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UNCLASSIFIED

SPECIAL REPORT

●

STRATEGIC ENGINEERING STUDY
No. 104

SOELA
(MOLUKKAS ISLANDS)

●

TERRAIN INTELLIGENCE

●

~~CLASSIFICATION CHANGED TO Restricted~~
~~BY AUTHORITY OF OCF~~
~~F. Whitmore 9/11/45~~
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Prepared by
GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR
Under direction of
CHIEF OF ENGINEERS, U.S. ARMY

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MILITARY INTELLIGENCE DIVISION
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MARCH, 1944

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 201016
4-44 1944

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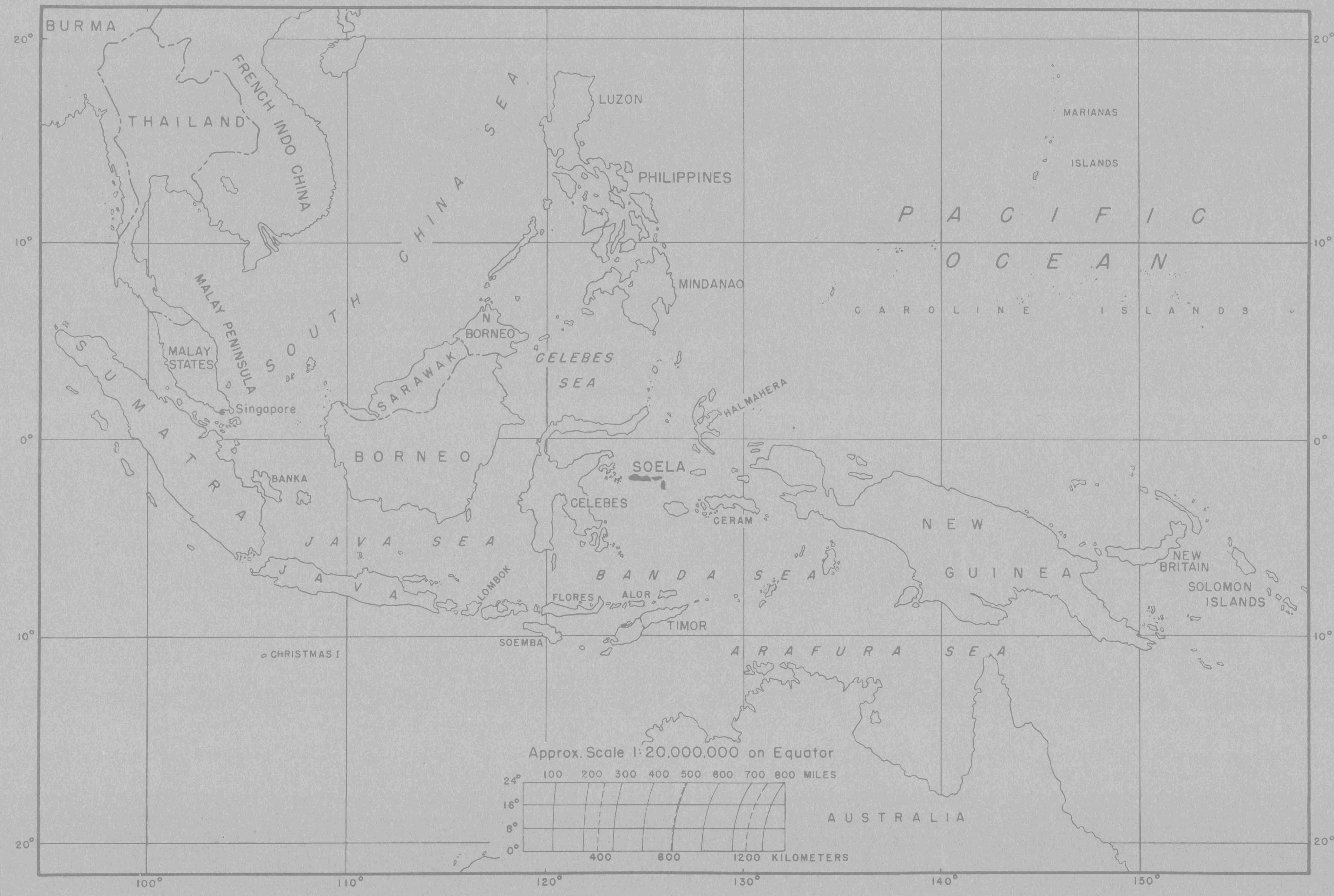

