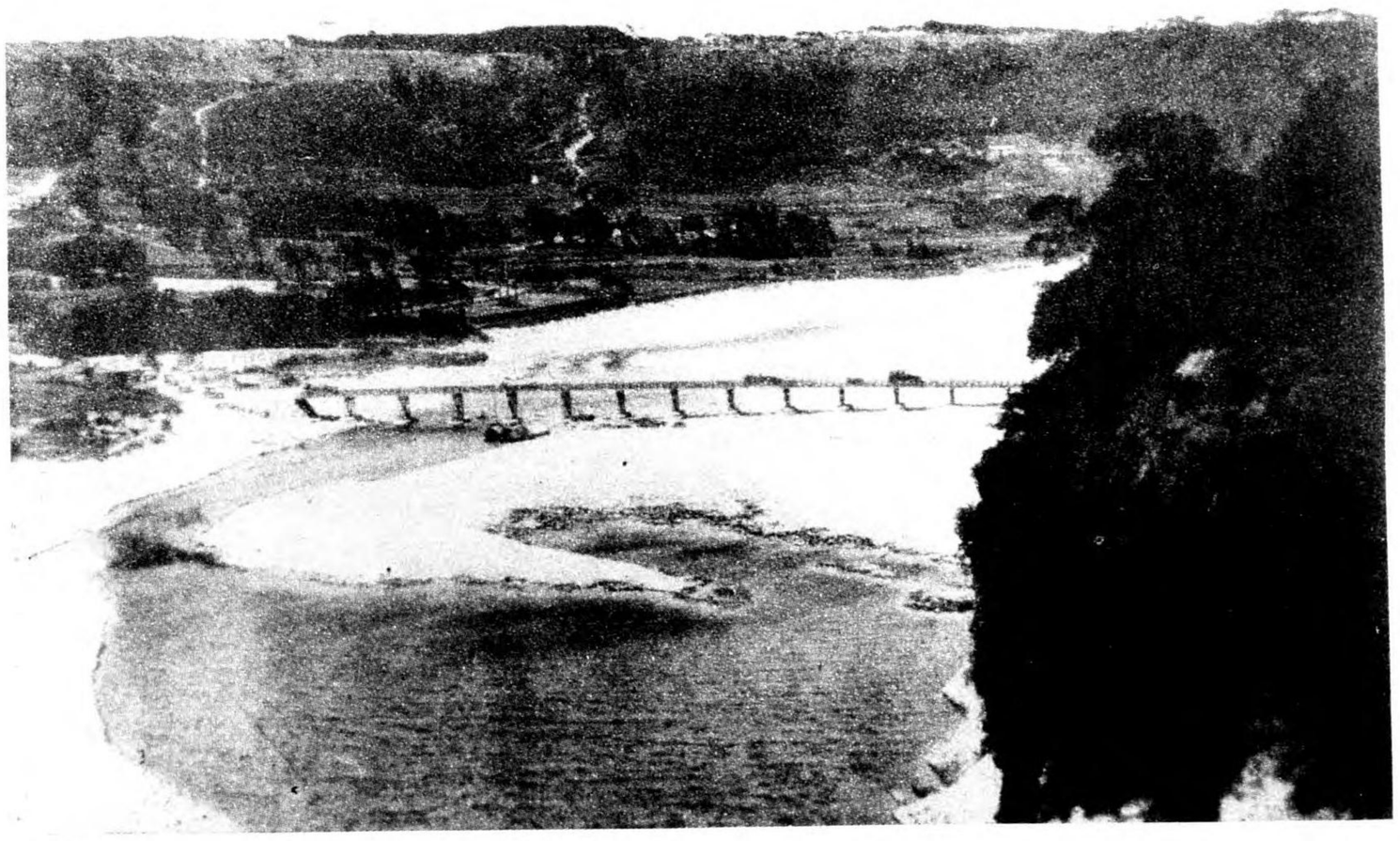
A.9. Tansui river, probably north of Kanto. Exact location unknown.

877(G) F/383

A.10. Tansui river, probably near its mouth. Exact location unknown.



A.11. Tansui river, south of Taihoku.



A.12. Tansui river at Taikei. Hills in background are of Young Sediments. Old gravelled terrace in right foreground.

847(C) F/383

A.13. Looking north across the mouth of the river south of Komo, with coastal sand dunes in background.

A.14. Sand dunes along coast south-west of Shinchiku. Railway (top right) runs along top of dunes.

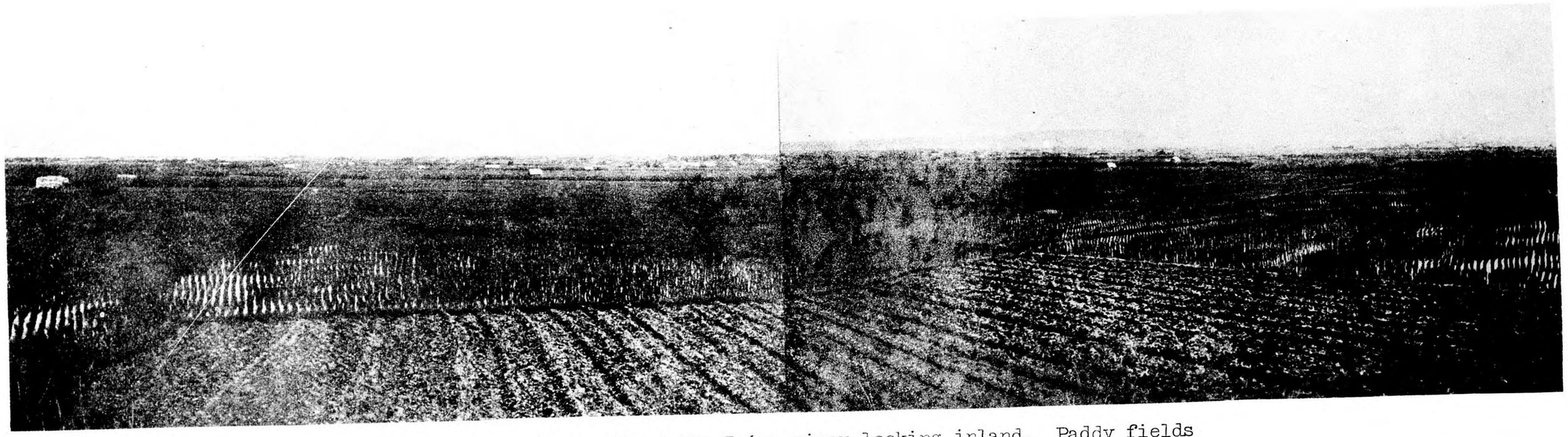
A.15. In northern part of Shinshiku province; tea plantation on slopes in background, terraced paddy in river valley in foreground.

877(Q) F/383

A.16. Near Shinshiku: typical tea plantation slopes, April - November.

877(C) F/383

877(Q) F/383



A.17. Near the mouth of the Taian river looking inland. Paddy fields on recent alluvium in foreground. Hills of old gravel terrace in background.

A.18. A field of young sugar cane north-west of Kobi.

A.19. Typical irrigation ditch of the south-western plain.

877(C) F/383

A.20. Harvesting rice on the south-western plain in November.

A.21. Paddy field on right, half grown sugar cane on left, with irrigation ditch between.

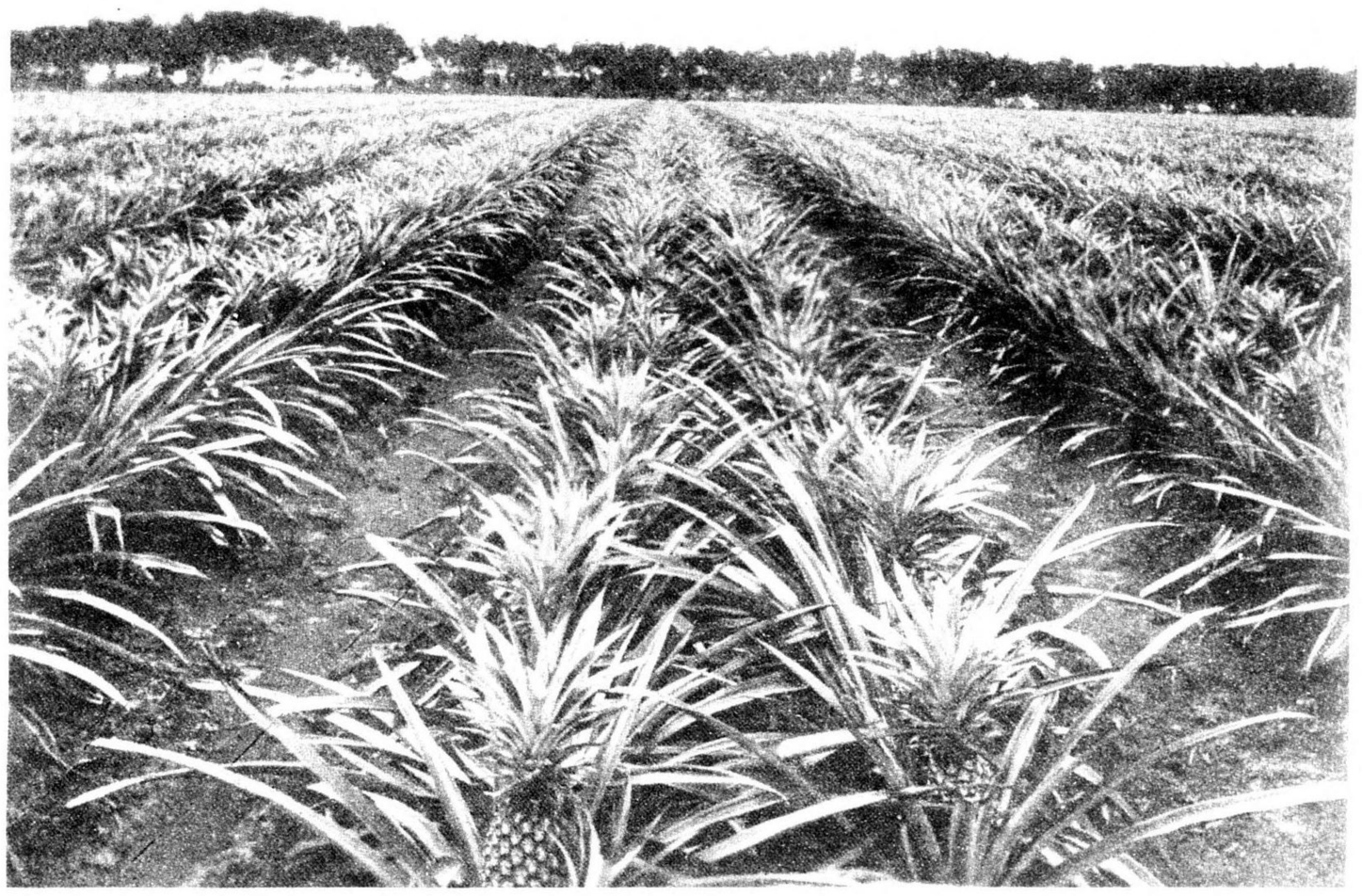
A.22. Sugar cane estate in Tainan province. Harrowing in April.

877(Q) F/383

A.23. Ridge and furrow arrangement in sugar field.

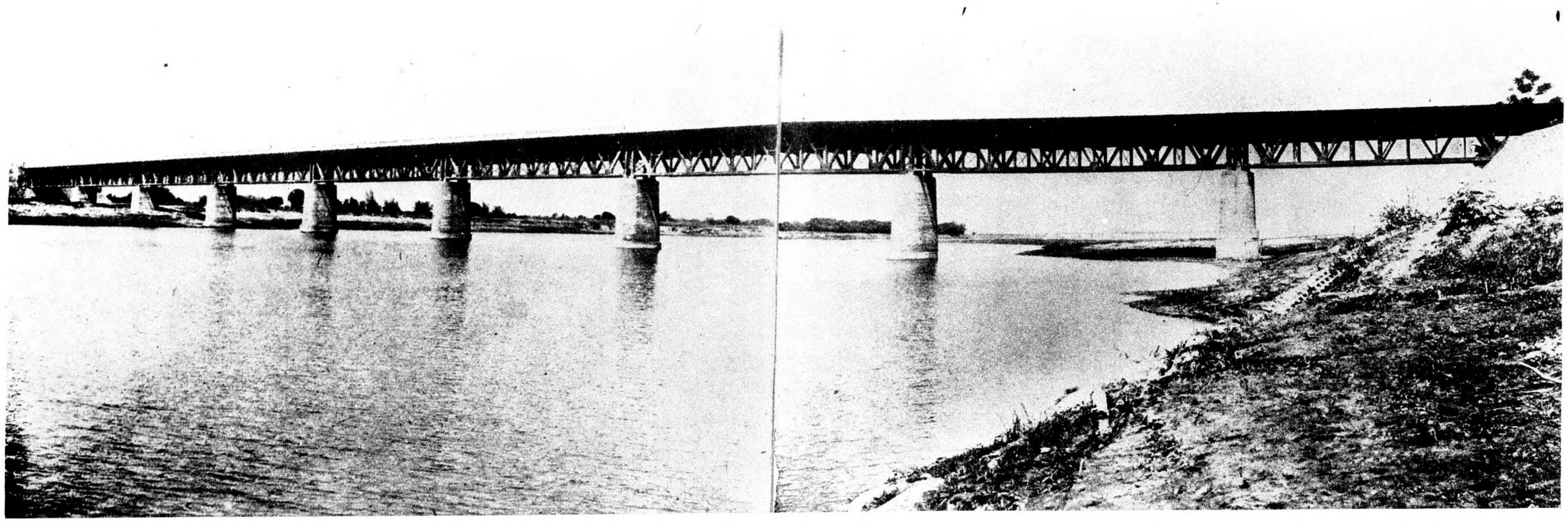
A.24. Fully grown sugar cane (Nov. to May); above average height.

877(Q) F/383



A.25. A pineapple field near Hozan.

877(G) F/383



A.26. Sobun river north-east of Zenka.

877(c) E/383

A. 27. Sand dunes on west coast with planted grasses to fix the sand.

A.28. Oyster beds near Rokko (Rokuko).

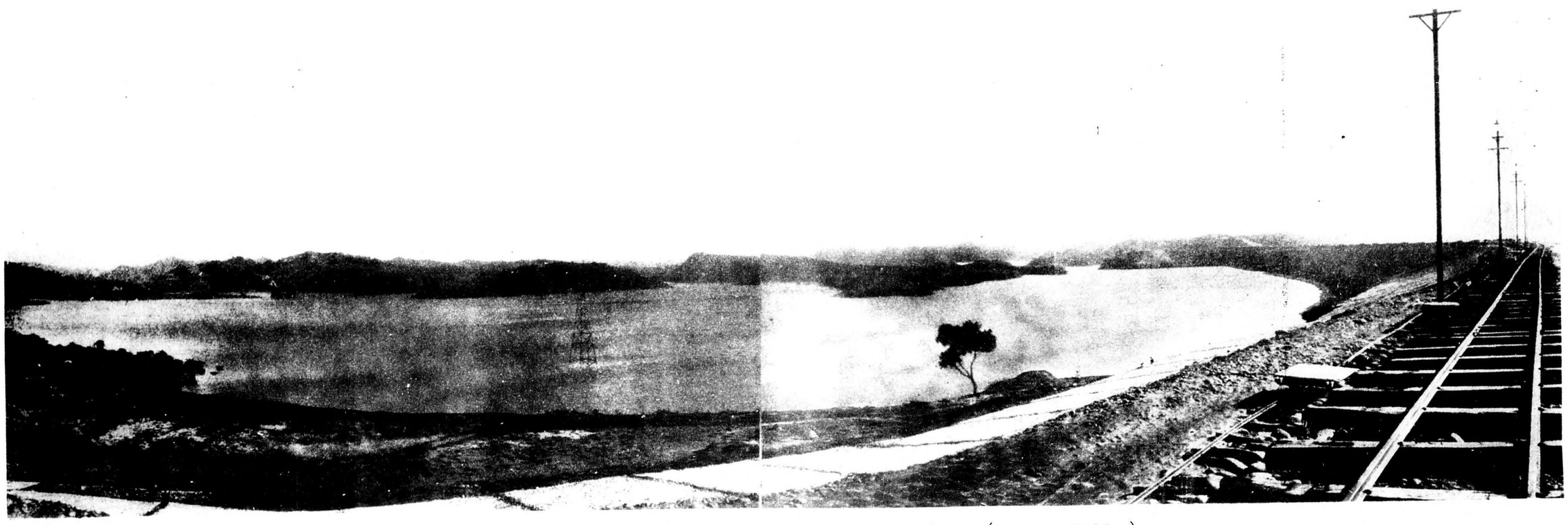
A.29. Salt beds north-west of Rokko (Rokuko).

877(Q) F/383

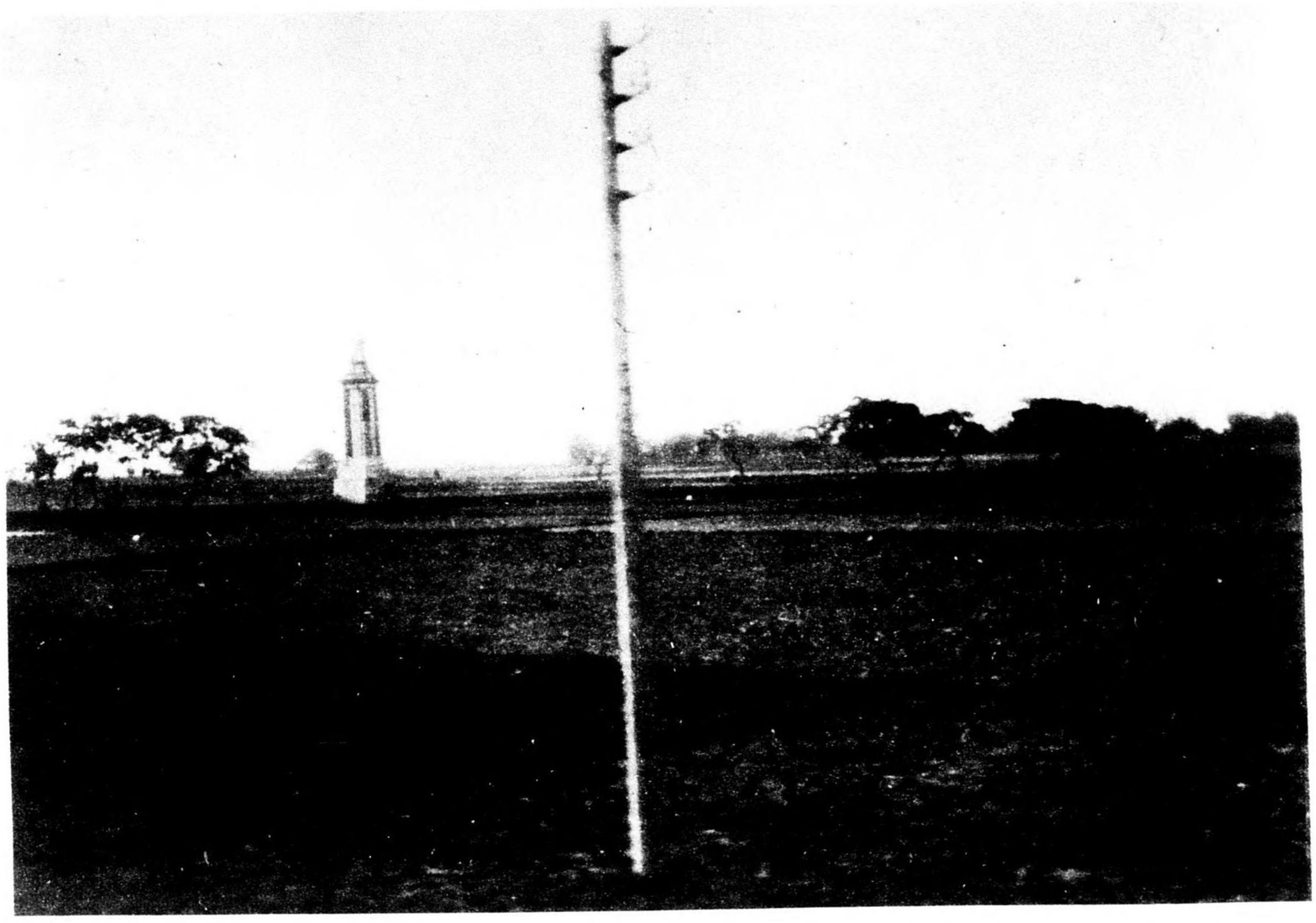
A.30. Salt fields near Anpin.