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Prepared by
SECTION OF MILITARY GEOLOGY
GEOLOGICAL SURVEY, U. S. DEPARTMENT OF THE INTERIOR
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STRATEGIC INTELLIGENCE BRANCH
MILITARY INTELLIGENCE DIVISION
OFFICE, CHIEF OF ENGINEERS
U. S. ARMY

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ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 201016
1944
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TABLE OF CONTENTS

Page

Military aspects of terrain i

Introduction 1

Sources of information 1

Terrain

- Terrain diagram 2

- Terrain appreciation

  - Map 4
  - Index to views 4
  - Table 5-6
  - Views 7-8

Water supply

- Map 10
- Table 11

Construction problems

- Construction materials

  - Map 14
  - Table 15

- Road and airfield construction

  - Map 18
  - Table 19-20

Climate

- Table and graphs 21

SOELA (MOLUKKAS)

MILITARY ASPECTS OF TERRAIN[a]

(A) Introduction

The Soela Islands, composed of three large mountainous islands and smaller satellite islands, are part of the Molukka Islands. They lie to the east of the Celebes, northwest of Boeroe and Ceram, and southwest of Halmahera. Two of the larger islands, Taliaboe and Soela-Mangoli, have an east-west trend and a total length of about 150 miles. They are separated by a narrow strait, in part less than half a mile wide. The third island, Soela-Sanana, has a north-south trend; it lies south of Soela-Mangoli, from which it is separated by a strait less than 5 miles wide. The islands have a central mountainous core surrounded by a narrow and discontinuous lowland.

All settlements are on the coastal lowlands; few contain more than scattered native huts. Sanana, the largest town, formerly had a population reported to be 3,000; may now be somewhat smaller. The total population of the islands is believed to be about 20,000 natives and 100 whites.

(B) Terrain

The three principal islands of the Soela group have been divided into 5 terrain units. Briefly, the salient strategic features of each terrain unit are:

(1) West Taliaboe: Mountainous, densely forested region with narrow, discontinuous, partly swampy coastal lowland. Mountainous interior relatively unknown. Movement is limited to narrow coastal lowlands. Penetration of mountainous interior by foot troops possible but difficult.

(2) East Taliaboe: Jungle-covered hill country of relatively low relief. Small areas of coastal lowland, in part swampy. Sandy beaches especially well developed along south coast. Dense jungle and lack of trails prevent easy movement away from coastal lowlands.

(3) West Soela-Mangoli: Low hill country, covered by dense jungle, in general similar to that of East Taliaboe. Movement difficult.

(4) East Soela-Mangoli: Mountainous region in east and west parts of island, separated by a central hill land. Mountains similar to those of East Taliaboe; hill land probably similar to that of East Taliaboe and West Soela-Mangoli. North coast may be generally cliffed. Central south coast is most favorable for movement; along sandy lowland, where trail is best, trail can be readily adapted to motorized movement.

(5) Soela-Sanana: Central mountain range less high than mountains of Taliaboe and Soela-Mangoli. Several trails cross island through passes at altitudes less than 600 feet. Narrow, sandy lowland along most of east coast. Poor to fair trails, in part suitable for light motorized traffic along east, north, and northwest coasts. Dense jungle is chief obstacle to movement of motorized units across island. Interior of island is easily penetrated by foot troops; easy movement along coastal lowlands.

(C) Climate

Climate of Soela Islands is tropical, dominated by winds of winter and summer monsoons, which bring heavy precipitation (rainy season) to the windward side of islands, and dry season to leeward side. The northwest monsoon blows from mid-November to mid-March, the southeast from mid-May to mid-September. Rainfall at sea level averages from 70 to 115 inches. Temperature range is small; average about 80° F.

(D) Water Supply

Water resources of the islands are excellent, but undeveloped. No hydroelectric plants, irrigation systems,or water-supply systems are reported. The natives use stream water, spring water, well water and collected rain water for drinking and culinary purposes.

Streams are numerous on the larger islands, but only the larger ones or those that are spring fed are perennial. However, the smaller streams probably have pools that are replenished by frequent rains; these could be supplemented by small storage reservoirs. The stream water is generally polluted and often muddy and should be purified by filtration and chlorination for drinking. The inhabitants of most coastal towns use raw stream water for drinking.

Springs are fairly numerous and will provide satisfactory supplies which should be chlorinated for drinking.

Wells are used to a limited extent by the natives along some of the non-perennial streams when stream water is not available. In the coastal areas, drilled wells would yield 20 to 50 gallons a minute each; this water need not be filtered. In the interior, prospects for obtaining well water are generally poor.

Collecting rain water for drinking and culinary purposes is practiced by the European inhabitants. Drainage from the roofs of houses will provide adequate water for household use, but would be inadequate for large concentrations of troops.

(E) Construction Materials

Little is known of the bedrock of the Soela Islands. Some rock, satisfactory for construction material, is found in coastal areas: limestone of elevated coral reefs, beach and dune sand, and gravel. Granite, granite-like rocks, and other hard, massive or thin-layered rocks may be deeply decayed at the surface and only suitable for construction where relatively fresh. Limestone, sandstone, and conglomerate, suitable for various types of construction occur in scattered areas throughout the islands.

(F) Problems of Road and Airfield Construction

About 15 miles of road on Soela-Sanana are suitable for light motorized traffic; elsewhere paths and trails form the only routes of communication. The latter are generally narrow and are not maintained. Soela-Sanana is encircled by trails; other islands have only small, discontinuous stretches of coastal trails near villages. Few trails cross the central mountains of the islands except for Soela-Sanana. Cross-island trails are generally poor and commonly follow stream beds and valleys to headwater divides. Coastal trails may be readily improved for motorized traffic but dense jungle, steep grades, and difficult alignments will be serious hindrances to hasty improvement of cross-island trails for use of motorized vehicles.

No airfields are known on the Soela Islands. Because of lack of detailed topographic information, no suitable sites have been selected. Parts of the coastal areas have been suggested for initial consideration as possibly containing areas suitable for the construction of emergency landing strips. No parts of the islands are known to be suitable for the construction of airfields with runways of 6,000 feet or more. In general, selected coastal areas may provide emergency runways with a minimum of grading and ground preparation. Clearing of coastal areas is in general relatively easy.

(G) Strategic Considerations

(1) Operational Features

- (a) Movement largely restricted to narrow, discontinuous coastal lowlands. Cross-island communication difficult.
- (b) Narrow coastal lowlands separated into compartments by mountain spurs, rugged hills, and rocky headlands.
- (c) Seasonal distribution of monsoonal rains produces widely differing rainfall regimen on windward and leeward sides of islands.
- (d) Few bays or harbors other than Vesuvius Bay on southwest coast of Soela-Mangoli.
- (e) No known sites suitable for airfields; emergency landing strips may be possible in coastal areas.

(2) Obstacles

- (a) Mountains are barriers. Cross-island trails poor or absent; improvement for motorized use difficult; new alignments necessary.
- (b) Dense vegetation will require clearing along paths and trails before they can be adequately utilized.
- (c) Swampy coastal lowlands are obstacle to coastal movement. In part may be by-passed, in part will require improvement.
- (d) Streams generally fordable except after heavy rains. Rapid variations in stream regimen.
- (e) Mountain spurs, hills, and rocky headlands, separating coastal lowlands into compartments, are obstacle to continuous movement along coast.

(3) Tactical Effects of Terrain

- (a) Most military activity will be limited to coastal regions because island interior is mountainous.
- (b) No important known objectives.
- (c) No known sites available for large airfields.

---

[a] For details concerning landing beaches, consult other intelligence sources.

Prepared by U. S. Geological Survey
for Chief of Engineers, U. S. Army.