877(G) F/383

877(Q) F/383



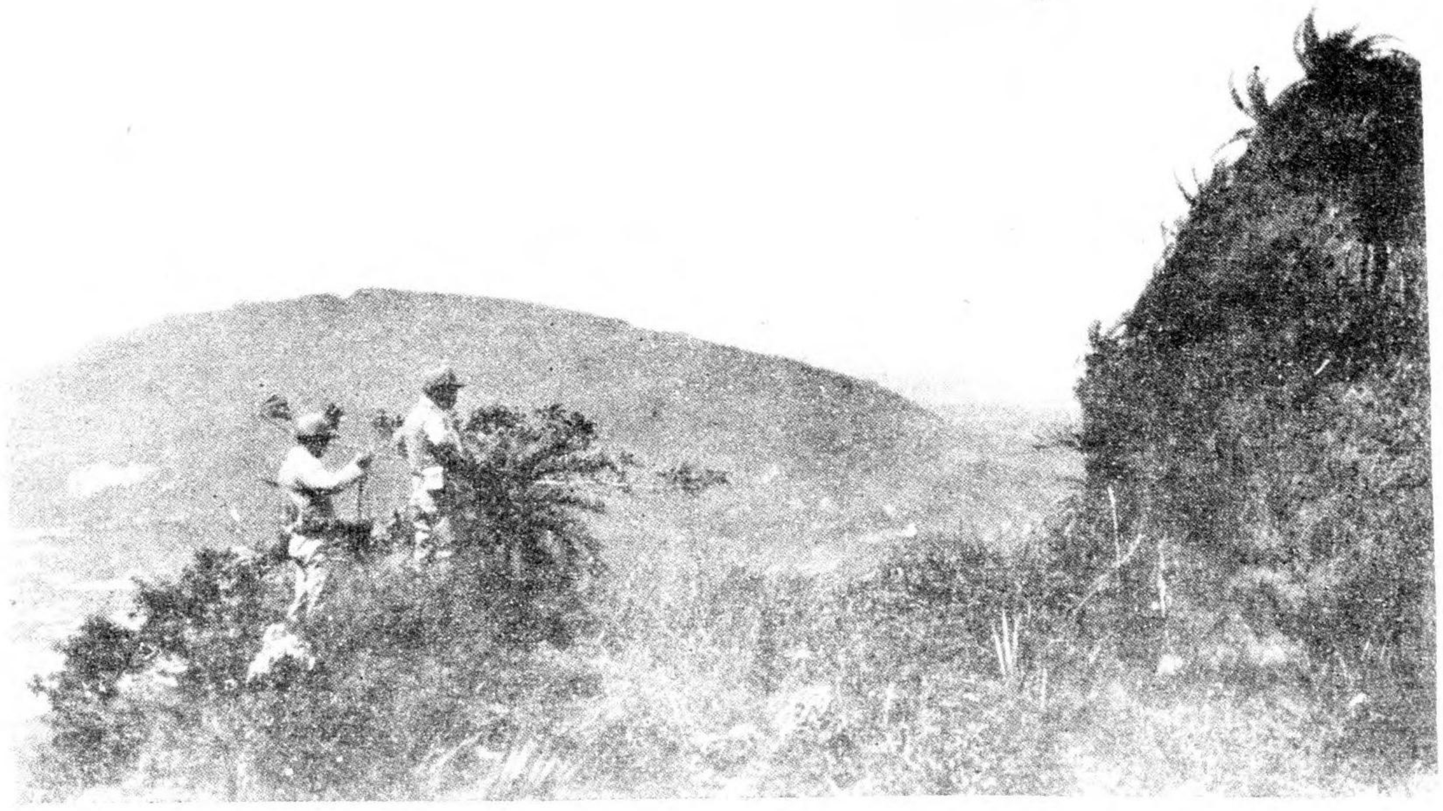
A.31. A reservoir in the Kanan irrigation scheme (? near Rokko).



A.32. Countryside just south of Kagi.

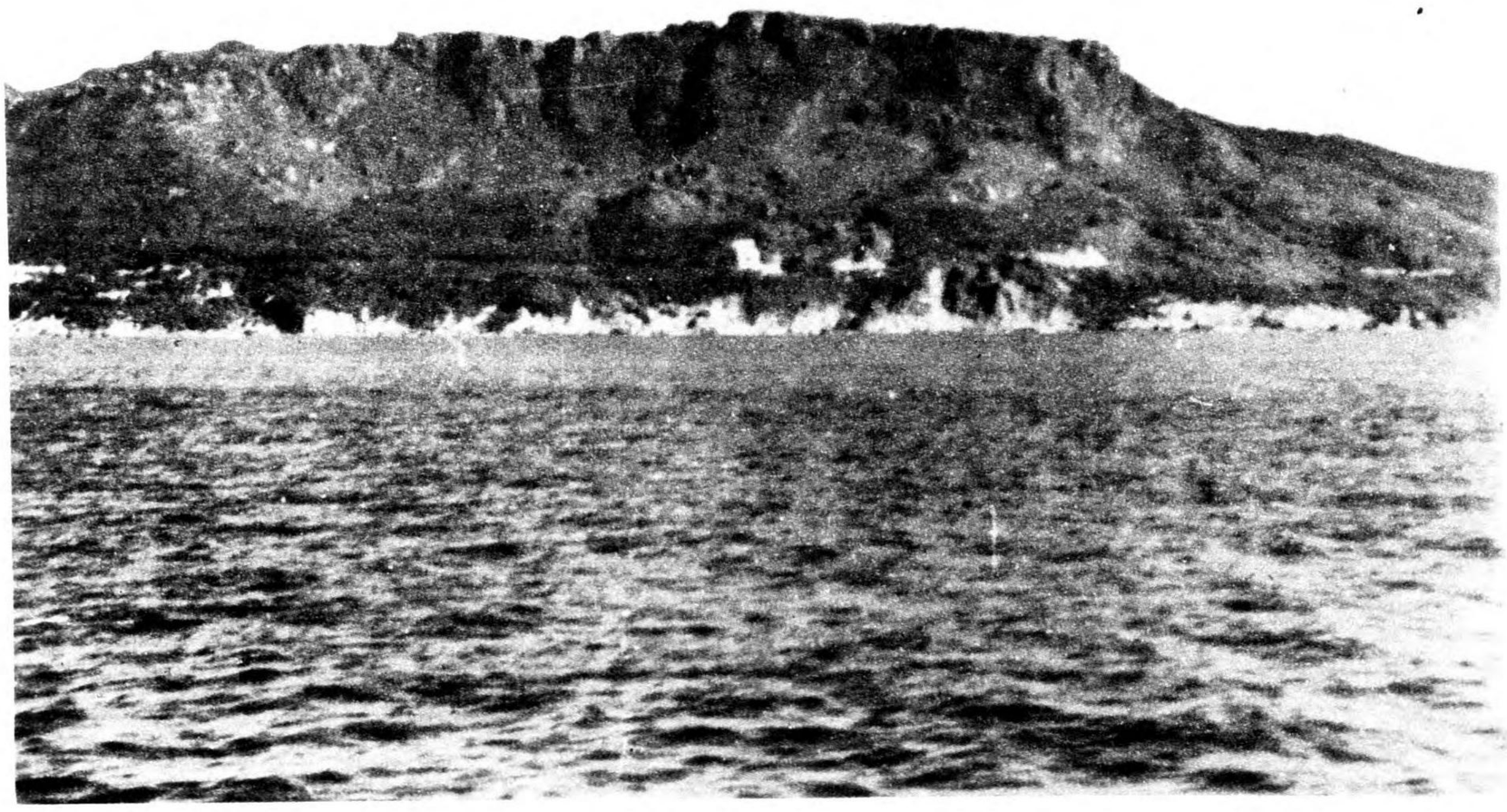
A.33. A typical mud volcano 2 miles east of Kyoshito.

877(C) F/383



A.34. Hills near Okayama.

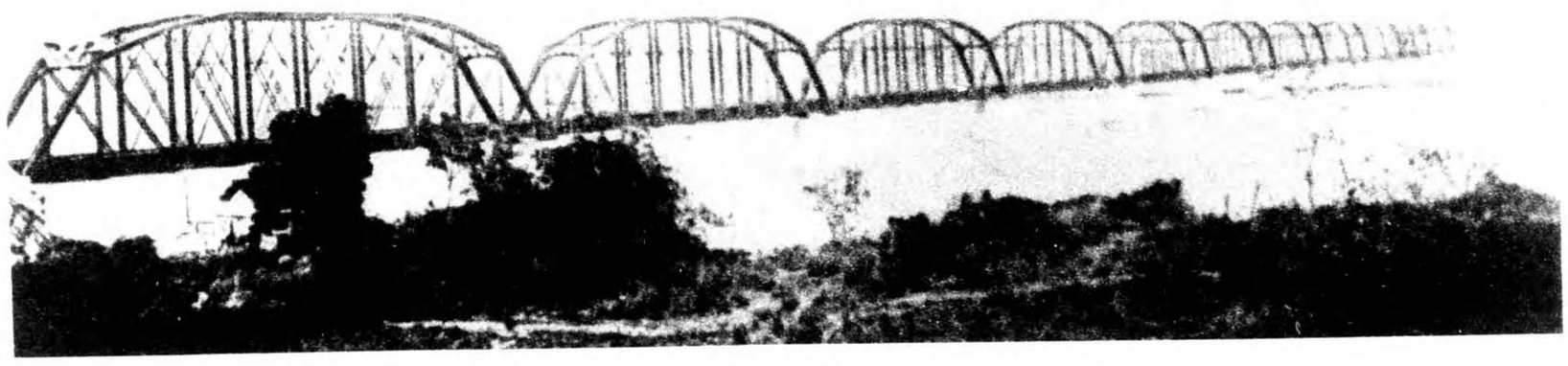
A.35. The river at Takao.



A.36. Monkey Hill, north of Takao.

877(Q) F/383

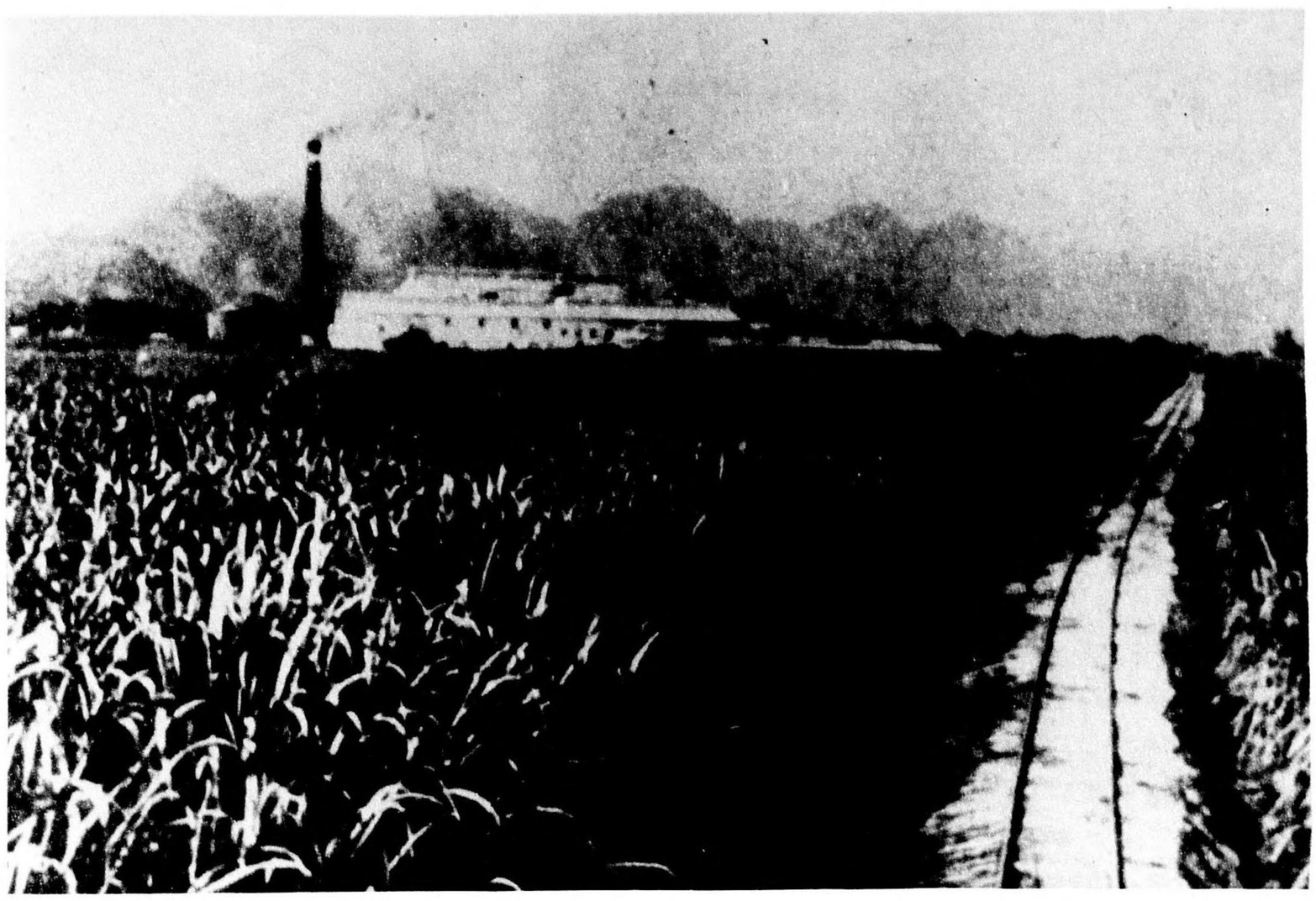
A.37. The Tainan - Anping canal, at Tainan.



A.38. Bridge over Shimotansui river west of Heito.

A.39. Typical boulder river walls (? the Shimotansui river near Heito).

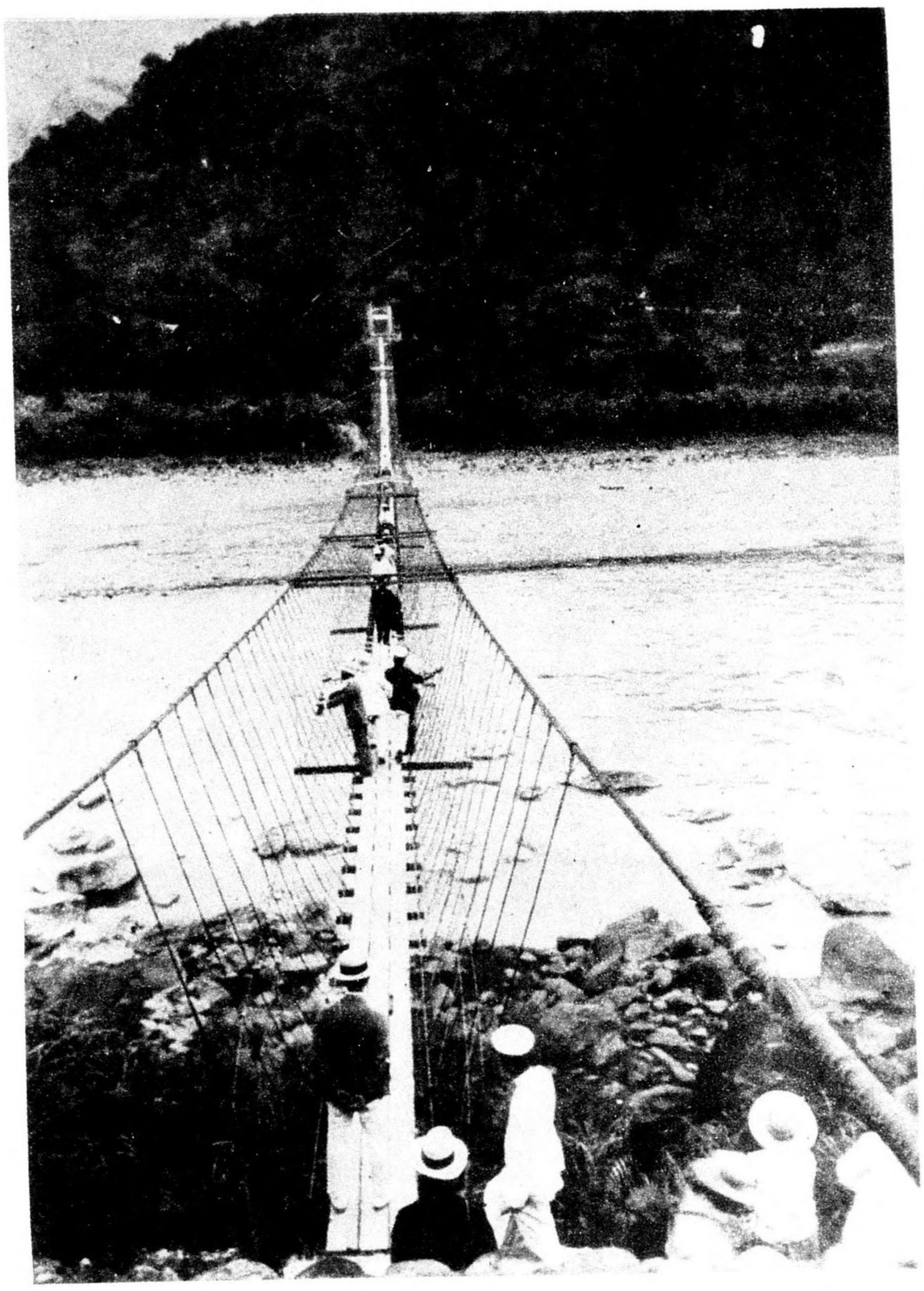
877(C) F/383



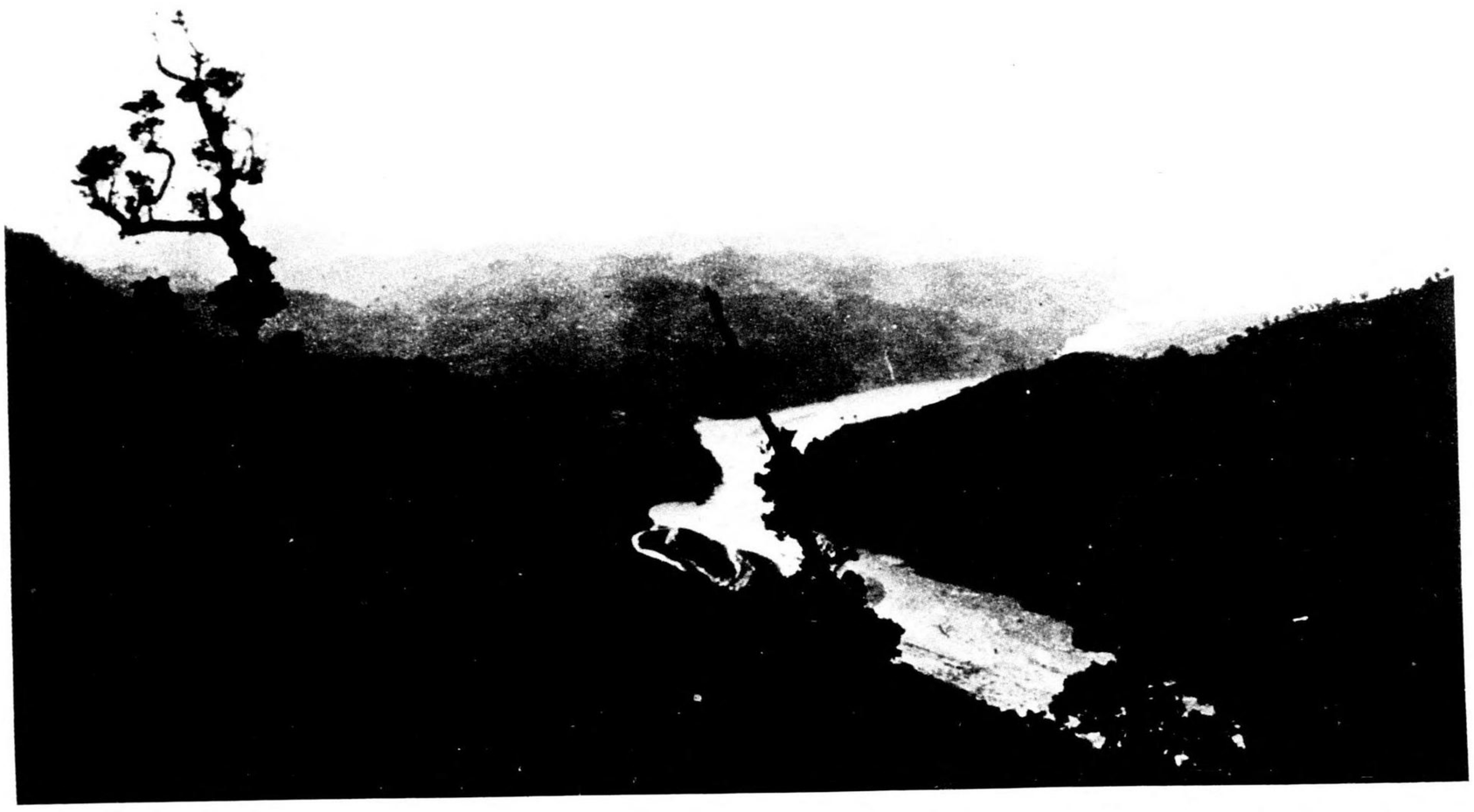
A.40. Typical sugar plantation surrounding a refinery, at Kizan.

A.41. Point of debouchment of Airyo (Al-Liau) valley on to Heito plain. Note rubbly mountain soils.