SOELA (MOLUKKAS)

INTRODUCTION

This folio of maps, tables, and views was prepared during January and February, 1944, by the Geological Survey, U. S. Department of Interior, for the Chief of Engineers, U. S. Army. It outlines the principal terrain features of the Soela Islands. Each map and table is devoted to a specialized set of problems; together they cover such topics as terrain appreciation, water supply, construction materials and geology, and problems of road and airfield construction. A brief summary of climatic conditions is included to complete the general picture. The folio presents a general picture of terrain and engineering problems in a relatively unknown region.

A brief summary statement of the military aspects of the terrain is included as an aid in planning.

The information presented in this report necessarily involves interpretation by the compilers and reliability ratings have been given to the tables ranging from A (excellent) to D (poor).

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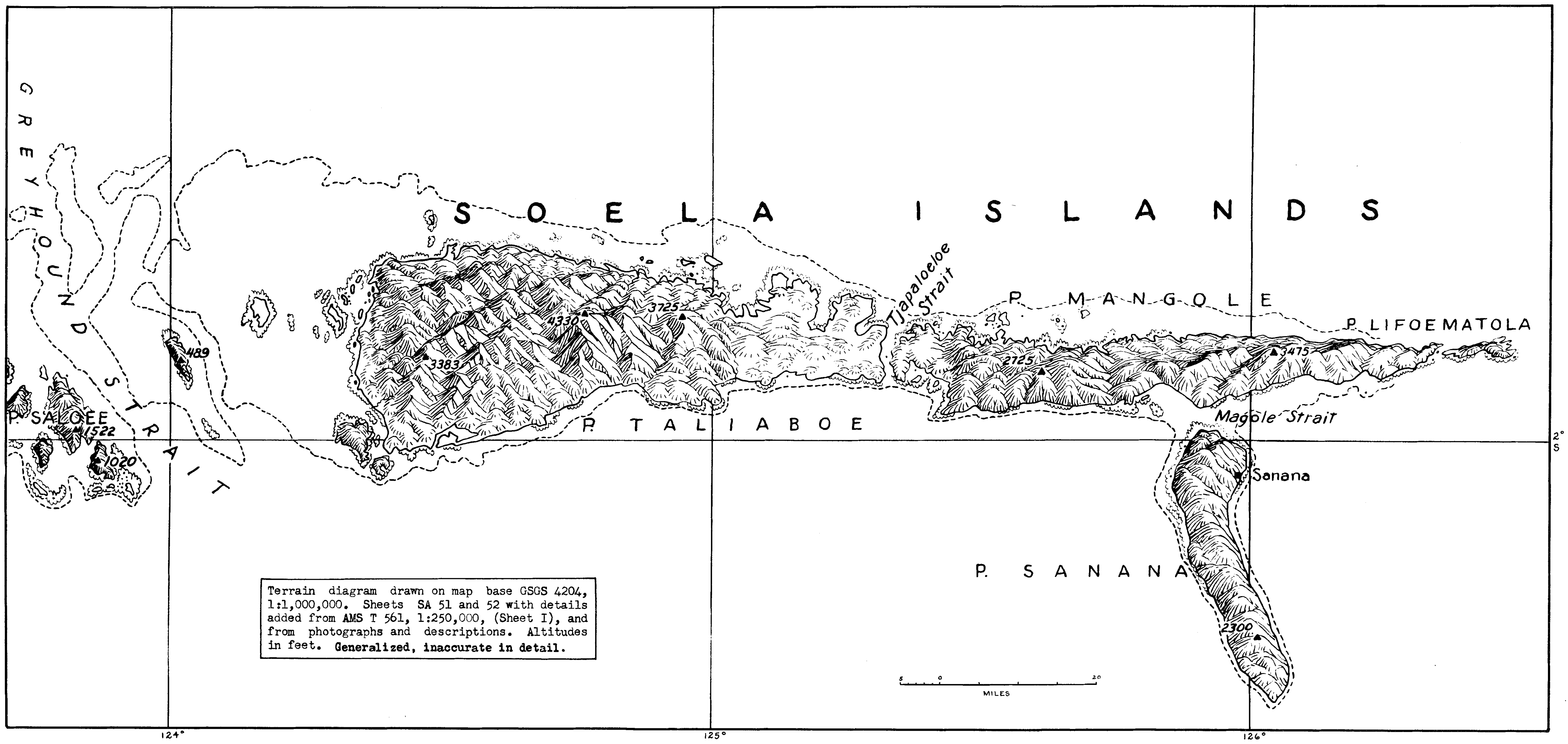
* Most useful source, construction materials and geology.
With the exception of a few specialized publications on invertebrate palaeontology and interpretations of the historical geology of the region, this publication of Brouwer's contains the most accurate and up to date compilation of the geology of the Soela Islands in the literature, including as it does the previously published data. The text, with accompanying maps and traverse data, is the source for the geological and construction materials data of this folio.