877(G) F/383

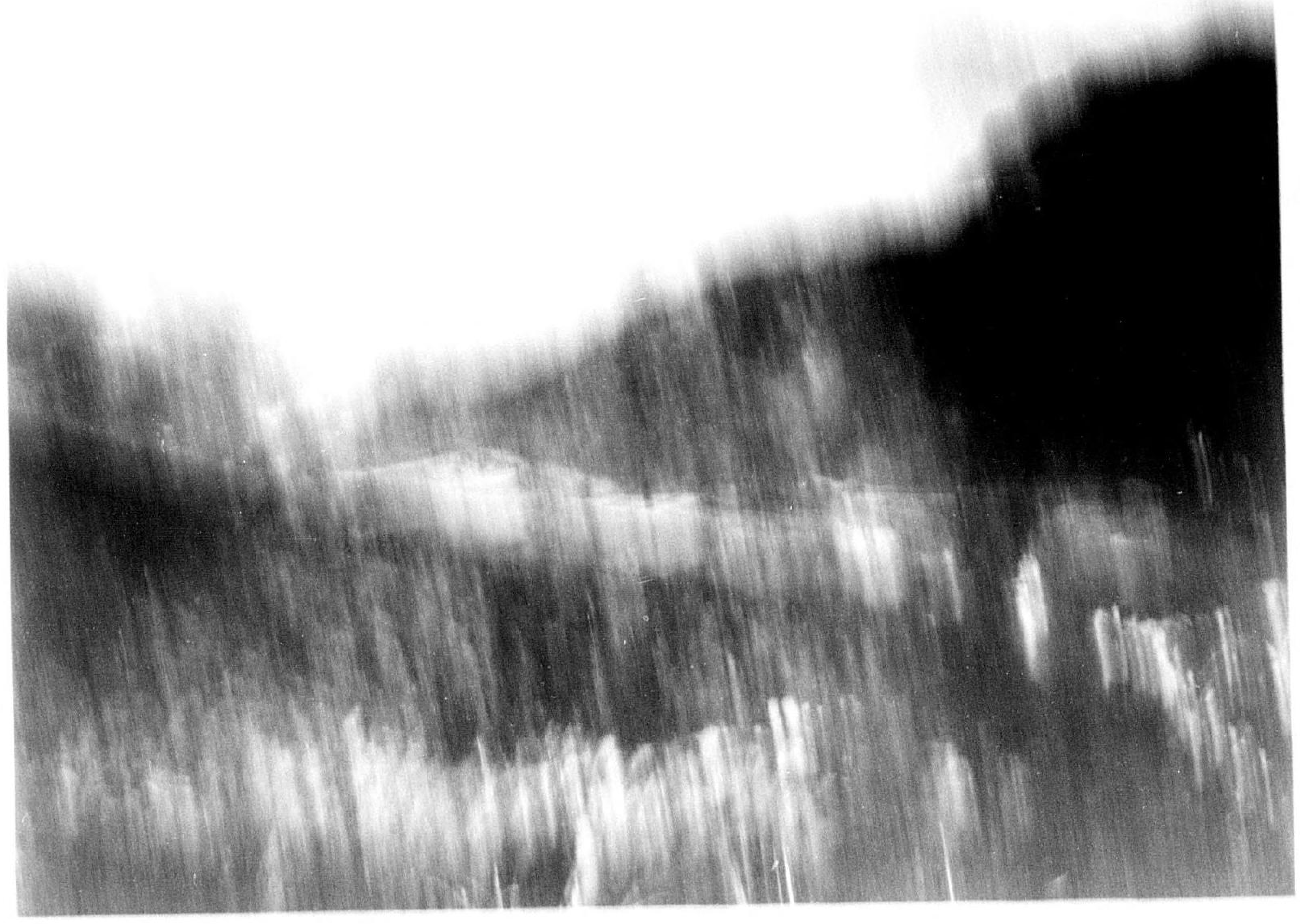


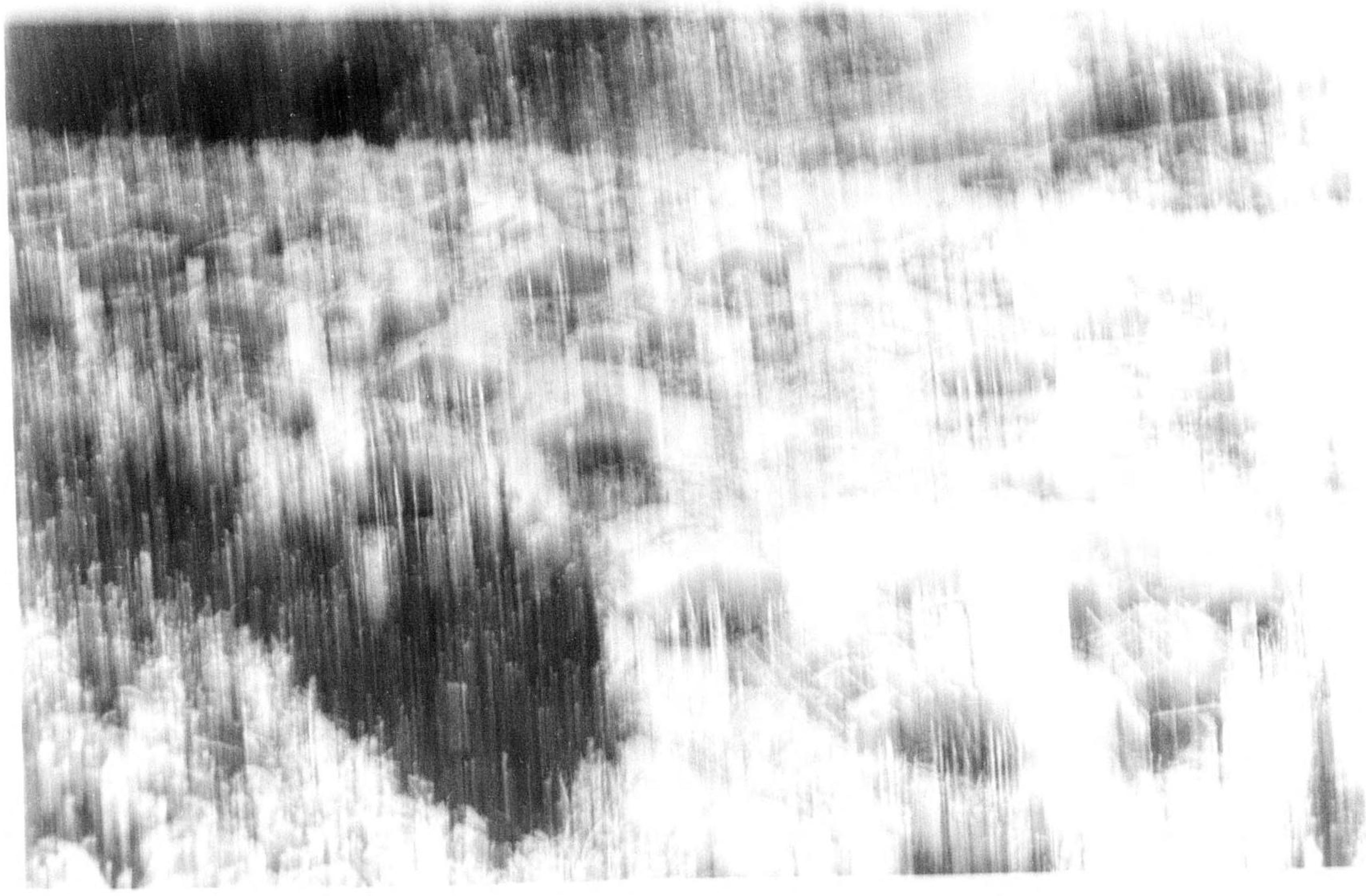
A.42. Tansui river at Kakpansua (Kappanzan). (The bridge is about 400 yards long.)



A.43. The Tansui valley near its debouchment on to the lowland.

877(Q) F/383





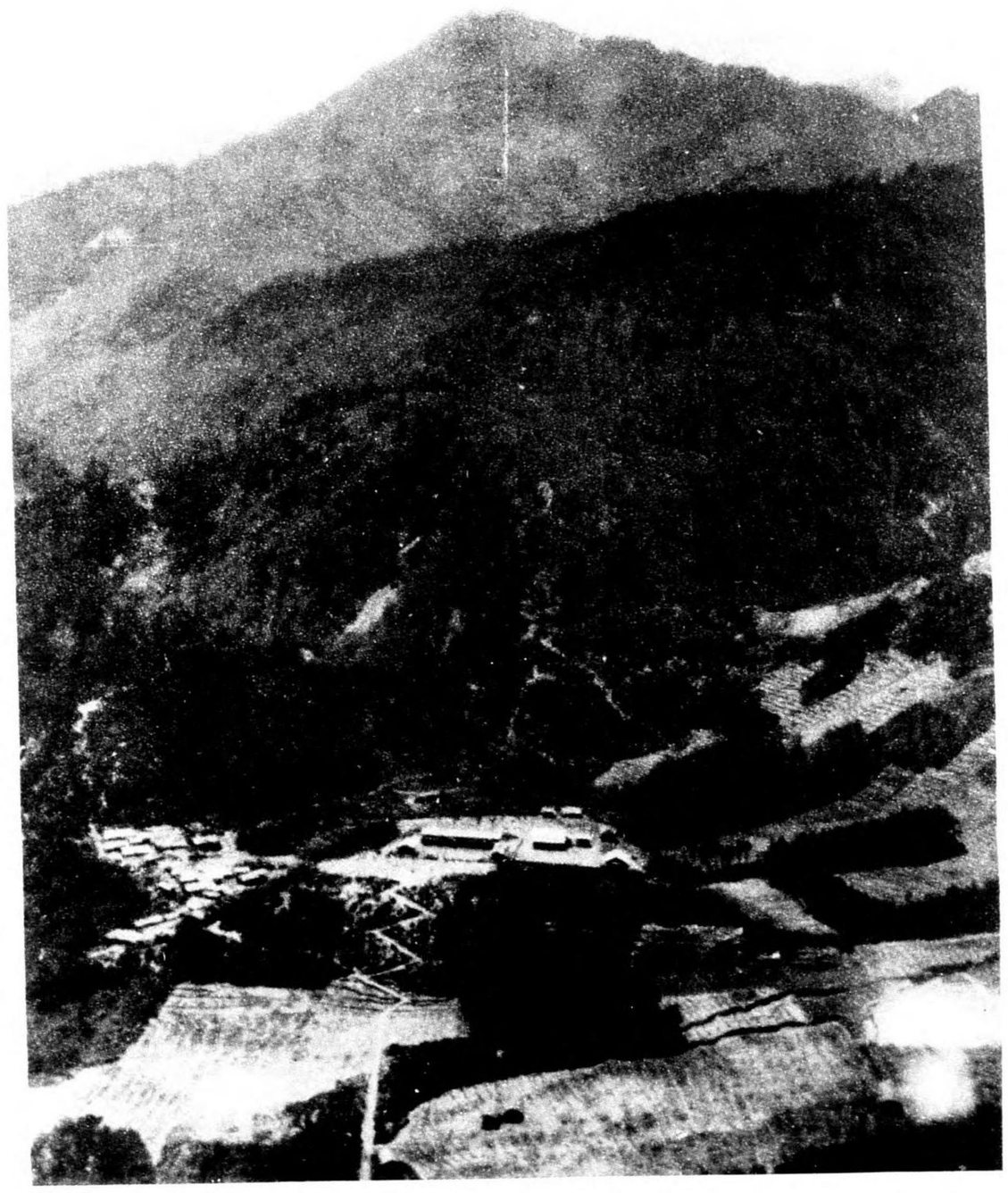
A.44. Uplands round Kakpansua (Kappanzan). Tansui valley is on the left.

A.45. Types of 'savage' settlements: Shikikun on the slopes above the upper Dakusui (Giran) river.

A.46. Mareppa, on the slopes above the upper Taiko valley.

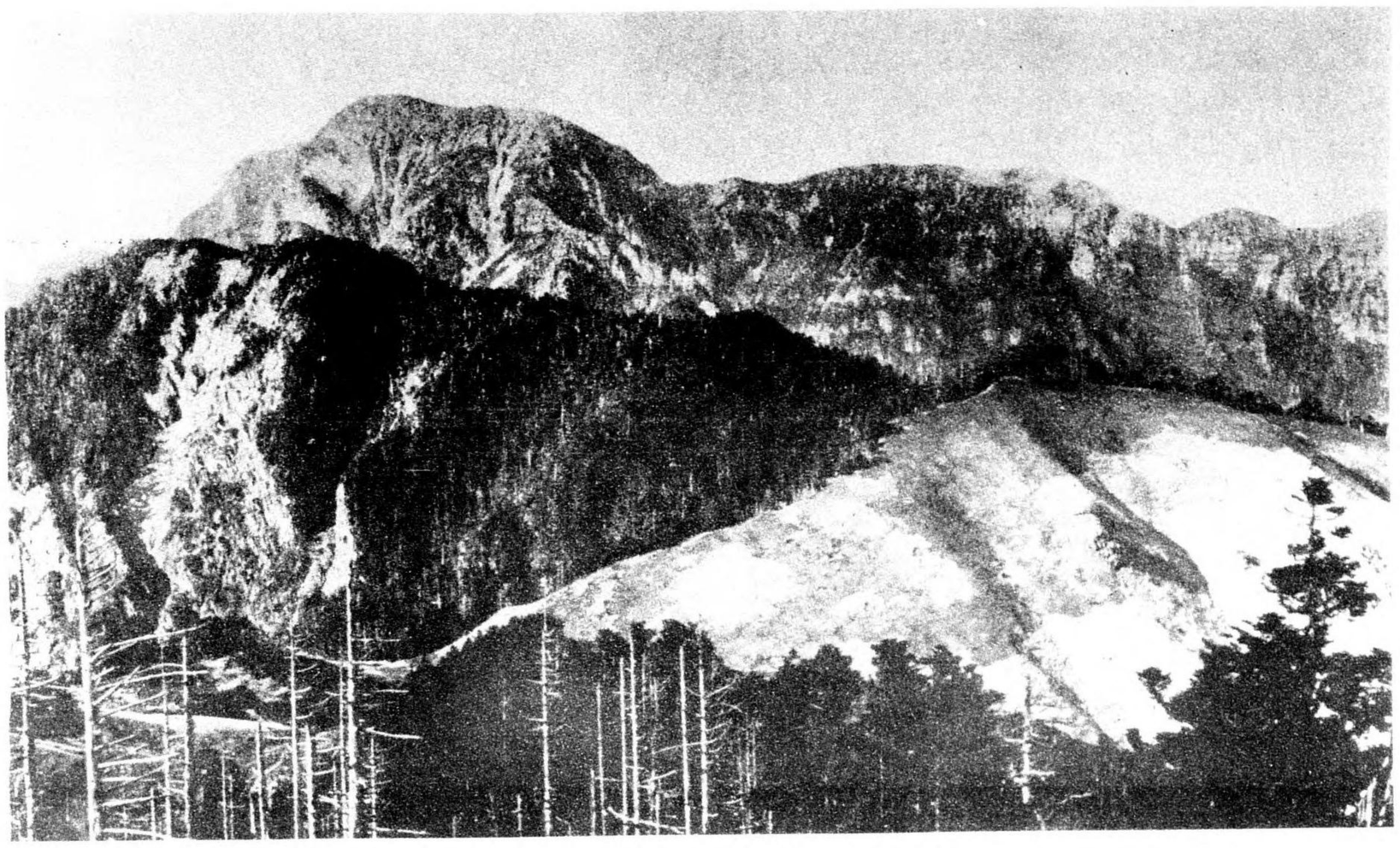
877(G) F/383

A.47. The upper Dakusui (Sera) valley near Musha. Evidence of landslide on right.



A.48. Police post and village at Shikayausia. Ridge leading up to Tsugitaka in background; gorge of upper Taiko river on left.

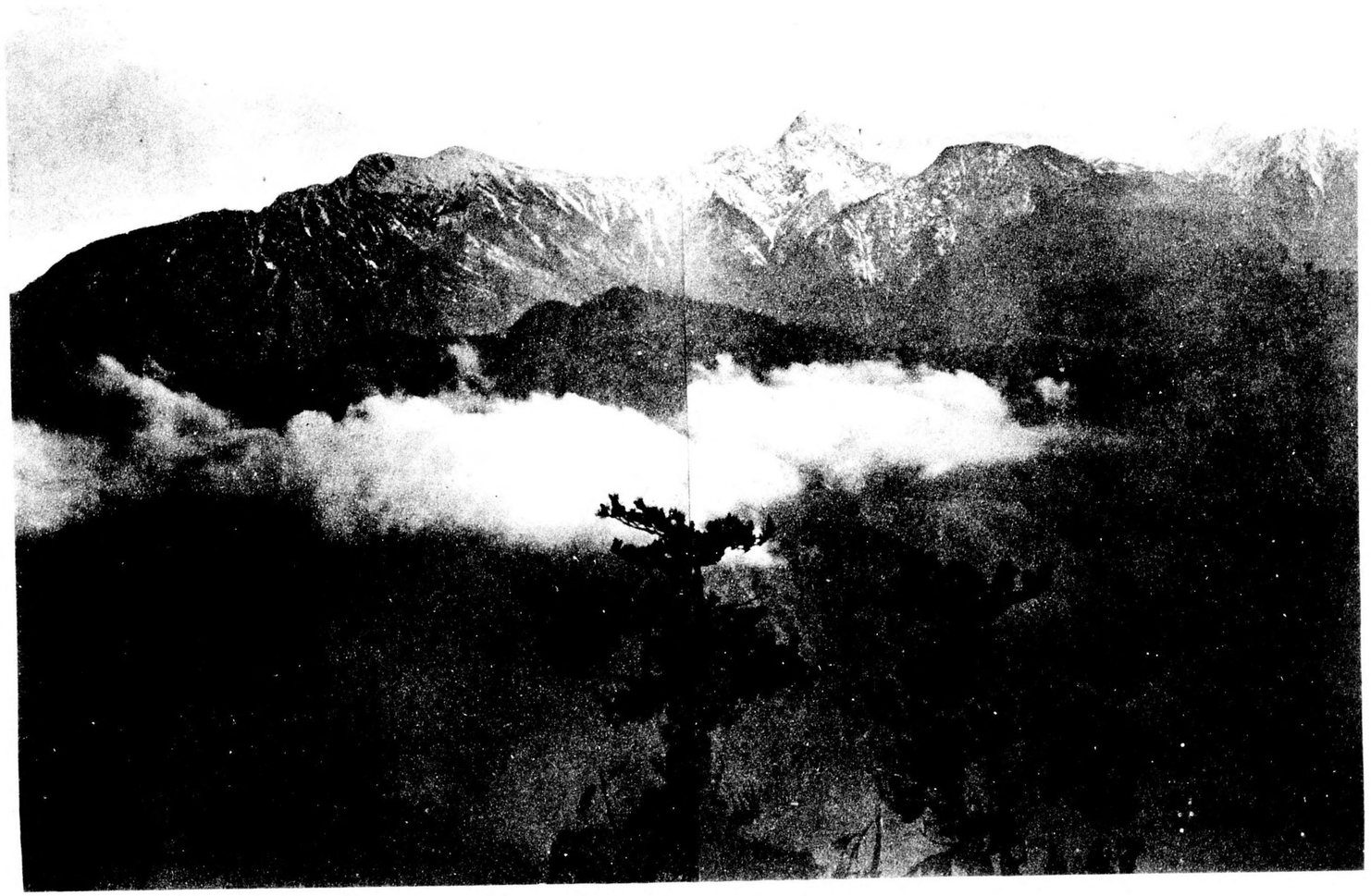
877(C) F/383



A.49. Mt. Tsugitaka: typical of higher mountain country.

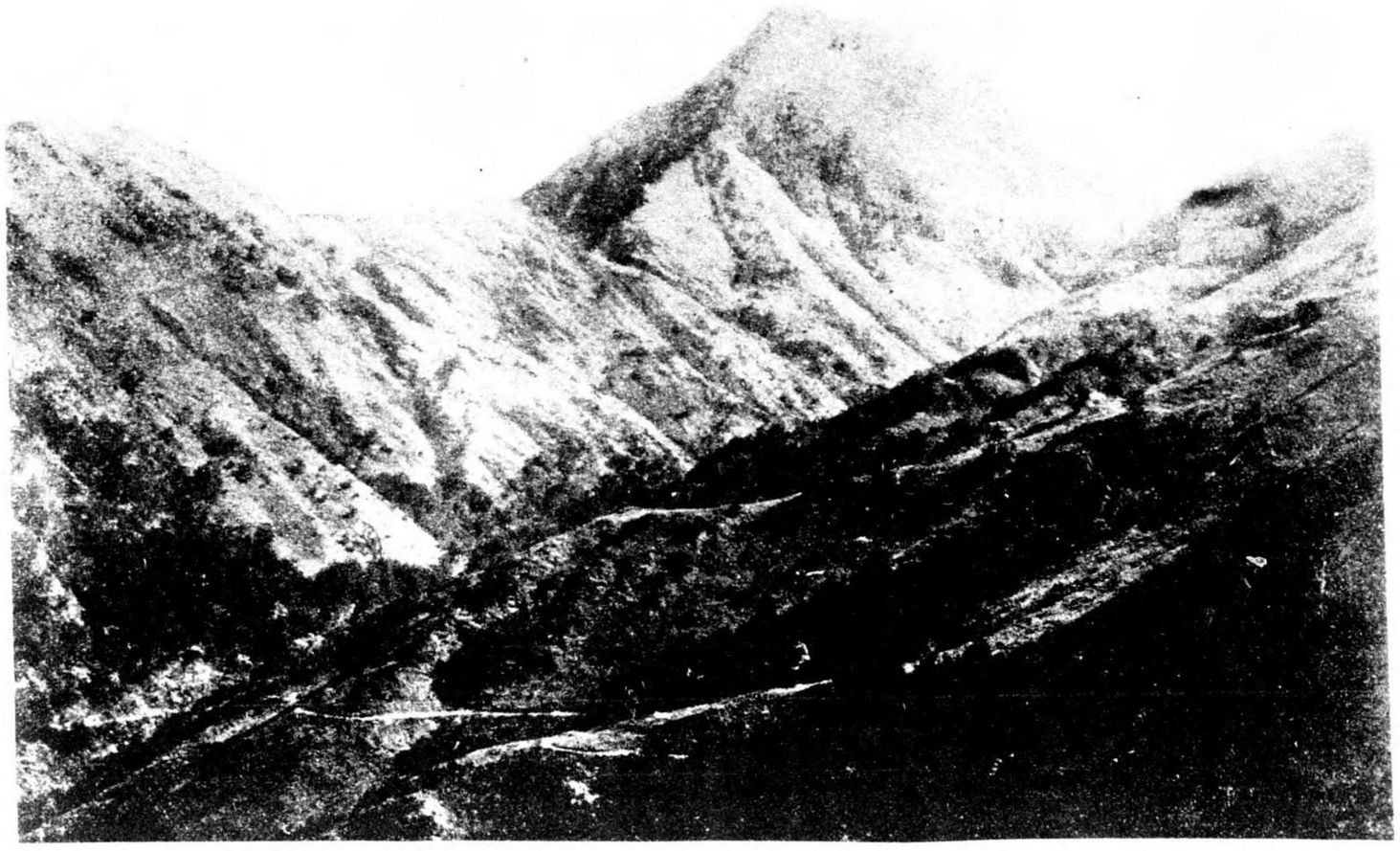
A.50. Jitsugetsutan lake and surrounding hills.