** Most useful source, terrain appreciation.
This memoir contains the most complete basic data, other than that dealing with geology and construction materials of a mineral nature.

*** Most useful published map.
The terrestrial features of AMS T561 are a monochrome (black) reproduction of this map, which was published with van Hulstijn's memoir on the Soela Islands. The original is superior, in that trichrome printing makes for greater legibility than is possible in monochrome: the topographic shading is greenish-brown; the streams, stream names, and bay names are blue; and the remaining printing is black. Folio data based on information from this map; data on U.S. Navy H.O. emergency reproductions Nos. 312 and 3241 contradictory in many respects.

TERRAIN DIAGRAM SOELA (MOLUKKAS)



Terrain diagram drawn on map base GSGS 4204, 1:1,000,000. Sheets SA 51 and 52 with details added from AMS T 561, 1:250,000, (Sheet I), and from photographs and descriptions. Altitudes in feet. **Generalized, inaccurate in detail.**

PREPARED BY U S GEOLOGICAL SURVEY
FOR
CHIEF OF ENGINEERS, U S ARMY

TERRAIN APPRECIATION AND INDEX TO VIEWS

MOLUKKEN ISLANDS 1:250,000

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SOELA

FIRST EDITION - AMS 1

SOELA (MOLUKKAS)

SHEET NO. 1

Sketch indicates the way the terrain was surveyed; the anchorages for the ships of the K. P. M. and other large steamers, and a diagram of the low tide current close to the coast, based upon information obtained from the native population and local native sailors. Additional information: The detail surveys, starting out from the coastline survey on Soela Sanana, were composed of observations from great distances along the coast, observing at sea towards known points along the shore and known hill and mountain tops. The altitudes were measured with an aneroid barometer, others were determined by the compass clinometer, others with a level compass.

LEGEND

- -------- Surveyed with the compass clinometer
- .... Measured by pacing-off and with the Smalkalder compass.
- -·-·-·-· Estimated distances and boussole compass measurements.
- -··-··-·· Surveys done by the mining engineer, Dr. H. A. Brouwer, azimuthal declination 1½°, distance deviation 150 M = 500′ in distance.
- ⚓ Anchorages for the ships of the Royal Dutch Steampacket Navigation Co.
- → Direction of current
- 9 Whirl currents

At high tide the direction of the current is reverse, as indicated on the map

Index to Reliability of Contouring

- ▨ Contouring approximate ; generalized from elevations on map and published data.
- ☐ Little or no information.

EXPLANATION

Large numbers and heavy lines indicate map areas described in accompanying table:

1. West Taliaboe
2. East Taliaboe
3. West Soela-Mangoli
4. East Soela-Mangoli
5. Soela-Sanana

Small numbers indicate location of views:

- ● Location known.
- ■ Location uncertain.

Reproduction Division of the Topographical Service, Weltevreden, 1918 (Simplified reprint, 1927).

AMS T561
First Edition 1943
Copied from a Dutch map dated 1927.
Grid and projection added by the Army Map Service, 1943.

Surveyed by the First Lieutenant of Infantry, P. van Halstyn, and the native surveyor, third class, Latamentik, and compiled by the former, further completed with information obtained from the Military Commander of Amboina & Ternate.