877(Q) F/383



A.51. Mt. Niitaka group seen from Arisan area.

877(Q) E/383



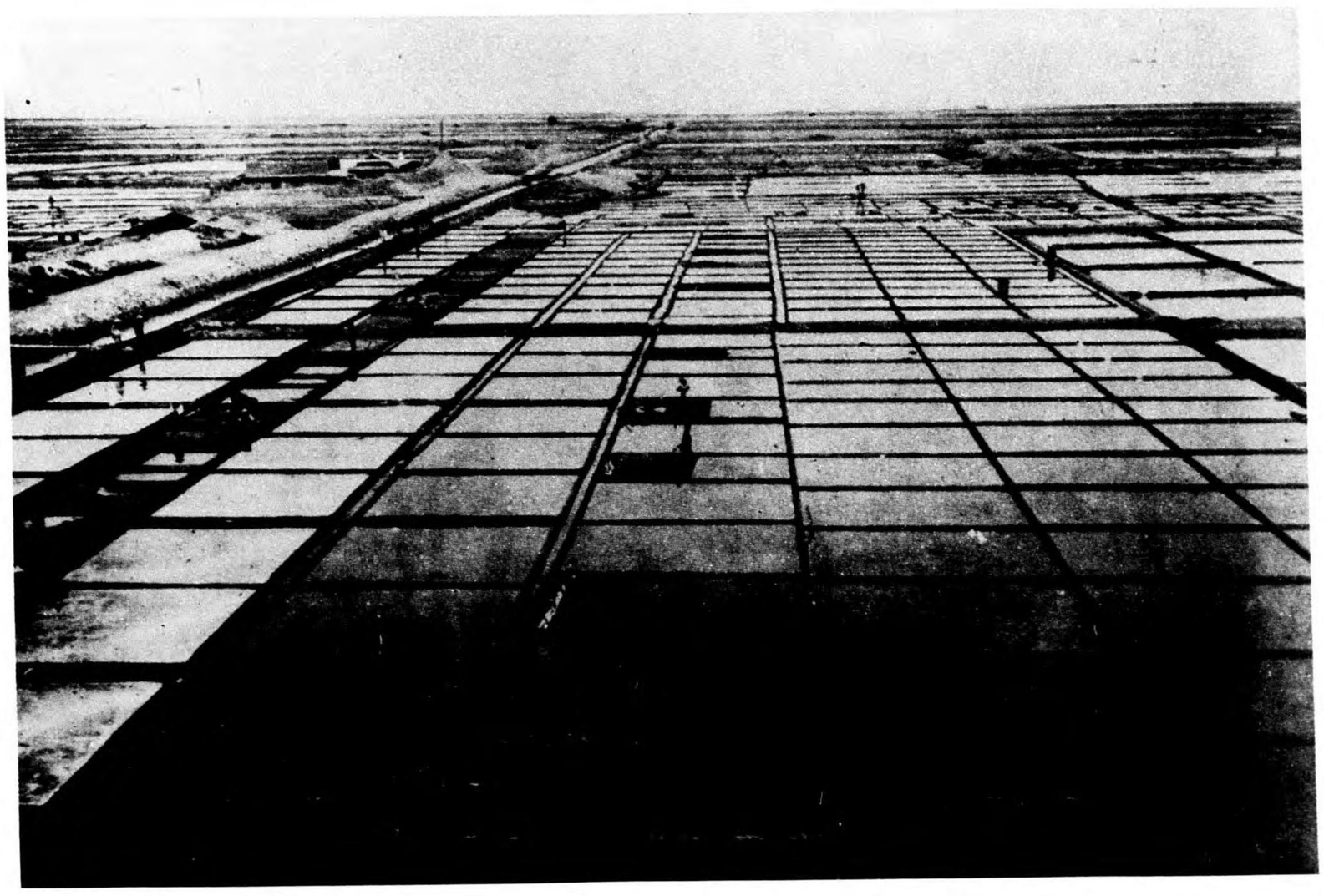
A.52. Track across the mountains: the Tamazato - Suiriko track at the foot of Mt. Shukoran.

A.53. Type of vegetation of the Arisan forest.

877(Q) F/383

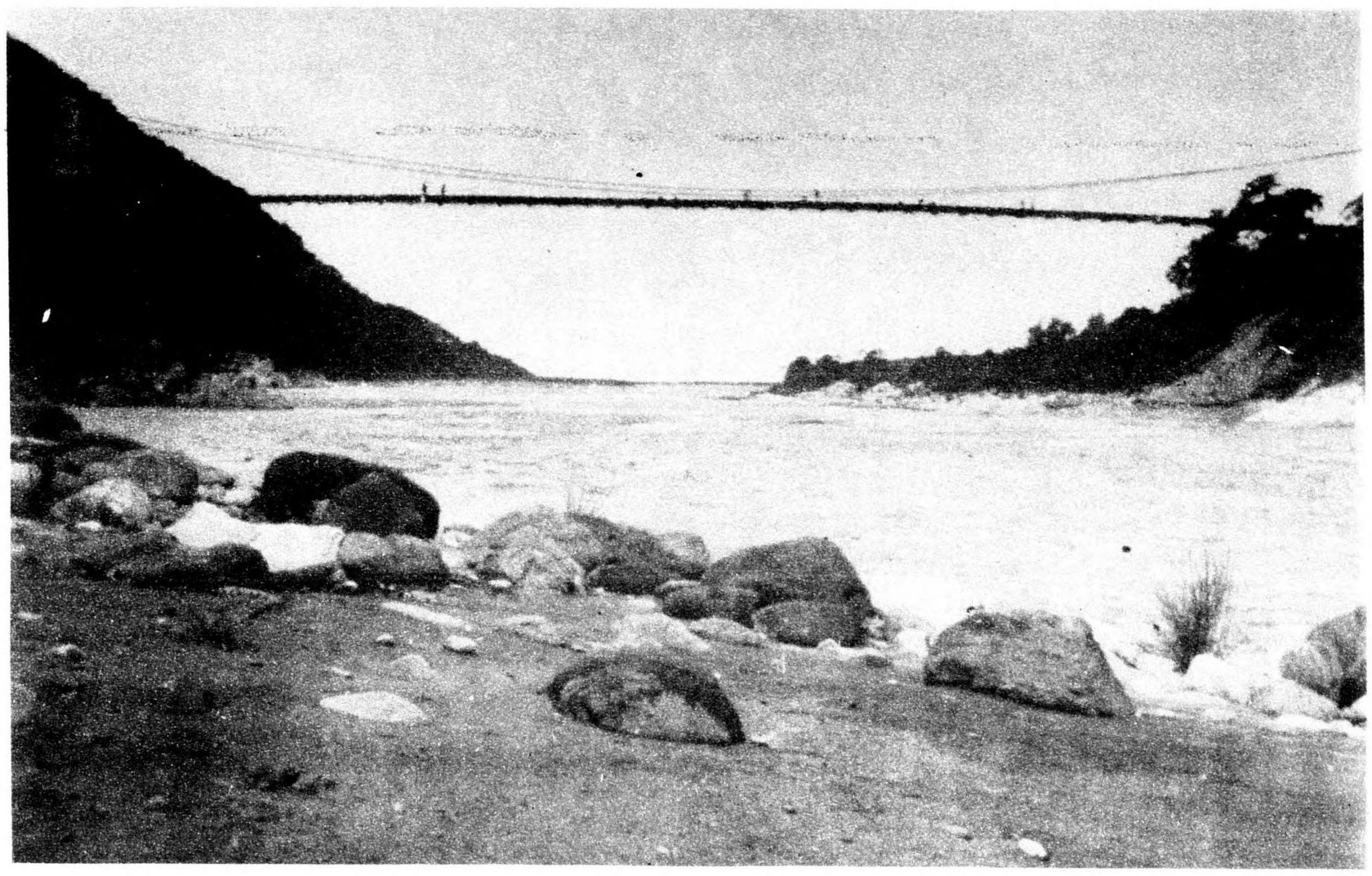
A.54. Valley of Tamari river, near Daibu on south-east coast.

A.55. Shiju river valley in the low hills of the south-west.



A.56. Bed of Tomari (Daimari) river near the coast.

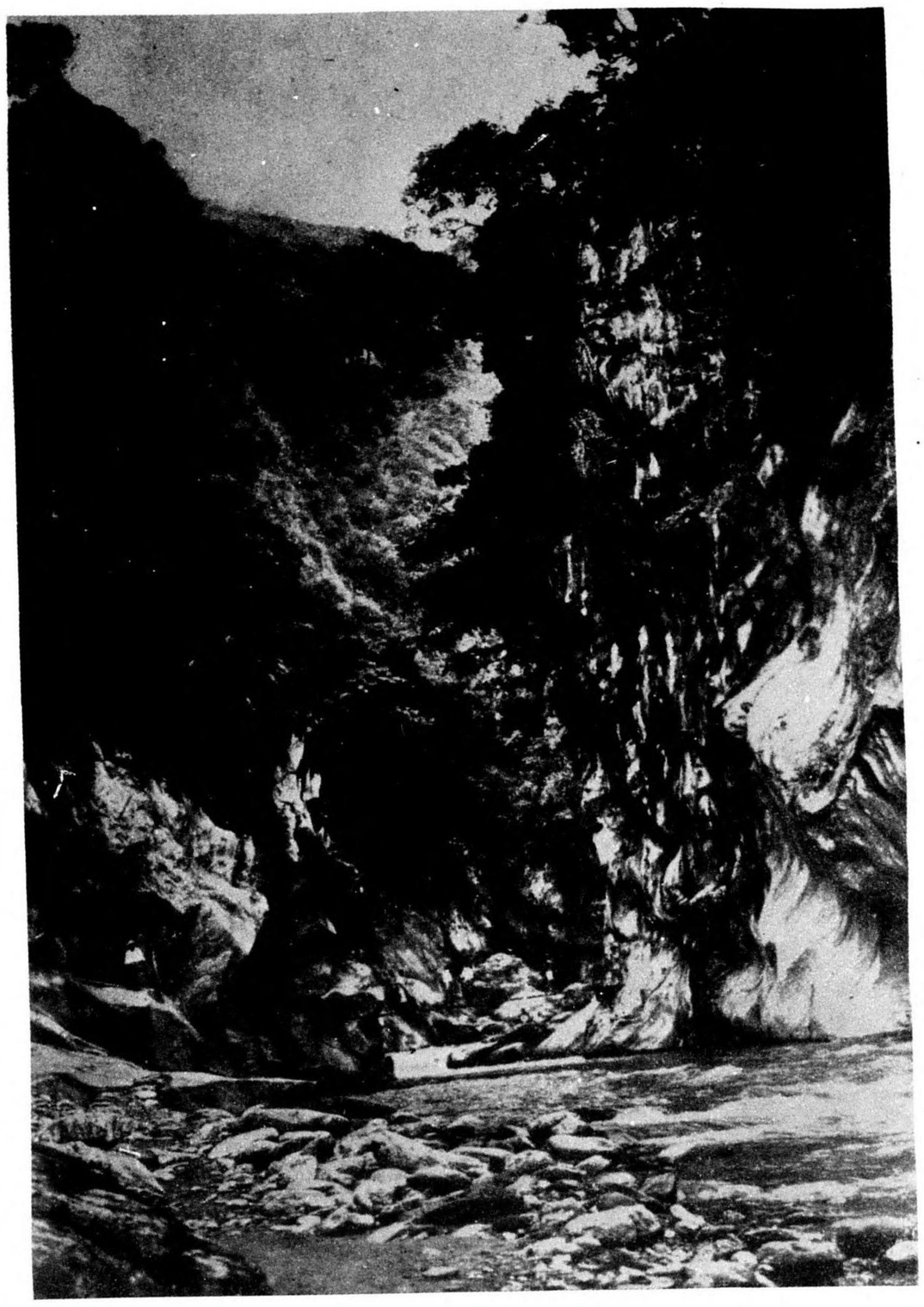
877(Q) F/383



A.57. Takkiri river about 3 miles from the coast.

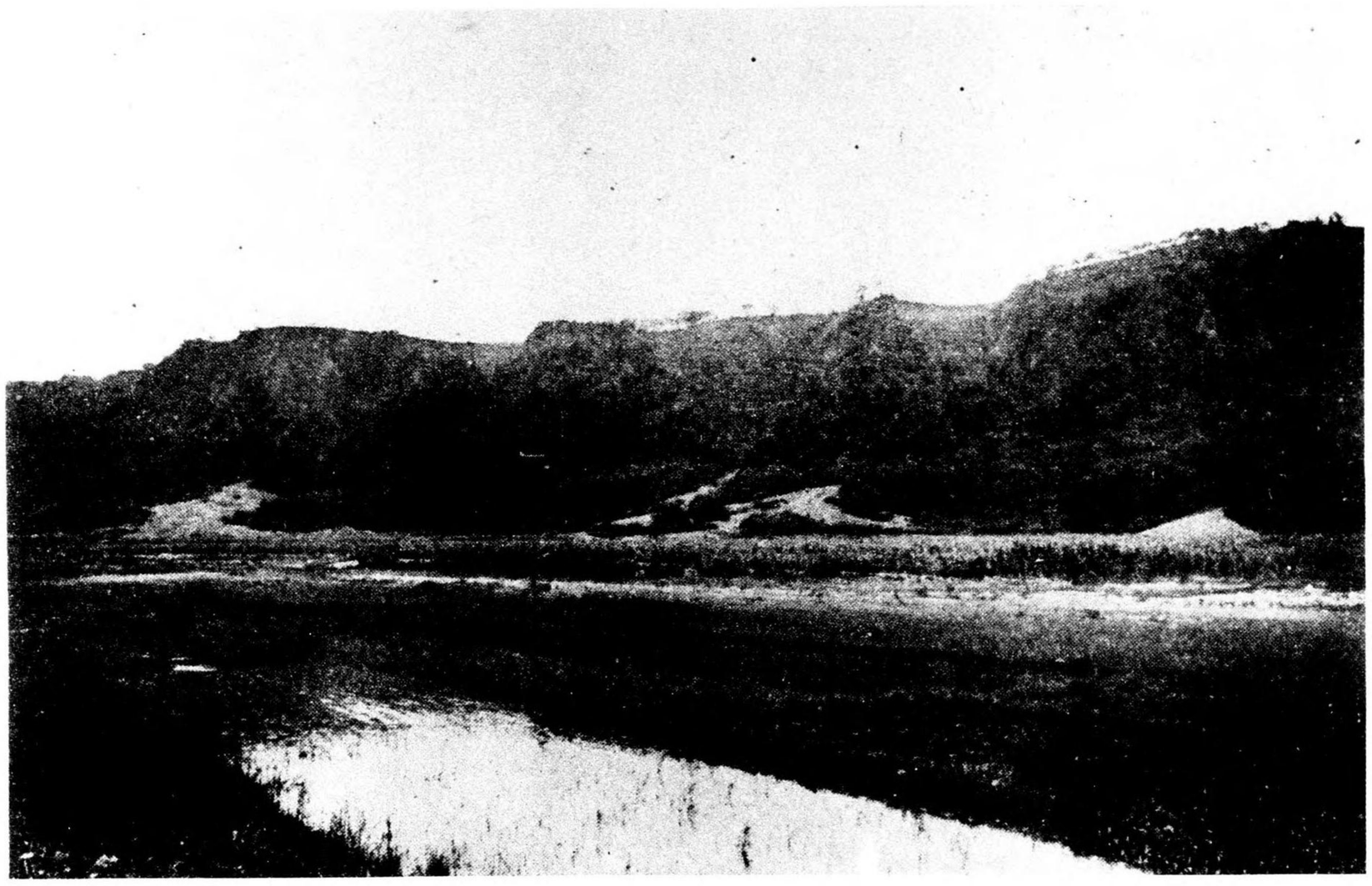
A.58. Taroko gorge with river Takkiri at bottom: track can be seen winding along the sides of the gorge and crossing the river.

877(Q) F/383

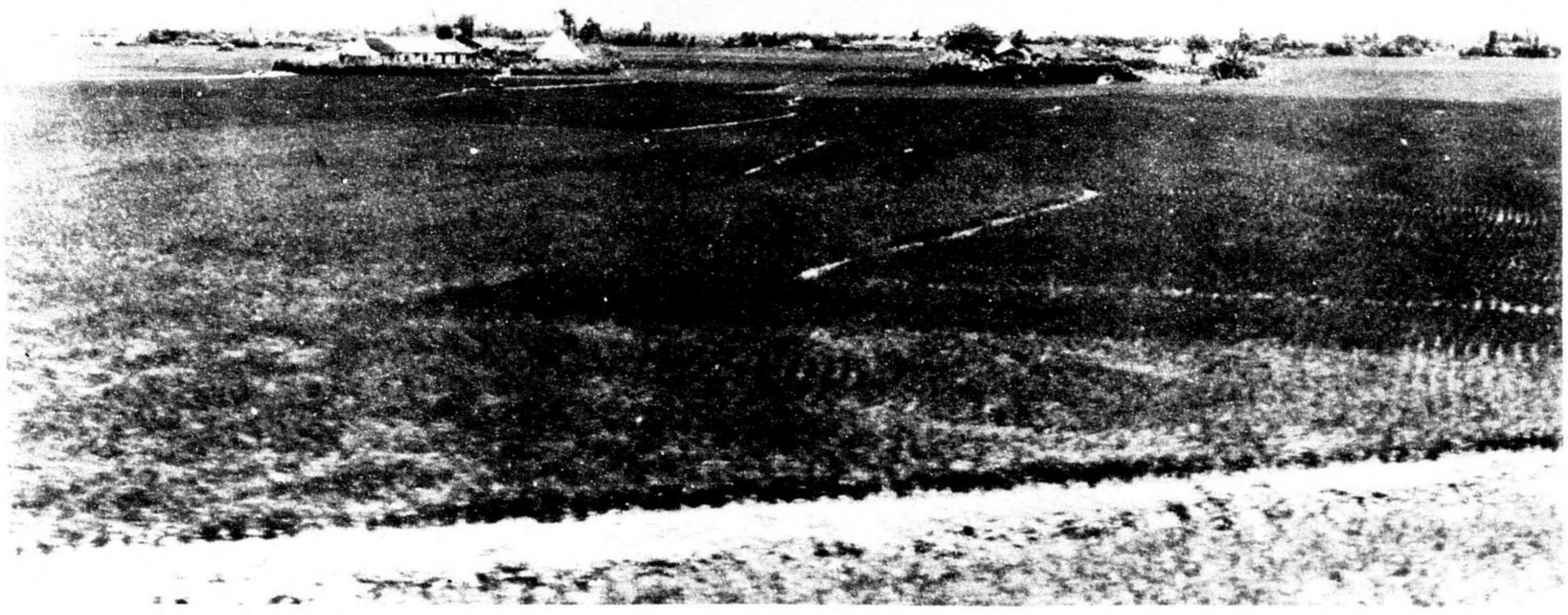


A.59. Taroko gorge: the river bed.

A.60. Valley of the upper Dakusui (Giran) river near Shikkikun shrine.