LEGEND

———	Bridle path
....	Foot path
--------	Parts along the coast which could be travelled on foot
⚓	Anchorages
⁘	Reefs, sandbanks and rocks
≡≡	Marsh
↥	Hot springs
⺦	Marsh palm trees
⺌	Bamboo
∘	Forests
B. =	Mountain
L. =	Mountain
Dj. =	Bay
P. =	Island
T =	Cape
W. =	River
+500	Mountain heights in meters.

Scale 1:250,000

5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 Kilometers
5000 0 5000 10000 15000 20000 25000 30000 Yards

Lambert Conical Orthomorphic Projection
Projection and Grid are approximate.

NETHERLANDS EAST INDIES EQUATORIAL ZONE GRID (Blue)

Projection:	Lambert Conical Orthomorphic
Spheroid:	Bessel
Origin:	Equator and 110°E
False Co-ordinates of Origin	3,900,000 meters East 900,000 meters North
Scale Factor:	0.997

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Contour Interval : 100 Meters .

Contouring approximate ; generalized from elevations on map and published data.

GN
3°30′
TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION 1943
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 3′ INCREASE

PREPARED BY U S GEOLOGICAL SURVEY
FOR
CHIEF OF ENGINEERS, U S ARMY

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 116464
2-44 1943

TO GIVE A GRID REFERENCE ON THIS SHEET

LETTER. Must be used for this sheet. Obtain from face of map or from diagram.
FIGURES. IGNORE the SMALLER figures printed near the sheet corners. These are for finding the full co-ordinates, viz 640000
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP. Viz. 640000

POINT SOFAN		LETTERS SQ	
East Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. *Estimate tenths Eastwards*	5 6	North Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itself on the face of the map. *Estimate tenths Northwards*	8 6
East	56	North	86
REFERENCE sQ5686		To nearest 1,000 metres	
Unit Square		Metre 10,000 Metres	

SOELA (MOLUKKAS)

TERRAIN APPRECIATION

Reliability rating: D

Introduction

The Soela Island group lies about 150 miles south of the equator, and is roughly equidistant from Halmahera to the northeast, Boeroe and Ceram to the southeast, and Celebes to the west. The group consists of three long, narrow islands and a number of much smaller, satellitic islands. Their total area is about 2,000 square miles. Two of the islands, Taliaboe and Soela-Mangoli (average length about 60 miles, average width less than 10 miles) lie in an almost straight, east-west line and are separated by a narrow strait. The third, Soela-Sanana (about 35 miles long, and an average of 7 miles wide), has a roughly north-south orientation; with Soela-Mangoli it forms a broad "T". The strait between these two islands is about 2.5 miles wide.

Basic data for much of the terrain information have been taken from van Hulstijn's report and map of the islands. The report deals chiefly with the ethnological and administrative features and contains only minor references to topographic features, a majority of which are in general terms, without specific localities or examples. Van Hulstijn's map of the islands is adequate insofar as general outlines, location of stream mouths and of settlements are concerned, but the shading used conveys no exact impression of relief. The accompanying contour map is based on van Hulstijn's outline map and on the comparatively few spot elevations which he determined by barometric or other crude surveying methods. The most important supplementary information has come from Brouwer's geological investigations which, though admittedly very incomplete, permit inferences regarding the nature of the topography from the character of the underlying bedrock. Scanty bits of information about coastal topography have been taken from various guides to sailing directions. It must be realized that with very few exceptions, any specific statement about an area may be inaccurate. The general nature of the terrain has probably been correctly described so far as larger features are concerned, but detailed information is lacking for all areas.

Map Area	Topography	Ground Conditions	Settlements	Movement	Cover, Concealment, and Observation
1 WEST TALIABOE	A mountainous region with small areas of isolated hills and discontinuous, narrow, coastal lowlands. Mountains, trending approximately east-west, have steep slopes and moderate to high relief. Streams flow in deep narrow valleys; divides generally sharp. Sandy or swampy coastal lowlands form narrow, isolated compartments around mountain area. Mountains and isolated hills: Maximum altitude 4,330 feet (1,320 m.), many over 3,000 feet. Steep escarpment marks east end of mountains; overlooks low hilly country of Area 2. In north and west, broad spurs and ridges from mountains extend to coasts. In south, low spurs reach coast in places; elsewhere isolated hills or groups of hills generally less than 1,000 feet high rise abruptly from low country near coast. East part of mountains a single east-west ridge. Detailed information about western mountains lacking; probably several ranges with no general trend. Highest points generally less than 3,000 feet. Mountains cut by deep narrow stream valleys; river flood plains small or lacking; divides sharp. Slopes steep (20-60%), in many places reaching 100% in higher mountains. Coasts and coastal lowlands: Northern and western coasts mostly steep and rocky; southern coast has stretches of low, sandy, or swampy ground. West end of north coast is sandy beach backed by bare sand dunes for about 10 miles east of T. Marikasoe (rP9817); in central part some sandy beaches; elsewhere on north coast are rocky cliffs, many promontories partly enclosing bays and coves. Heads of bays swampy. Fringing coral reefs along most rocky shores. Surf may be heavy on exposed coast from November to March. On west coast, sandy beach for few miles south of T. Marikasoe (rP9817). Swampy areas from T. Lidi (rP9311) to Wajhaja, and near Bobong (rU9687). Remainder of west coast cliffed and generally bordered by coral reef. On south coast, low red-brown rock cliffs from T. Mera (rU9775) (View 3) to T. Bota. Broadest sandy lowland of Area 1 in vicinity of Likitobi (sQ0980) and Kawaloe; entrance to Likitobi Bay often blocked by sand. Between Kawaloe and T. Wojo (sQ2880) cliffed coast. Between T. Wojo and T. Pastoeri (sQ4986) sandy beach, some cliffs, and swampy or densely wooded areas at stream mouths (View 5); beach crossed by many small streams during rainy season (May to August). From T. Pastoeri to T. Kona high cliffed coast with border of fringing reefs. Moderate to heavy surf on south coast May to August. Streams: Larger perennial streams have a three-fold character; a) For greater part of course are mountain torrents with steep gradients, narrow valleys without flood plains, steep rocky banks, bouldery beds, waterfalls and rapids (Views 2, 6, 7); b) In marginal hills, especially near south coast, channels are up to 150 feet wide and gradients low. Streams entrenched a few feet in reed-covered alluvial flats; stream beds of gravel or small cobbles; water one to two feet deep. Walls of valley may be bare rock, or soil-covered forested slopes; c) In lowlands streams meander, banks are low and sandy or muddy; low natural levees in places. Stream beds sand; water few feet deep. Streams may end in mangrove swamp. Streams in all sections may rise several feet after few hours of heavy rain and return to normal stage in two to twelve hours. Smaller streams have no flowing water in dry season. No streams navigable except by small praus near mouth at times of high water. Islands: Low coral islands off north coast; usually have sand beaches. Tonghaja, Tenga, and Kabihoe are raised reef limestone. Four largest islands off west coast bordered by mangrove swamps. Masoni low and swampy. Maximum altitudes of Limbo probably less than 100 feet; Sehoe 1,400 feet (425 meters); and Kano 450 feet (140 meters). From the sea Sehoe looks like volcanic cone. Only Sehoe and Kano have small streams. Other small islands generally low and swampy; some are little more than reefs or sandbars. Most islands have fringing coral reefs.	