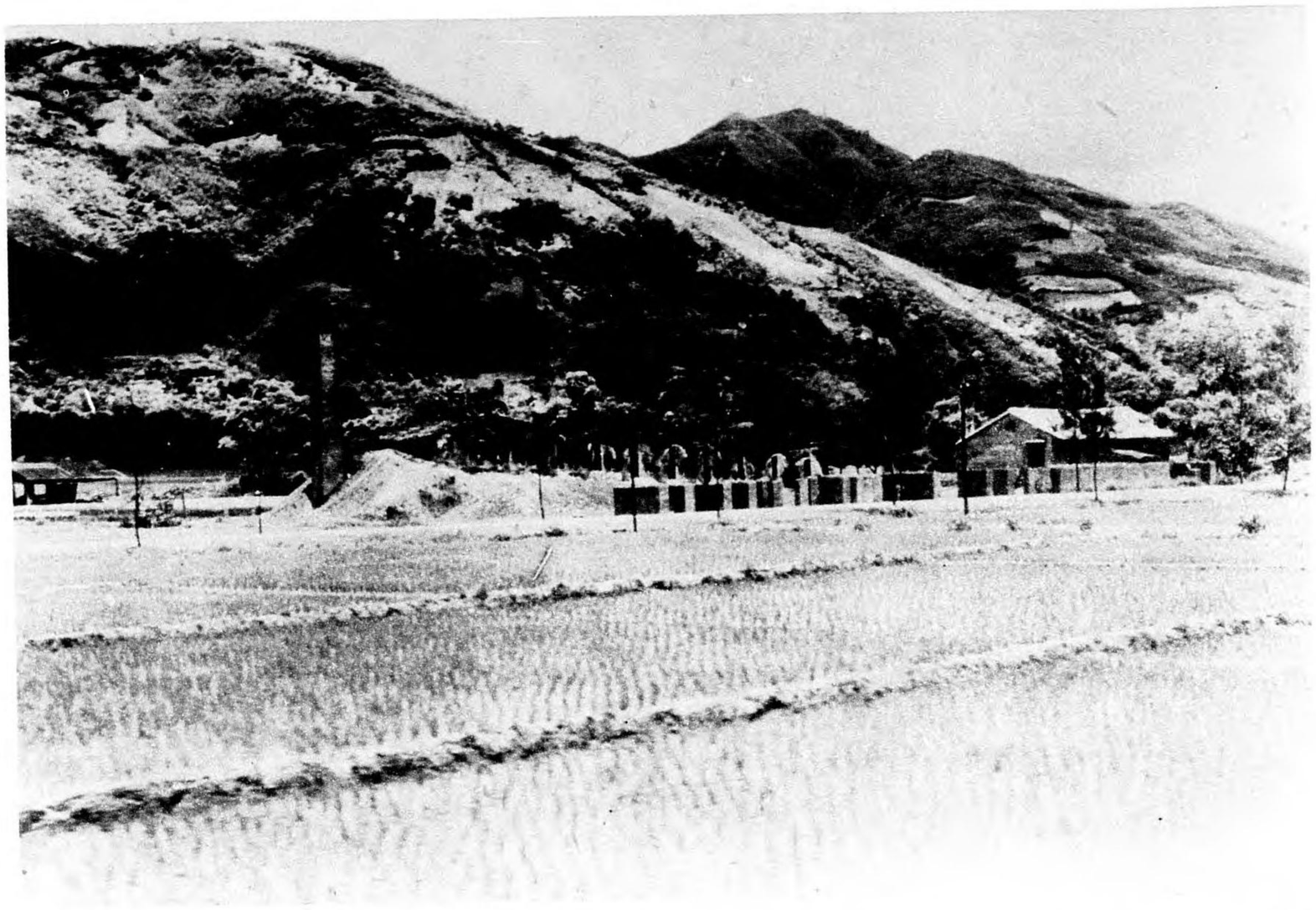


A.61. Right bank of Dakusui (Giran) river near its mouth.



A.62. Paddy fields and farms of Giran plain.

877(Q) F/383

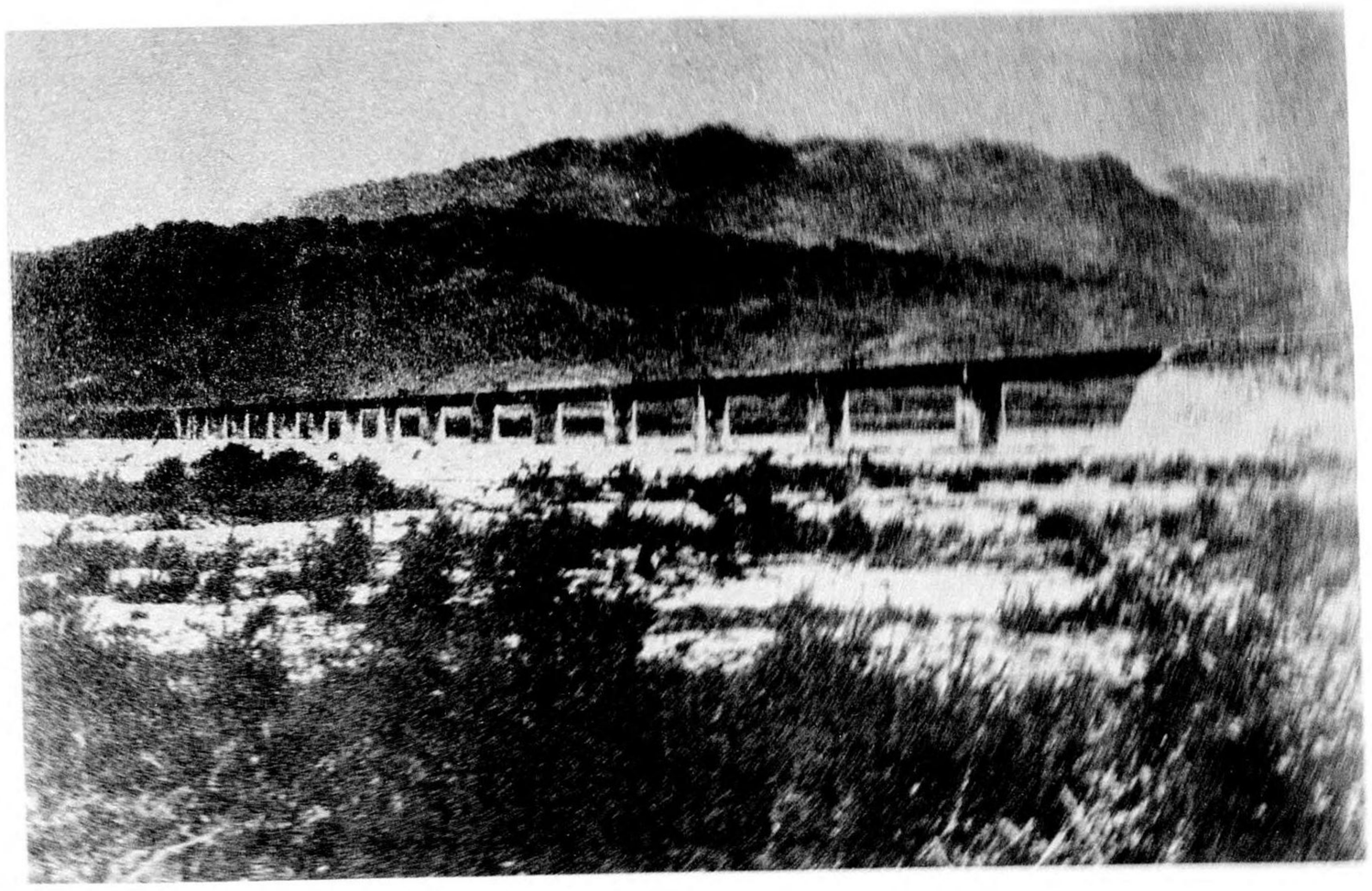


A.63. Sudden transition from Giran plain to upland; probably near Shokei.

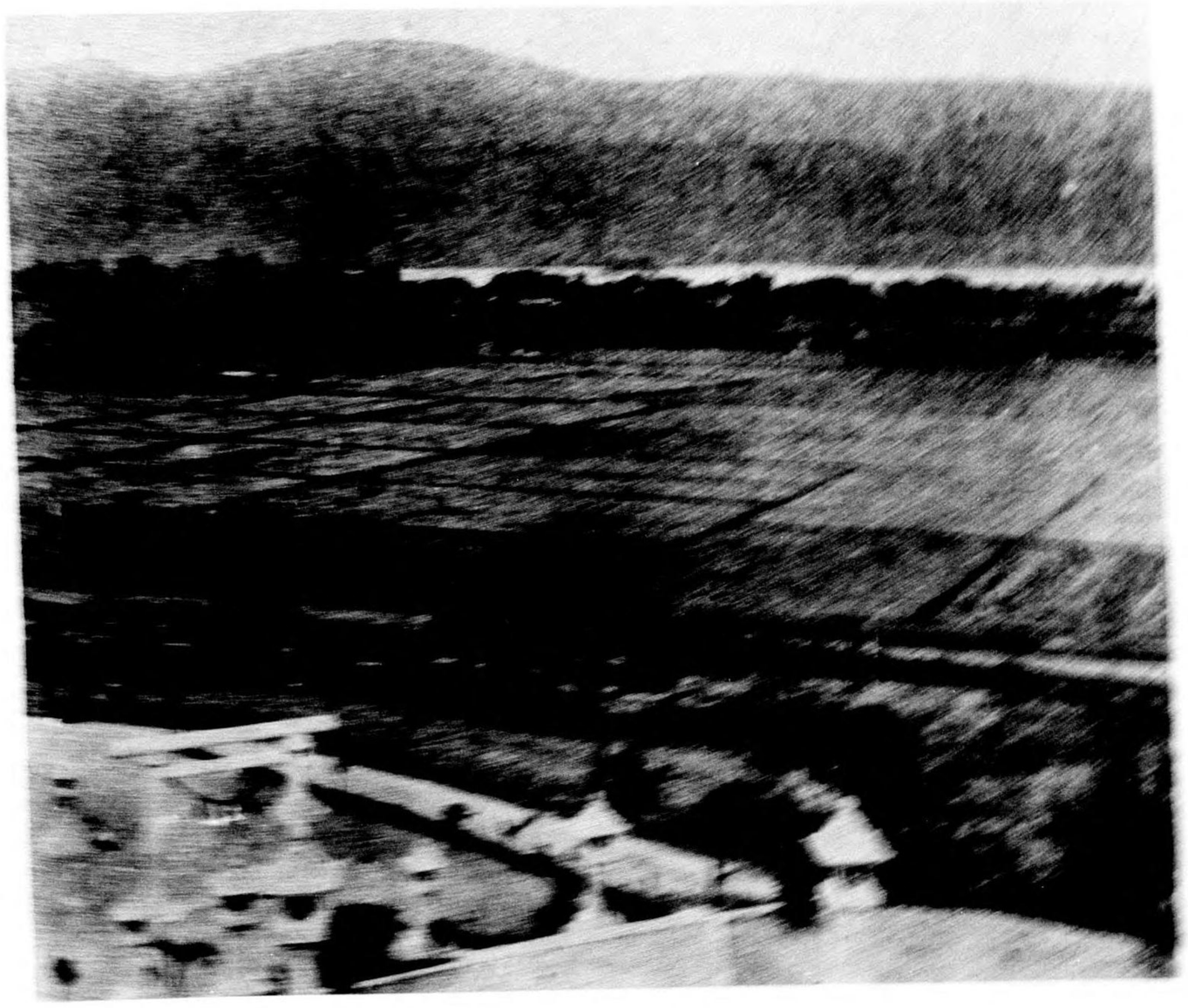
A.64. The Karenko plain.

A.65. Fields near Yoshino on Karenko plain. (The crop shown is tobacco.)

877(Q) F/383

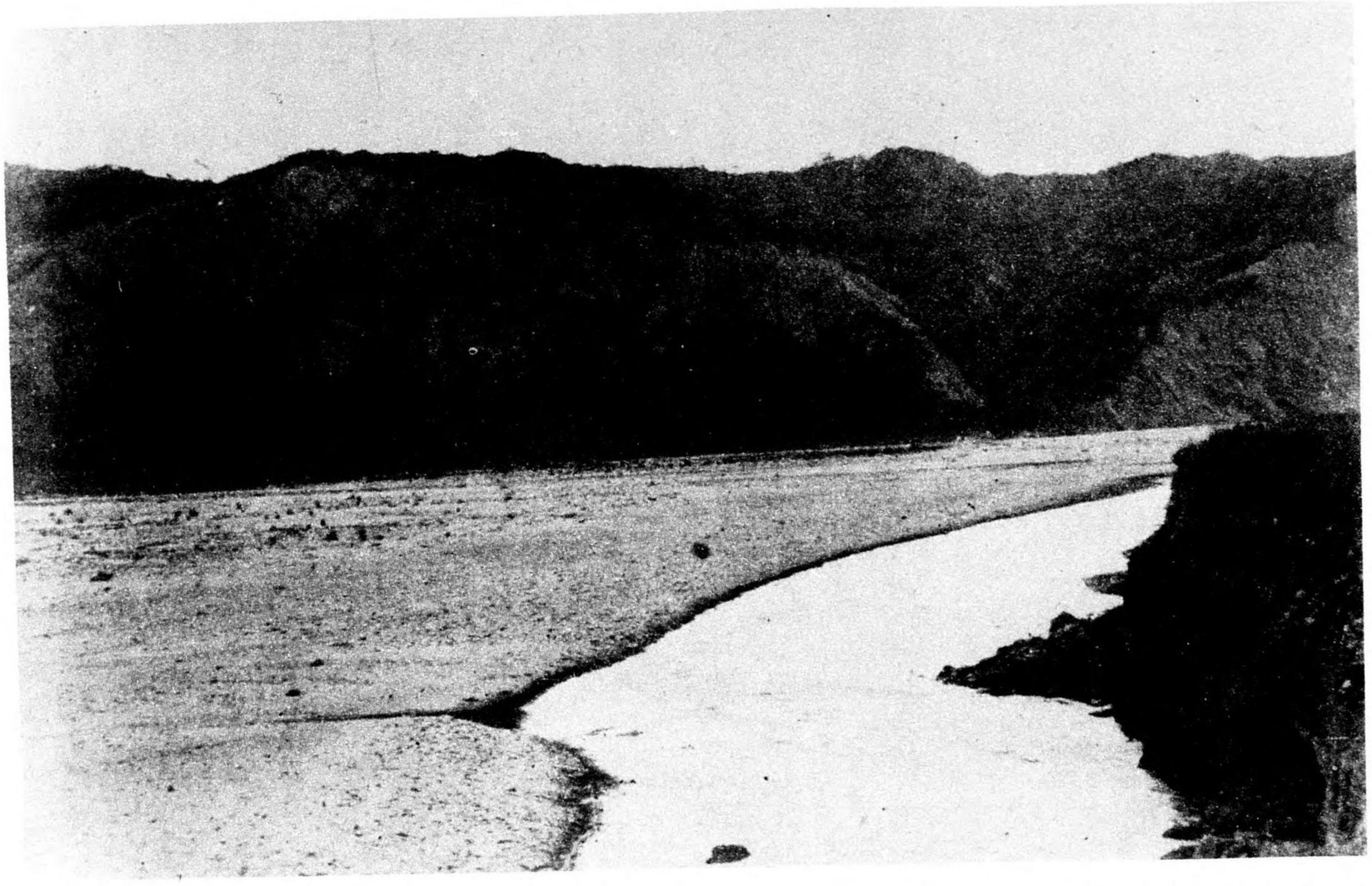


1.66. The [illegible] valley near [illegible].

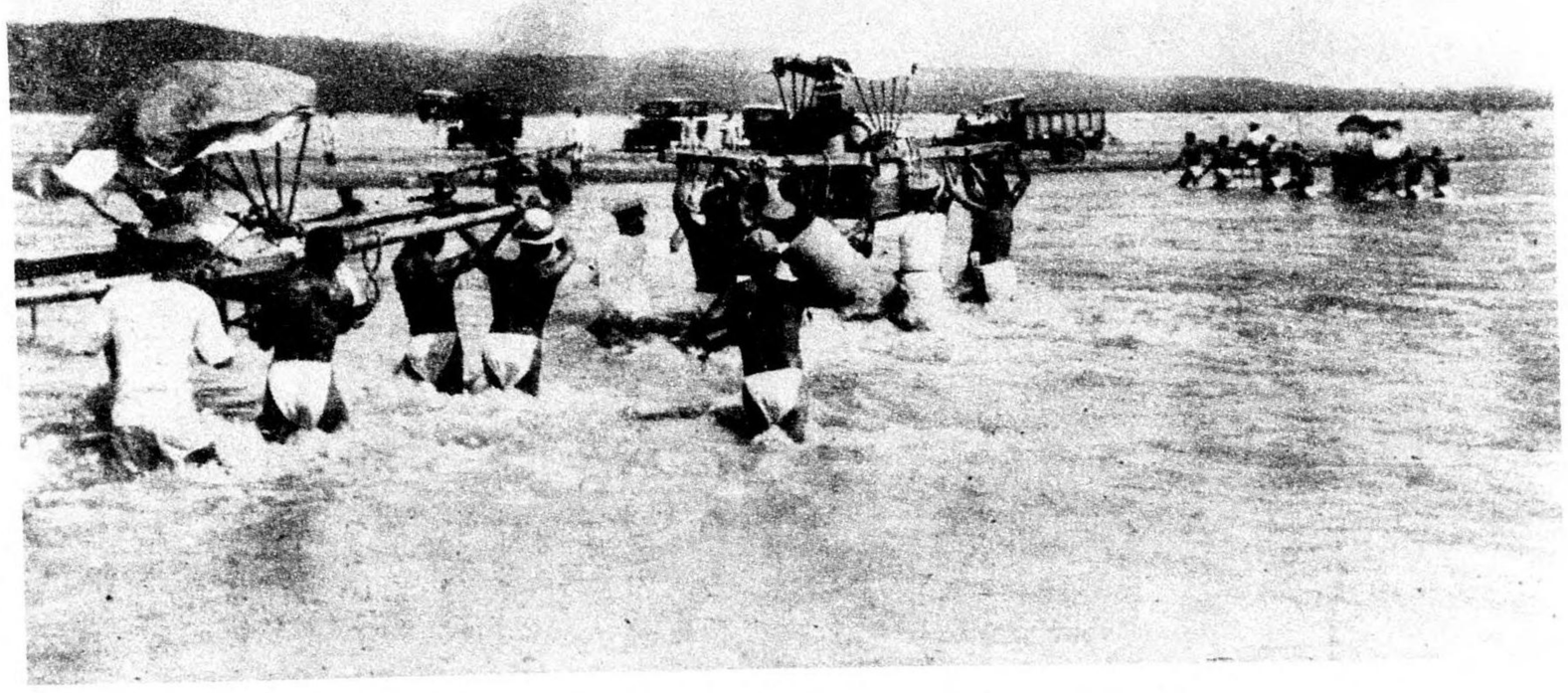


[illegible]

[illegible]

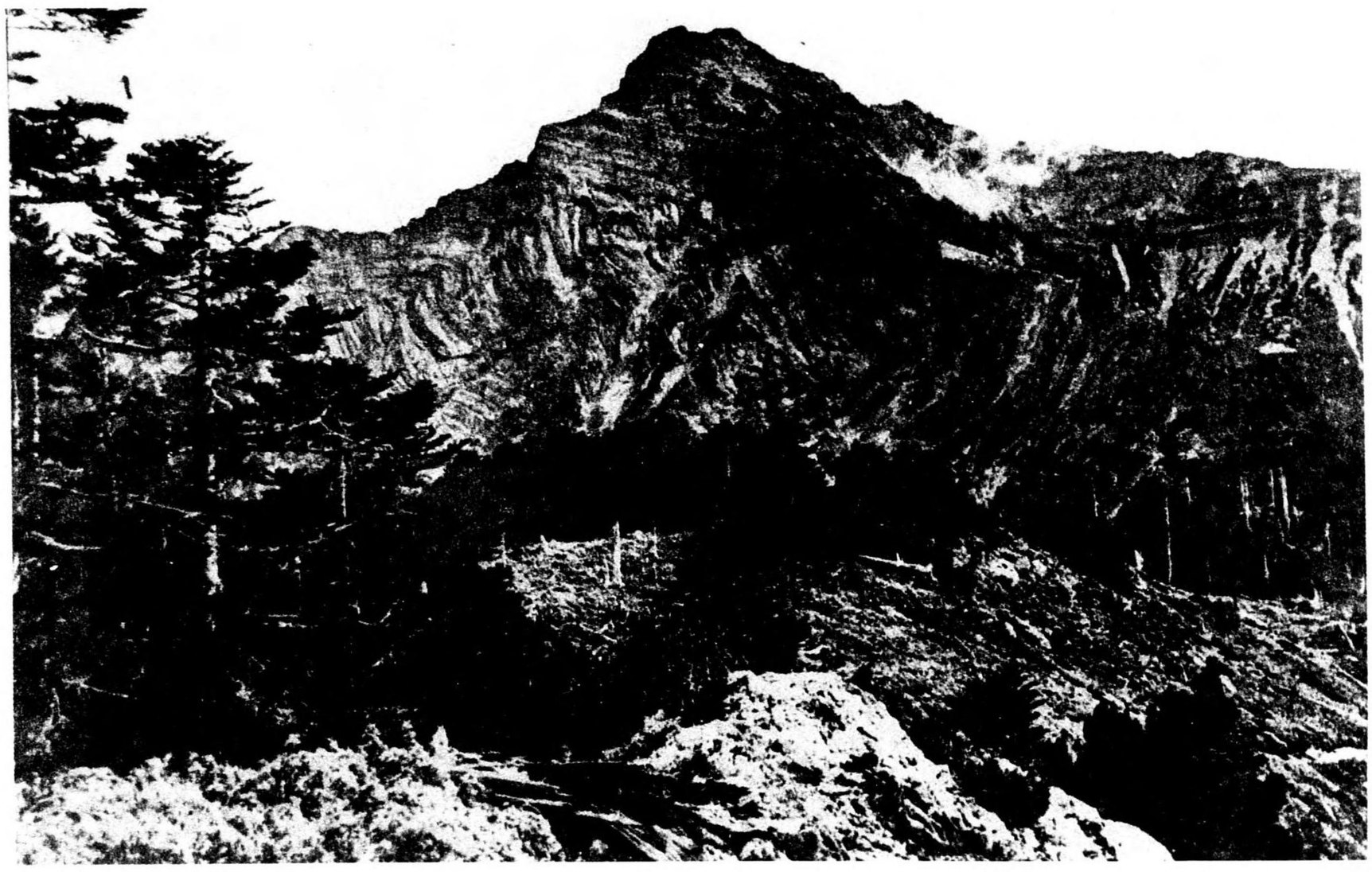


A.69. The river Pinan and rift valley side at northern end of Taito plain. Note recent terraces on right.

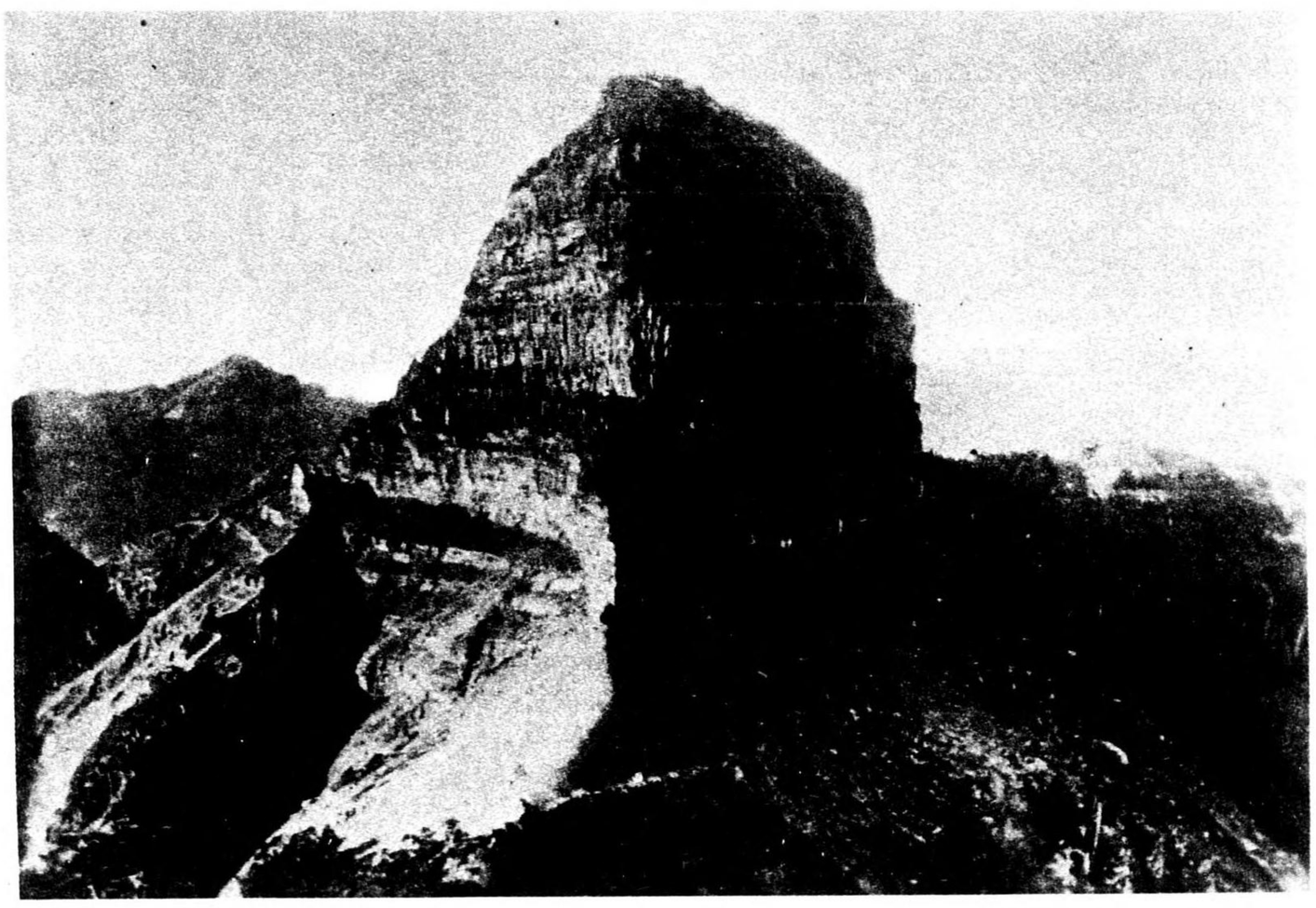


A.70. The river Pinan near its mouth.

877(C) F/383



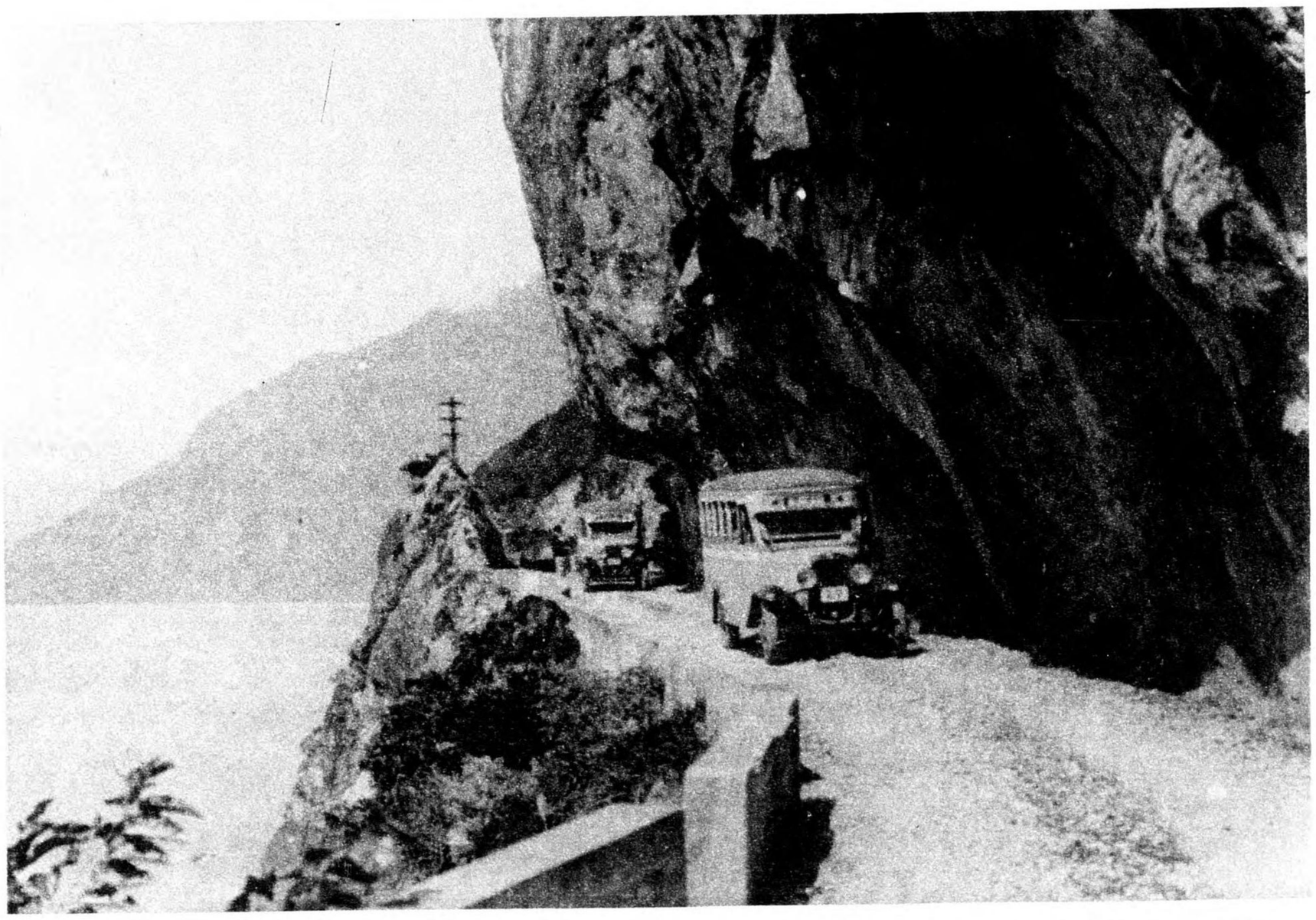
A.71. Mt. Morrison. Contorted clay-slate series.



A.72. Mt. Daihasen. Flat-lying rocks of the clay-slate series.

877(Q) F/383

A.73. Suo - Karenko road. Steeply inclined schists.



A.74. East coast road, probably near Gukutsu. Massive rocks of the schist series.

877(C) F/383

A.75. Taroka gorge (about 15 miles north-west of Karenko). Contorted schists.

A.76. Rakurakiu waterfall near Karenko. Steeply inclined bed (quartzite ?) in clay-slate series.

A.77. Mountain stream near Piyahausia (about 25 miles south-west of Suo). Clay-slate series.

A.78. Hokuto. Sulphur mine in region of volcanic rocks.

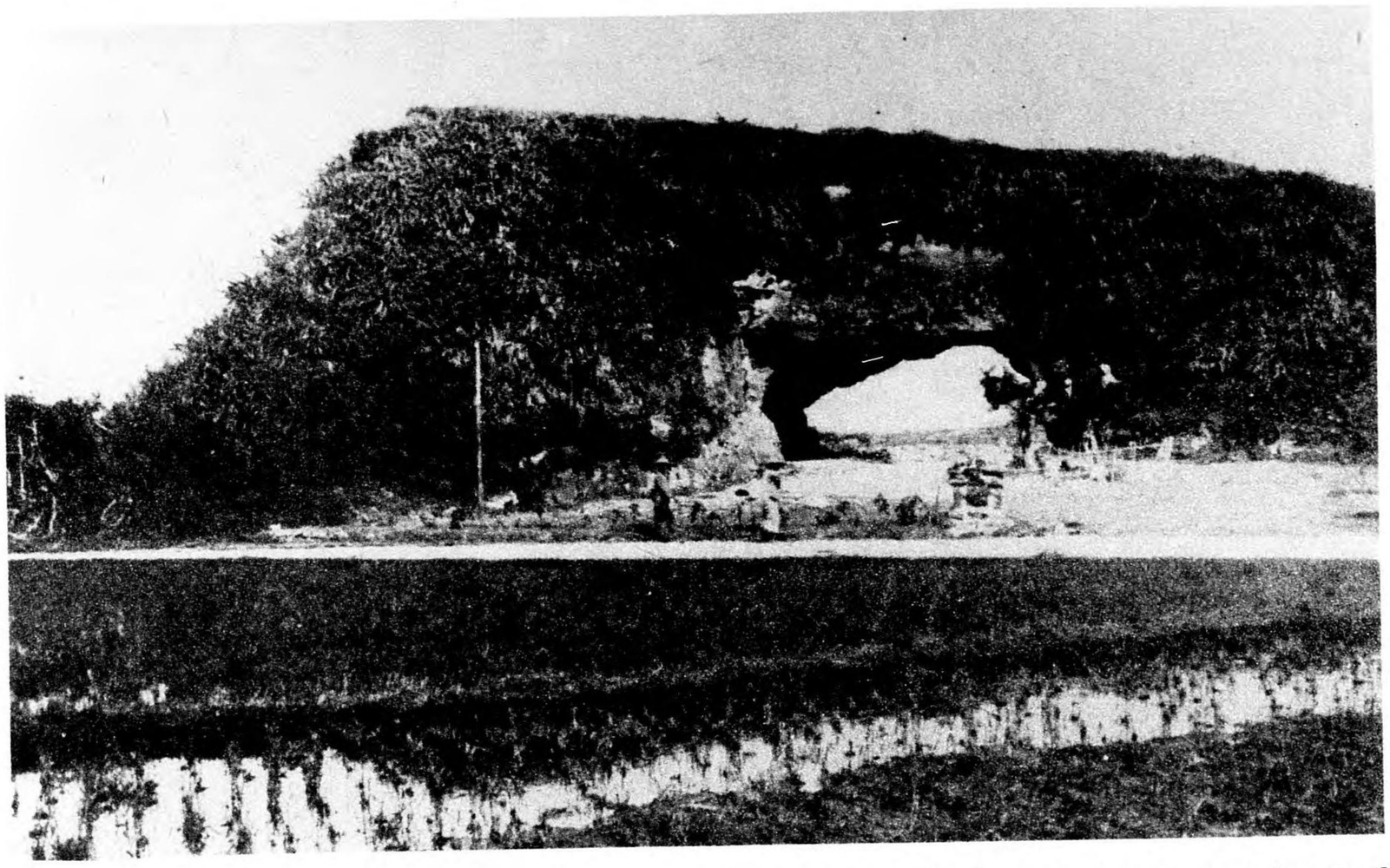
877(C) F/383

A.79. Hodai-Yama, Takao. Cliff of coral limestone.

A.80. Cape Garambi. Coral limestone cliff; raised coral beach in foreground.

A.81. Kasho island, north tip. Raised coral beach.

877(Q) F/383

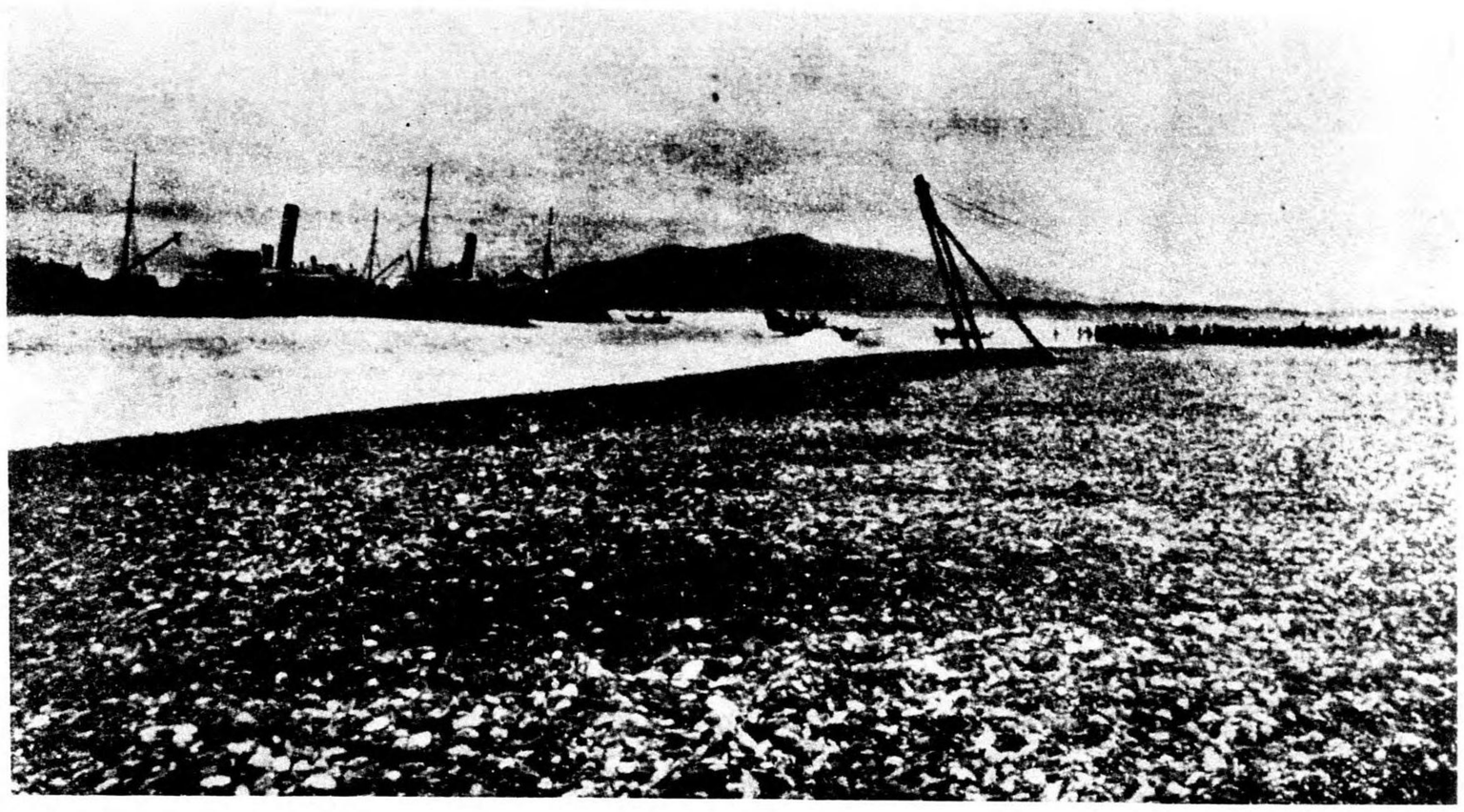


A.82. Sekimon (about 20 miles north of Karenko). Raised coral reef.

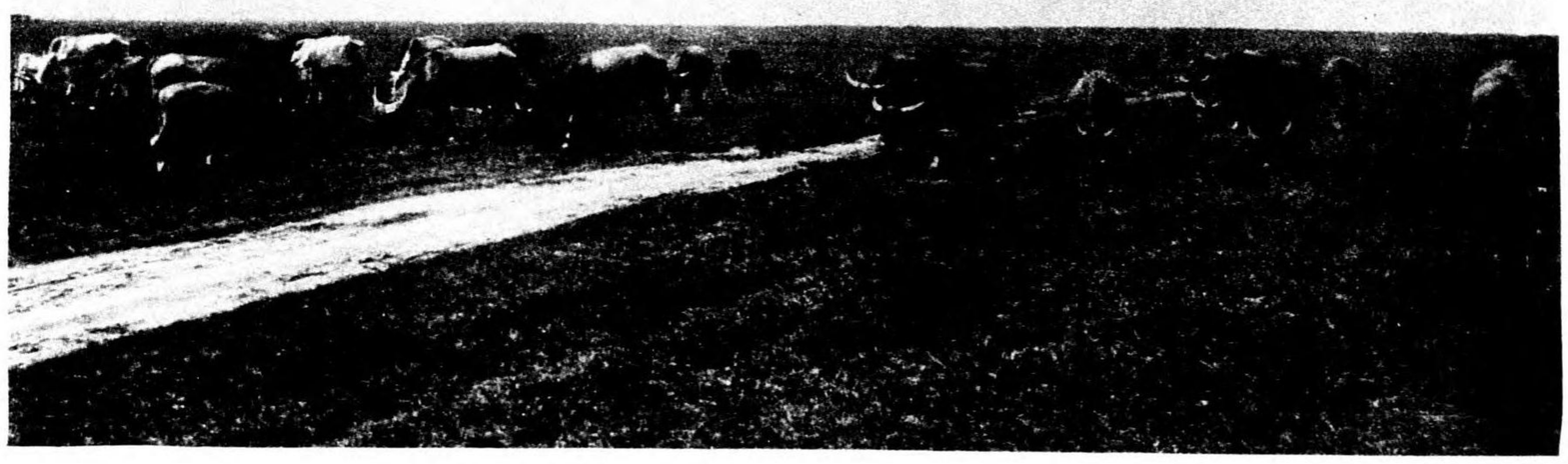
A.83. Near Suiseisi (Taichu). Old gravel terrace deposit overlying beds of the Young Sediments.

A.84. Tansui river near Taihoku. Rocks to right of river are Young Sediments, hills probably the same. Note coarse nature of river gravels.

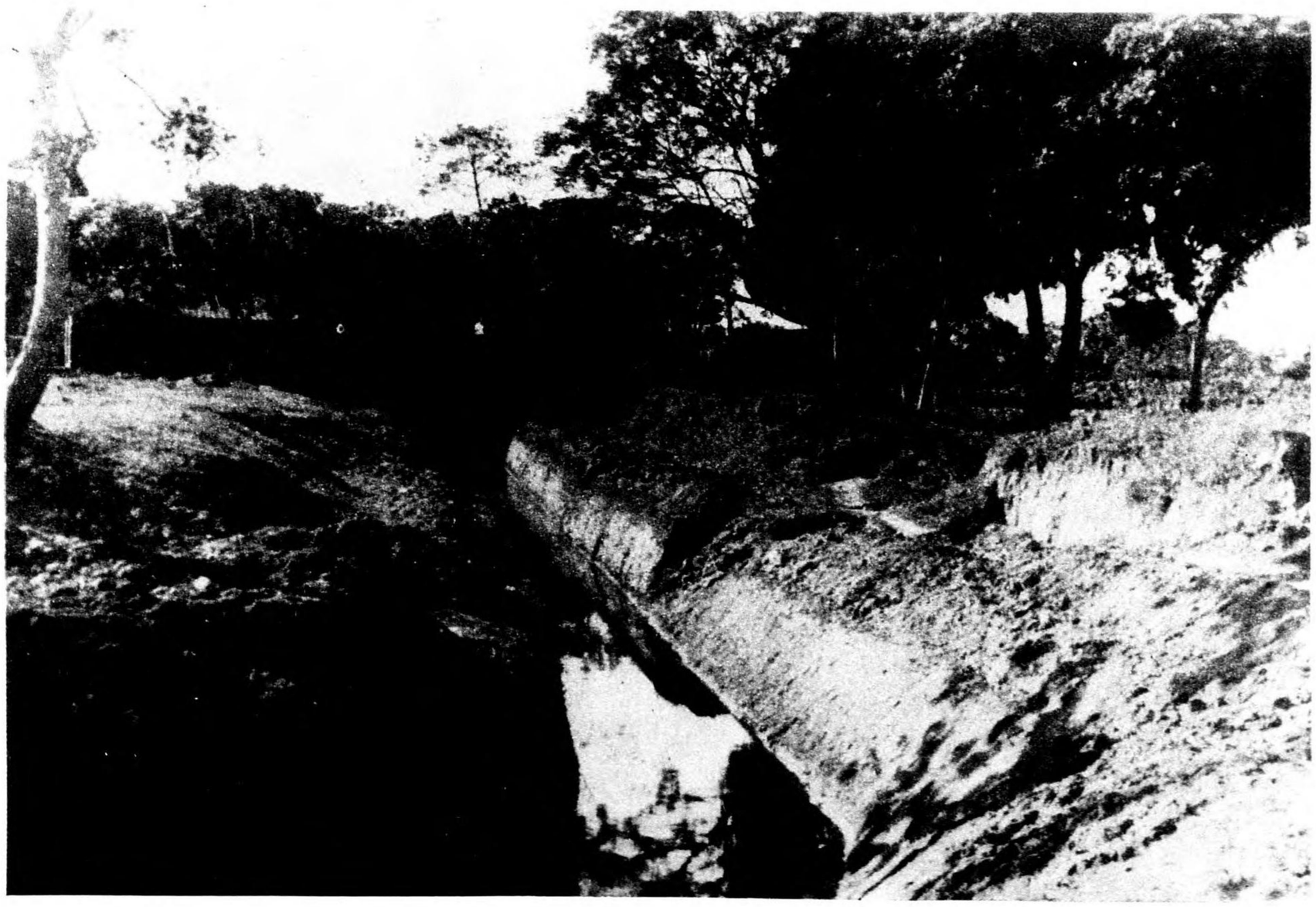
877(C) F/383



A.85. Karenko. Gravel beach. Note deep water close off-shore.



A.86. Plain near Karenko (Kareian plain). Flat alluvial plain.



A.87. Near Hozan. An irrigation ditch cut through alluvium.

877(G) F/383

A.88. Typical paddy fields with irrigation ditches near Taihoku.

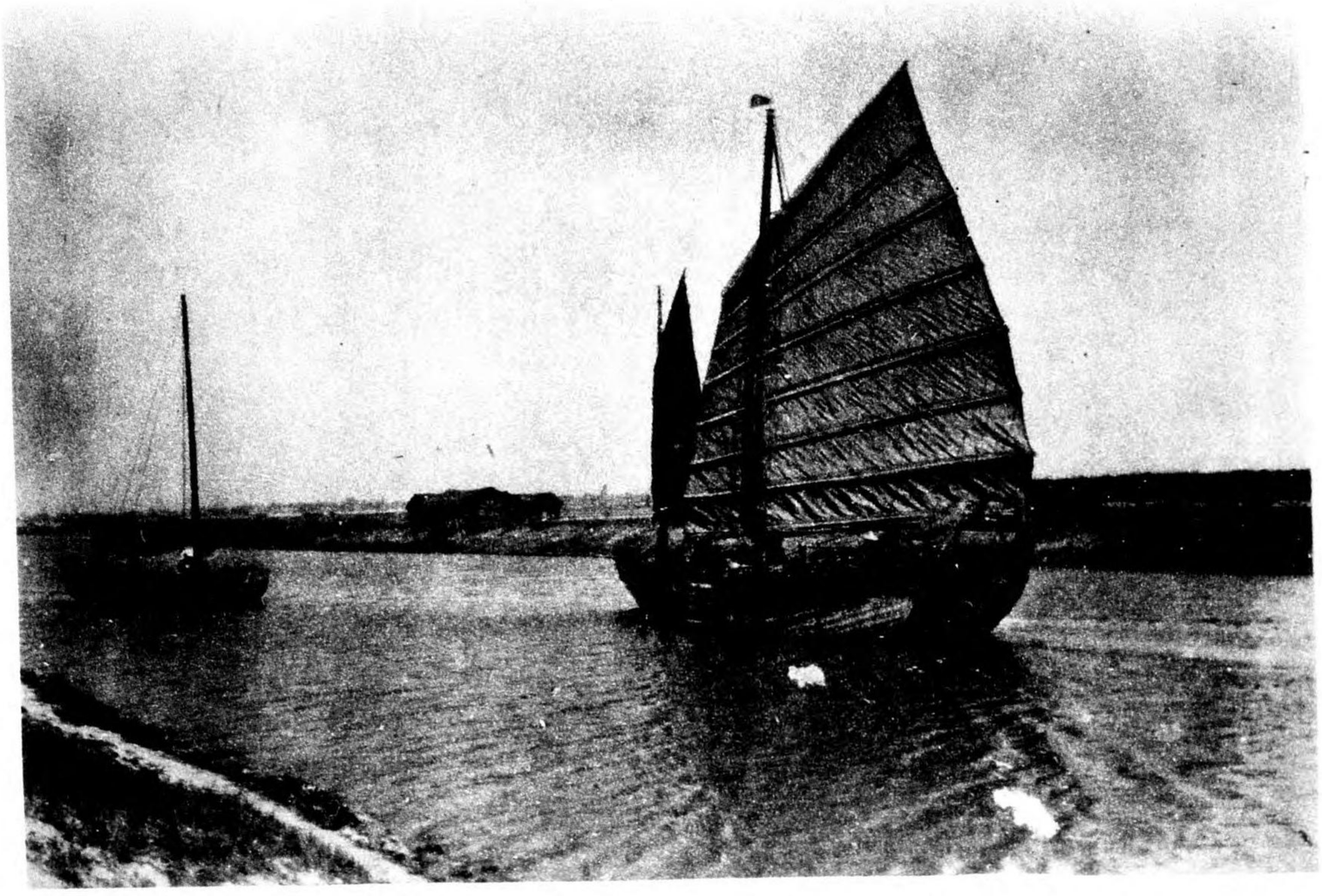
A.89. Close up of paddy field showing bund and waterlogged top soil.

A.90. Typical Formosan farmhouse. Above the dwelling is a betel nut palm, a papaya tree, and banana foliage.

877(Q) F/383

A.91. A banana plantation.

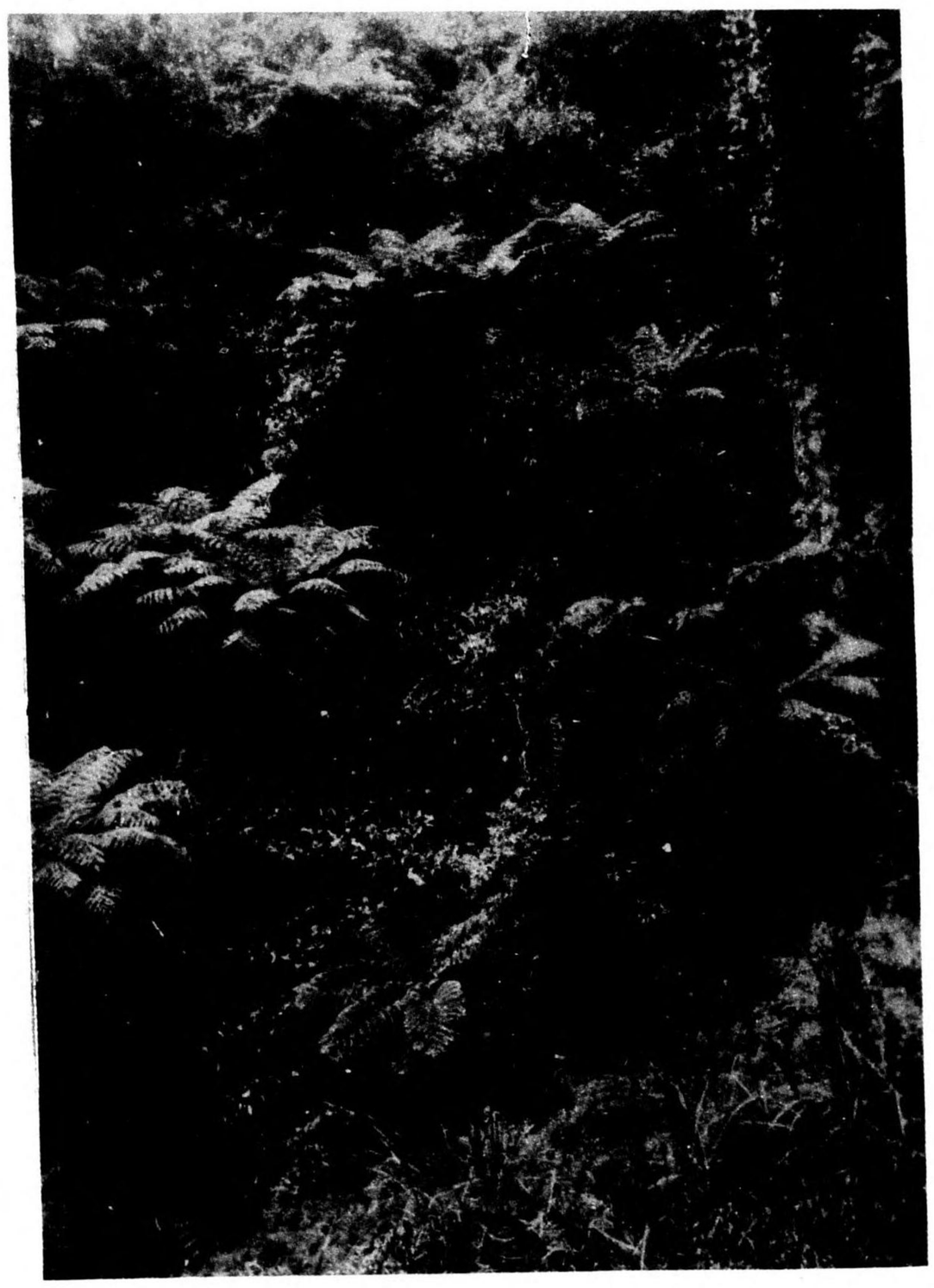
A.92. Sugar field at ploughing stage.



A.93. Tainan - Anpin canal.

877(G) F/383

A.94. Cleared patches of 'savage' agriculture. Terracing by stone walls. Probably near Noko pass.



A.95. Tree fern vegetation on lower western slopes of mountains.

877(C) F/383

LIBRARY

I.S.T.D. REPORTS ON FORMOSA

These reports are preliminary editions of the various parts of B.R. 877 Q, the I.S.I.S. report on Formosa. The list which follows is the list of plans for B.R. 877 Q and shows in which I.S.T.D. report advance copies of these plans are to be found.

LIST OF PLANS

Plan No.	*Title*	*Date*	*Contained in I.S.T.D. Report*
1	General	*April* 1944	F/383
2	Geology	*April* 1944	F/383
3	Airfield Suitability	*April* 1944	F/384
4	Resources	*April* 1944	F/386
5	Key to Coast and Port Plans	*April* 1944	F/386
6	Garan Bi to the Nisoko Kei: Beaches and Landing-places	*April* 1944	F/386
7	The Nisoko Kei to Koryu Road: Beaches and Landing-places	*April* 1944	F/386
8	Koryu Road to Suo Wan: Beaches and Landing-places	*April* 1944	F/386
9	Karenko to Sancho Kaku: Beaches and Landing-places	*April* 1944	F/386
10	Garan Bi to Taito Hakuchi: Beaches and Landing-places	*April* 1944	F/385
11	Key to Roads	*April* 1944	F/385
12	South Coast: Hakikaku	*April* 1944	F/385
13	West Coast: Tainan	*April* 1944	F/385
14	West Coast: Kagi	*April* 1944	F/385
15	West Coast: Taichu	*April* 1944	F/385
16	North Coast: Taihoku	*April* 1944	F/385
17	East Coast: Giran	*April* 1944	F/385
18	East Coast: Karenko	*April* 1944	F/385
19	East Coast: Koto Sho	*December* 1943	F/387
20A	Takao: Mosaic	*January* 1944	F/387
21A	Toshien: Mosaic	*April* 1944	F/387
23	Tansui: Port	*April* 1944	F/387
24	Kiirun: Port	*November* 1943	F/387
25A	Suo: Mosaic	*April* 1944	F/387
26	Karenko: Port and Town	*January* 1944	F/387
27A	Heito: Mosaic	*January* 1944	F/387
28A	Tainan: Mosaic	*January* 1944	F/387
29A	Kagi: Mosaic	*January* 1944	F/387
30A	Taichu: Mosaic	*November* 1943	F/387
31A	Shinchiku: Mosaic	*April* 1944	F/387
32	Taihoku: Town	*April* 1944	F/385
33	Submarine Cables: Tansui Ko	*April* 1944	F/385
34	Submarine Cables: Pescadores Channel	*November* 1942	F/385
35	Kato: Seaplane base		
36-40	Not issued		
41	Pescadores: Mosaic	*December* 1943	F/440
42	Pescadores: Topography	*June* 1944	F/440
43	Pescadores: Beaches and Landing-places	*May* 1944	F/440
44	Pescadores: Roads	*June* 1944	F/440

INTER-SERVICE TOPOGRAPHICAL DEPARTMENT

MAY 1944

B.R. 877 Q (RESTRICTED)

FIRST EDITION

FORMOSA
GEOLOGY

SIMPLIFIED FROM GOVERNMENT MAP 1926

SCALE 1:500 000

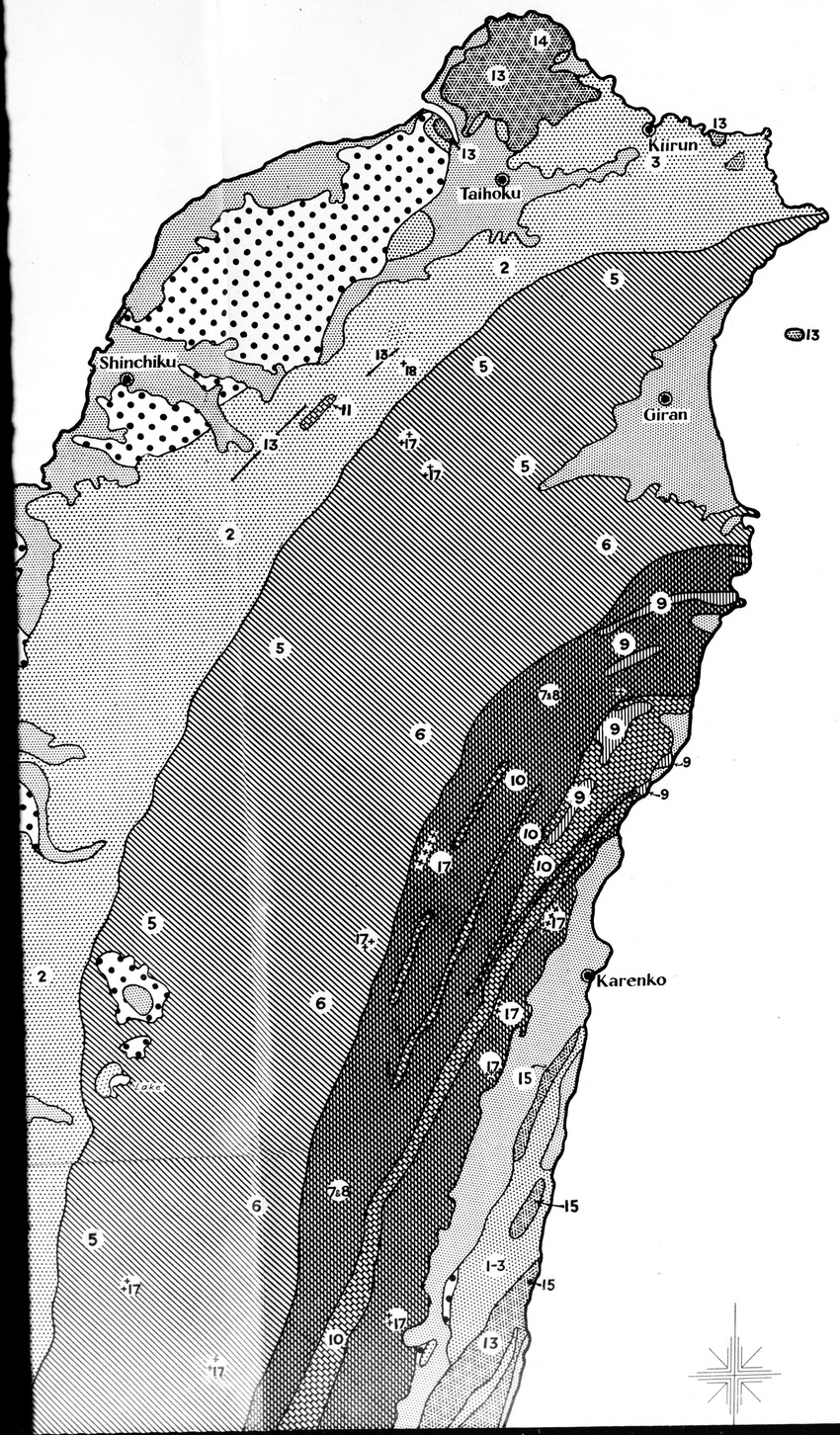
Miles 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

REFERENCE

SYMBOL	ROCK GROUP	GEOLOGICAL AGE	ROCK TYPES	PHYSICAL CHARACTERISTICS	STRU
	ALLUVIUM	RECENT	Unconsolidated sand, gravel clay and silt	Loose or plastic Generally grey	Flat – fans a
	OLD TERRACE	QUATERNARY	Poorly consolidated gravel with some sand and clay beds	Incoherent Grey, brown or yellow	Flat – l
	YOUNG SEDIMENTS	TERTIARY	1. Shale } Interbedded alternations 2. Sandstone } Interbedded alternations 3. Pebble-beds 11. Little limestone	Fine, soft Coarse, mediumly hard Very coarse, hard Fine, soft	Gently folded Some f
	CLAY-SLATES	TERTIARY (EOCENE) ?	UPPER – to west 5. Clay-slates and thin sandstone beds. LOWER – to east 6. Phyllite with quartzite & limestone beds.	Soft, black, laminated } Grey when weathered Harder, black, laminated } Grey when weathered	Folded Steeper
	SCHISTS	PRE-TERTIARY ?	7. Graphitic, chloritic & micaceous schists. 8. Quartzite and sandstone.	Black or dark, foliated, tough Grey, hard, banded	Much f Inclina
	GNEISSES	PRE-TERTIARY ?	9. Gneisses	Dark-coloured hard, foliated, granular rocks.	Folded Inclinat
	LIMESTONE	MANY AGES, MAINLY CONTEMPORANEOUS WITH THE SCHISTS	10. Crystalline limestone with the Schists. 11. Limestone interbedded with the Young Sediments.	Hard, grey, massive Fine and soft	Folded Inclinat Gently Unfol

FIRST EDITION APRIL 1944

2



FORMOSA
GEOLOGY

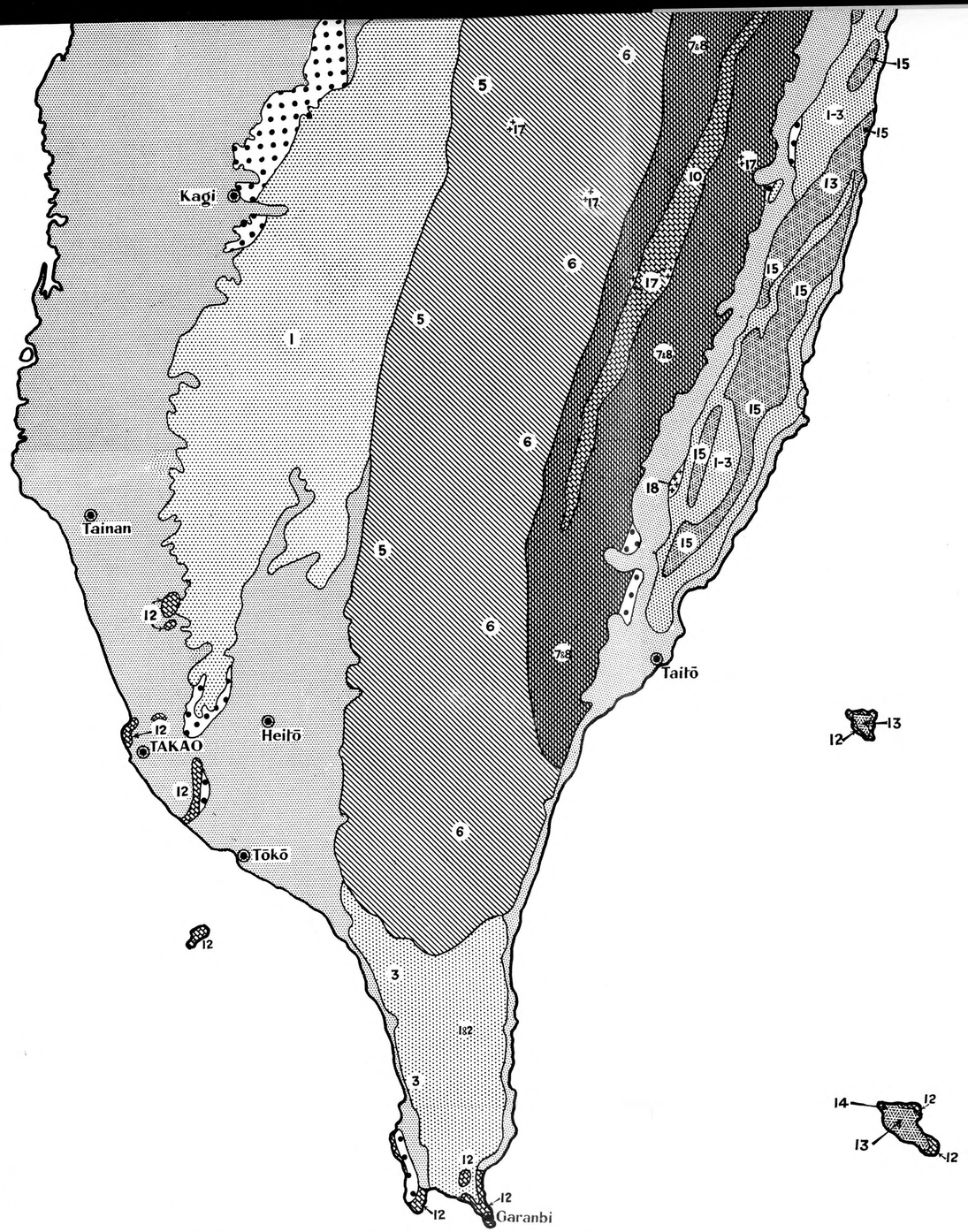
SIMPLIFIED FROM GOVERNMENT MAP 1926

SCALE 1:500 000

Miles 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 Miles

REFERENCE

SYMBOL	ROCK GROUP	GEOLOGICAL AGE	ROCK TYPES	PHYSICAL CHARACTERISTICS	STRUCTURE	DERIVED SOILS
	ALLUVIUM	RECENT	Unconsolidated sand, gravel clay and silt	Loose or plastic Generally grey	Flat-lying beds, fans and lenses.	Sands, Gravels, Clays and silts.
	OLD TERRACE	QUATERNARY	Poorly consolidated gravel with some sand and clay beds	Incoherent Grey, brown or yellow	Flat-lying beds.	Gravels, sands and loams – usually capped by lateritic earth.
	YOUNG SEDIMENTS	TERTIARY	1. Shale } Interbedded alternations 2. Sandstone } Interbedded alternations 3. Pebble-beds 11. Little limestone	Fine, soft Coarse, mediumly hard Very coarse, hard Fine, soft	Gently to moderately folded or inclined Some faulting.	Clay Sand Gravel Loam
	CLAY-SLATES	TERTIARY (EOCENE) ?	UPPER – to west 5. Clay-slates and thin sandstone beds. LOWER – to east 6. Phyllite with quartzite & limestone beds.	Soft, black, laminated } Grey when weathered Harder, black, laminated } Grey when weathered	Folded and Faulted Steeper inclination.	Clays and loams – with much rock rubble in highlands
	SCHISTS	PRE-TERTIARY?	7. Graphitic, chloritic & micaceous schists. 8. Quartzite and sandstone.	Black or dark, foliated, tough Grey, hard, banded	Much folded and faulted Inclinations steep.	Clayey loams. } All mixed with rock rubble Sands and sandy loams } All mixed with rock rubble
	GNEISSES	PRE-TERTIARY?	9. Gneisses	Dark-coloured hard, foliated, granular rocks.	Folded and much faulted Inclinations steep.	Loams – with rock rubble
	LIMESTONE	MANY AGES. MAINLY CONTEMPORANEOUS WITH THE SCHISTS	10. Crystalline limestone with the Schists. 11. Limestone interbedded with the Young Sediments. 12. Young coral limestone	Hard, grey, massive Fine and soft Open-textured and soft	Folded and much faulted Inclinations steep. Gently folded, interbedded. Unfolded.	Thin Loam Thin Loam Coral Sand



			6. *Phyllite with quartzite & limestone beds.*	*Harder, black, laminated* } *weathered*	
	SCHISTS	PRE-TERTIARY?	7. *Graphitic, chloritic & micaceous schists.*	*Black or dark, foliated, tough*	*Much fo Inclinat*
			8. *Quartzite and sandstone.*	*Grey, hard, banded*	
	GNEISSES	PRE-TERTIARY?	9. *Gneisses*	*Dark - coloured hard, foliated, granular rocks.*	*Folded a Inclinatio*
	LIMESTONE	MANY AGES, MAINLY CONTEMPORANEOUS WITH THE SCHISTS	10. *Crystalline limestone with the Schists.*	*Hard, grey, massive*	*Folded a Inclinatio*
			11. *Limestone interbedded with the Young Sediments.*	*Fine and soft*	*Gently fo*
			12. *Young coral limestone*	*Open-textured and soft*	*Unfolde*
	VOLCANIC ROCKS	TERTIARY?	13. *Lavas*	*Dark, hard, fine-grained*	*Gently to or inclin*
			14. *Volcanic Ash*	*Dark, mediumly hard, fine-grained*	*Often int*
			15. *Agglomerate*	*Dark, hard, aggregate of angular fragments in ashy matrix*	*Young Sed*
+ + + + + + + +	BASIC IGNEOUS ROCKS	?	16. *Diorite*	*Dark, hard, coarse - grained*	*Massive, n*
			17. *Diabase*	*Dark, hard, fine - grained*	*Usually*
			18. *Serpentine*	*Dark green, mediumly hard & massive*	*Massive,*

SOURCES

PERMEABILITY

Highly permeable.....sand and gravel beds of alluvium and old terrace deposits.

Permeable.....**2; 3; 5** (sandstone only)

Permeable in places.....**6** (limestone only); **10 – 15**

Almost impermeable.....**1; 5; 6; 7; 8; 9; 16; 17; 18**

SUITABILITY OF MATERIALS

FOR ROAD METAL

Good.....**6** (quartzite & limestone only); **8–10; 13–17**

Fair.....gravel of alluvium and old terrace deposits. **2 : 3 : 11 : 12**

For Natural Concrete Aggregate.....sand and gravel of alluvium and old terrace deposits

NOTE

NUMBERS **1–18** INDICATE PREDOMINANT ROCKS

Geographical Section, General Staff. (Misc.) Nº 125.
Published by War Office, 1944

Compi
Photo

			6. Phyllite with quartzite & limestone beds.	Harder, black, laminated } weathered		rubble in highlands
	SCHISTS	PRE-TERTIARY?	7. Graphitic, chloritic & micaceous schists.	Black or dark, foliated, tough	Much folded and faulted Inclinations steep.	Clayey loams. } All mixed with rock rubble
			8. Quartzite and sandstone.	Grey, hard, banded		Sands and sandy loams } All mixed with rock rubble
	GNEISSES	PRE-TERTIARY?	9. Gneisses	Dark - coloured hard, foliated, granular rocks.	Folded and much faulted Inclinations steep.	Loams - with rock rubble
	LIMESTONE	MANY AGES, MAINLY CONTEMPORANEOUS WITH THE SCHISTS	10. Crystalline limestone with the Schists.	Hard, grey, massive	Folded and much faulted Inclinations steep.	Thin Loam
			11. Limestone interbedded with the Young Sediments.	Fine and soft	Gently folded, interbedded.	Thin Loam
			12. Young coral limestone	Open-textured and soft	Unfolded.	Coral Sand
	VOLCANIC ROCKS	TERTIARY?	13. Lavas	Dark, hard, fine-grained	Gently to moderately folded or inclined, little faulted. Often interbedded with Young Sediments as on W. coast.	Silty loams and fine clays.
			14. Volcanic Ash	Dark, mediumly hard, fine-grained		Silty loams and fine clays.
			15. Agglomerate	Dark, hard, aggregate of angular fragments in ashy matrix		Same with angular fragments and boulders
+ + + + + + + + + + + +	BASIC IGNEOUS ROCKS	?	16. Diorite	Dark, hard, coarse-grained	Massive, no stratification.	Loams
			17. Diabase	Dark, hard, fine-grained	Usually as dykes.	Loams
			18. Serpentine	Dark green, mediumly hard & massive	Massive, no stratification.	Loams

SOURCES

PERMEABILITY

Highly permeable.....sand and gravel beds of alluvium and old terrace deposits.

Permeable.....**2; 3; 5** (Sandstone only)

Permeable in places.....**6** (limestone only); **10 – 15**

Almost impermeable.....**1; 5; 6; 7; 8; 9; 16; 17; 18**

SUITABILITY OF MATERIALS

FOR ROAD METAL

Good.....**6** (quartzite & limestone only); **8–10; 13–17**

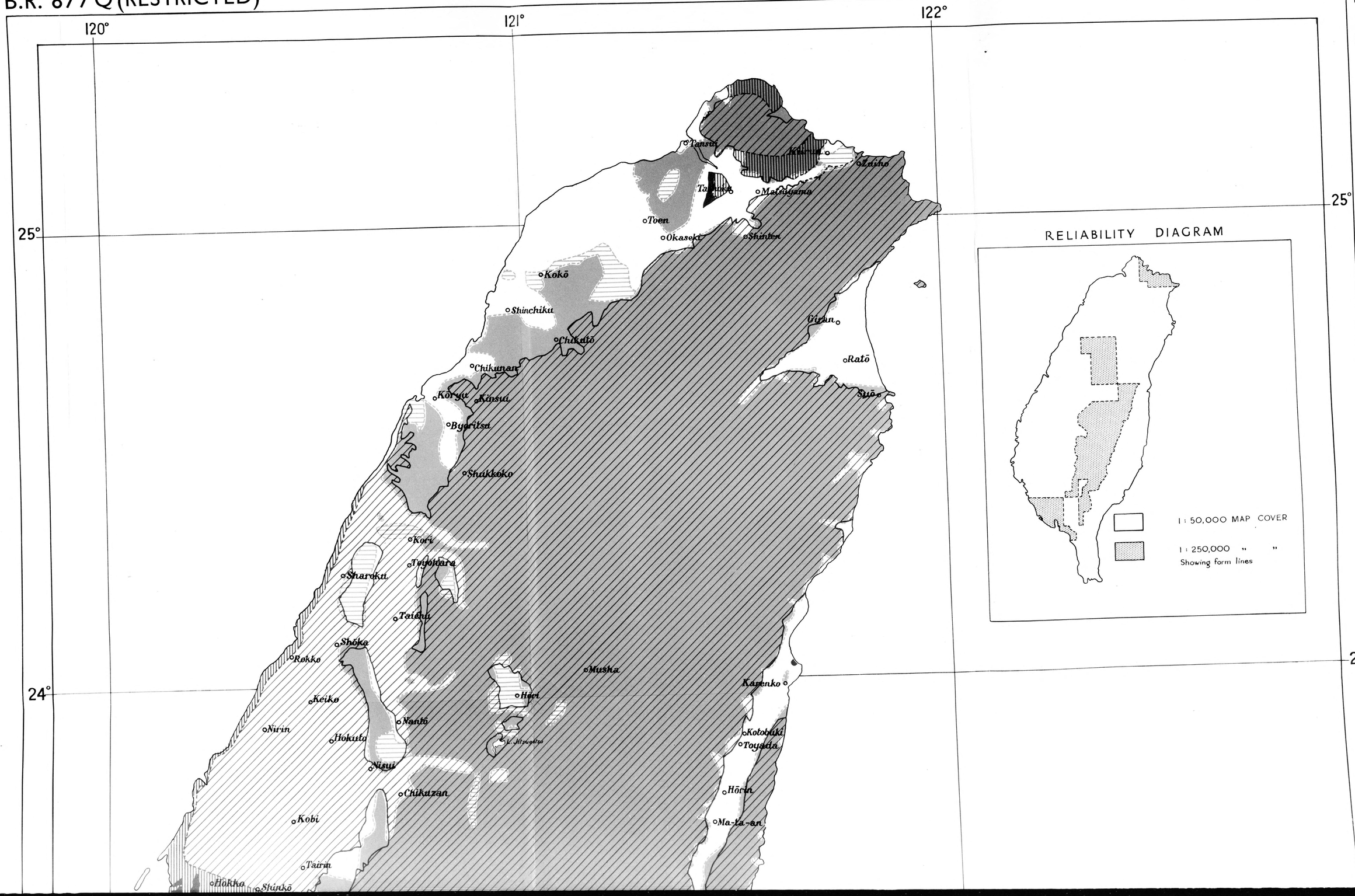
Fair.....gravel of alluvium and old terrace deposits. **2; 3; 11; 12**

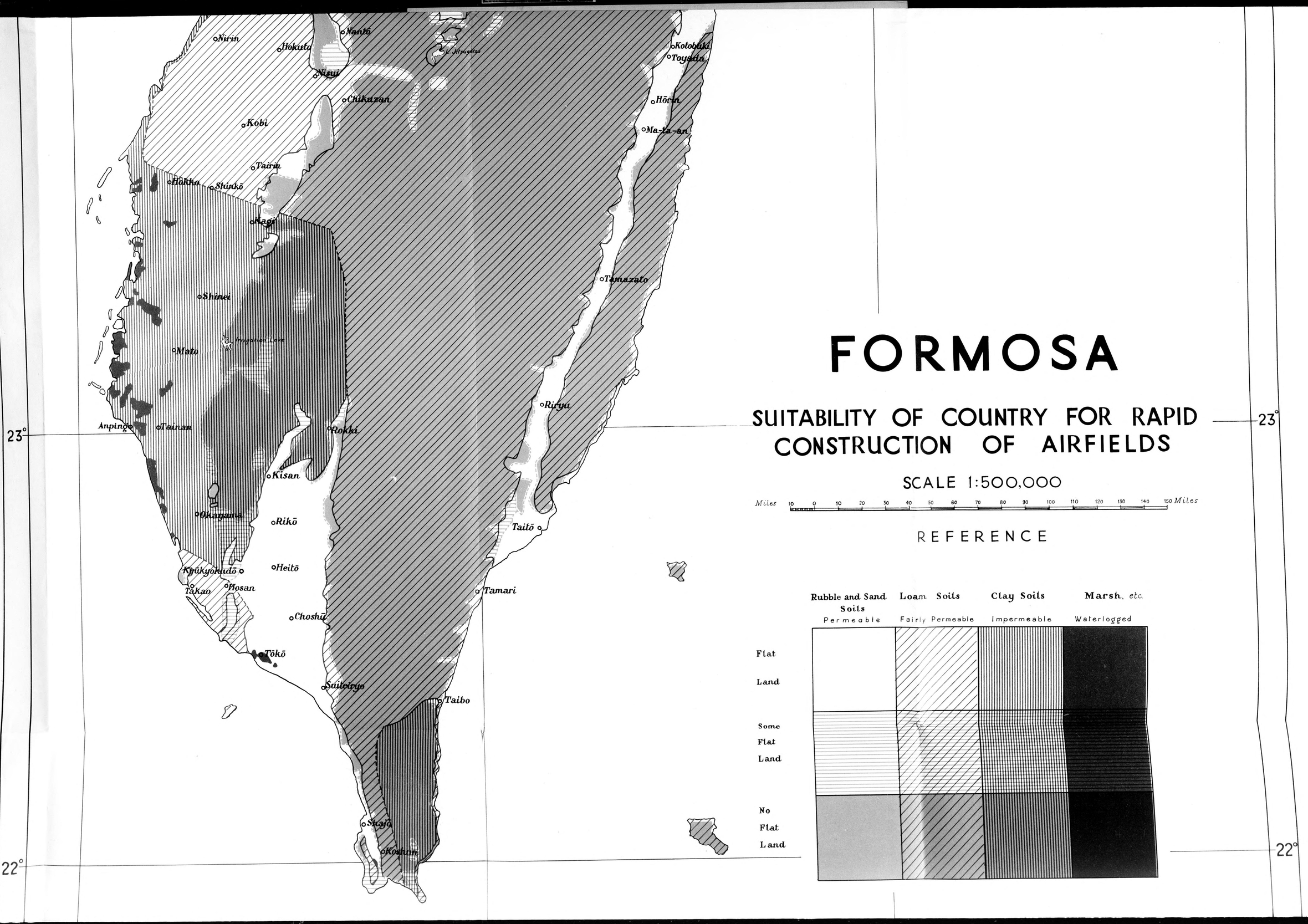
For Natural Concrete Aggregate.....sand and gravel of alluvium and old terrace deposits

NOTE

NUMBERS **1–18** INDICATE PREDOMINANT ROCKS

Compiled and drawn by I.S.T.D.
Photolithographed by the War Office, 1944.


120°
121°
122°
25°
24°
Tansui
Kōrin
Zaishō
Matsugama
Toen
Okaseki
Shinten
Kokō
Shinchiku
Chikutō
Chikunan
Girin
Ratō
Suō
Kōryū
Kūnsui
Byōritsu
Shukkoko
Kori
Teiyokara
Sharoku
Taichū
Shōka
Rokko
Musha
Kamenko
Keikō
Hori
Nantō
Nirin
Hokuto
L. Mizugatsu
Kotobuki
Toyada
Nisui
Chikuzan
Hōrin
Kobi
Ma-ta-an
Tairin
Hokka
Shinkō
RELIABILITY DIAGRAM
1 : 50,000 MAP COVER
1 : 250,000 " "
Showing form lines

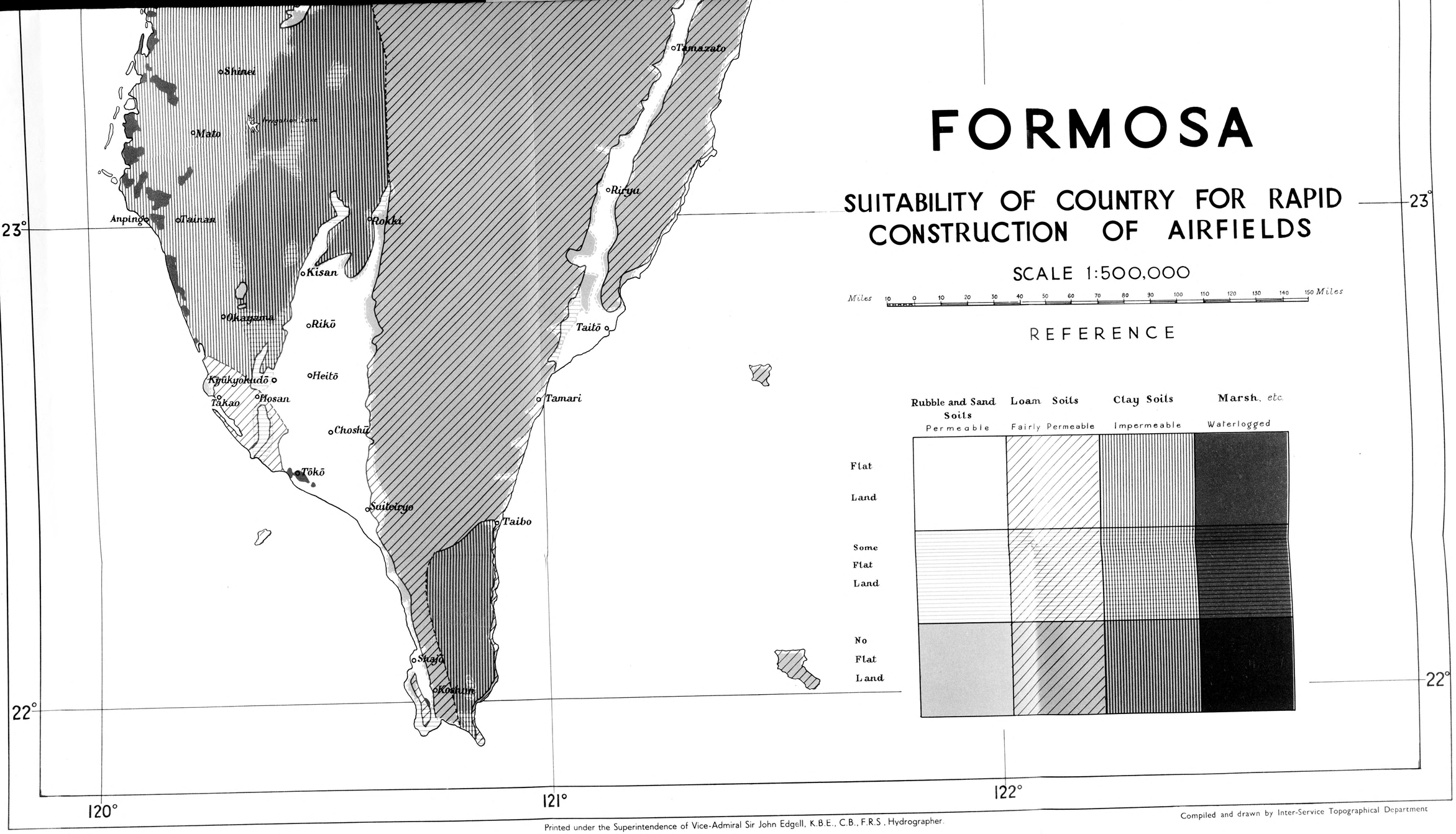

FORMOSA
SUITABILITY OF COUNTRY FOR RAPID CONSTRUCTION OF AIRFIELDS
SCALE 1:500,000
Miles 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 Miles
REFERENCE
Rubble and Sand Soils
Permeable
Loam Soils
Fairly Permeable
Clay Soils
Impermeable
Marsh, etc.
Waterlogged
Flat Land
Some Flat Land
No Flat Land
23°
22°
Nirin
Hokuto
Nantō
Nisui
Chikuzan
Kobi
Tairin
Hōkko
Shinkō
Kagi
Shinei
Mato
Irrigation Lake
Anpingo
Tainan
Rokka
Kisan
Okayama
Rikō
Heitō
Kyūkyokudō
Takao
Hosan
Choshū
Tōkō
Suiteiryo
Taibo
Skajō
Koshun
Kotobuki
Toyada
Hōrin
Ma-ta-an
Tamazato
Riryu
Taitō
Tamari

FORMOSA

SUITABILITY OF COUNTRY FOR RAPID CONSTRUCTION OF AIRFIELDS

SCALE 1:500,000

Miles 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 Miles



Printed under the Superintendence of Vice-Admiral Sir John Edgell, K.B.E., C.B., F.R.S., Hydrographer.

Compiled and drawn by Inter-Service Topographical Department