Bedrock: Area primarily underlain by two main rock types: granite and granite-like rocks, and layered, crumpled rocks (schists, mica-schists, and phyllites). Isolated steep hills near coasts chiefly granite; elsewhere distribution and relative abundance of two rock types not known. Gray to dark-gray limy shales along north and west coasts, in the region of Waj Miha (sQ3488) and nearby streams, and in a belt crossing the island from Waj Najo (sQ5090) to Waj mBono (sL5611). Bedded conglomerate, sandstone, limestone, and clay underlie small areas at southwest tip and on nearby island of Sehoe; beds nearly horizontal; total thickness probably 10-100 feet; any one rock type probably only a few feet thick, or may be missing locally. One larger area of sandstone in northwest corner of Taliaboe. Part of north Sehoe and some of islands off north coast (Samada Besar, Samada Ketjil, Tonghaja, Tenga) underlain by upraised reef limestone. Soil: On granite, sandy loam soil (A-3) at surface grading downward into sandy clay loam (A-2) 1½ to 2 feet below surface; fairly well drained; stable except under heavy loading in wet weather. On schist, red-brown silt or clay loams (A-4 or A-6); often contains mica flakes and lens-like fragments of bedrock. Drainage inferior to soil on granite; stability poor in wet weather. Slumping may occur on steep slopes not held by dense vegetation (View 6). On shale, sandy or silty clay (A-6); poor surface when wet (see Area 2 for details). On conglomerate, sandstone, limestone, and clay, soil types change rapidly within short distances. On conglomerate and sandstone pebbly sand to sandy loam (A-3); on limestone and clay, soil is clay or silty clay A-6), which offers poor surface when wet. Sand or sandy loam (A-3) in northwest Taliaboe. Narrow coastal lowlands are underlain by alluvium. Soils in swamp areas are silty or sandy clay (A-6 or A-7); generally saturated, soft and sticky; may be high in organic matter (A-8). Very poor footing; impassable for motorized units. Soils of sandy coastal strips may have cobbles and gravel near mouths of steep streams or adjacent to cliffs; along and behind beaches, sand or silty sand (A-2). Soil on raised reef limestone often thin or lacking; red silty clay or clay (A-6), plastic and sticky when wet (see Area 4). Vegetation: Above 1,500 feet rain forest covers mountains; moss forest at highest altitudes. Tall trees (mostly soft wood), lianas, and moderately dense undergrowth; ground covered with mat of tangled roots, fallen trees, and low growth, making passage slow and difficult. At lower altitudes, hill slopes covered with jungle trees, rattan, and bamboo, and some divides with grass (alang-alang). Coconut palms, pandan, and tjemara (Casuarina) in sandy lowlands; swamps covered with mangrove and some nipa and sago palms.	Settlements mostly restricted to coastal lowlands. Populations (1918) of Likitobi (View 4) 626, Menanga 128, Sofan 125; other coastal settlements small. A few small settlements in interior along larger rivers; single houses in interior built by dammar gatherers. Most of north and west coasts, and high mountain country uninhabited.	Mountain and hill country generally impassable for motorized units; movement hindered by steep slopes, dense forest cover, and deep, steep-walled valleys. Marginal areas adjacent to coastal lowlands may be locally passable for tracked vehicles in grassy areas. Foot troops can move slowly through high areas by cutting dense growth; streams can be forded except during heavy rains; good footing in beds of streams. In lowlands, swampy areas near mouths of larger streams generally impassable. Sandy areas have good drainage and are locally passable for tracked vehicles; but streams with muddy, slippery banks and muddy beds are obstacles. Timber available for short bridges. Established routes: No roads; a few poor trails. Natives use outrigger praus (canoes) for travel from village to village. Routes to interior follow stream courses, but are on divides where valleys are too narrow and steep. Two trails, less than 1 yard wide, not maintained, cross the island; 3 days required to travel 15 (airline) miles from Tano (sQ4988) to north coast.	Cover: In mountain and hill country cover afforded by narrow steep valleys if adjacent ridges held. Hasty fortifications may be dug with hand tools in weathered rock; on steepest slopes fresh rock may be near surface. In lowlands cover generally lacking; commanded by bordering heights. Foxholes and shallow trenches easily dug in sandy ground; support needed for sides. High water table prevents digging deep shelters in lowland. Concealment: In heavy forest good against air and land observation. More open growth on hills or lowlands offers little concealment. Observation: In mountains, ground observation limited by dense forest growth; equal height of trees makes treetop observation poor unless extensive cutting is done. Tops of steep hills near coast may offer limited observation over lowland. Hill (sQ0878) southwest of Likitobi should command surrounding lower country. In lowlands observation good.
2 EAST TALIABOE	Rolling forest-covered hill country, generally less than 600 feet in altitude; narrow fringing strips of sandy or swampy lowland. Hills: Probably highest adjacent to Area 1, decreasing in altitude toward Tjapaloeloe Strait (View 9). Maximum altitude less than 1,000 feet; average probably 200-500 feet. No definite trend or alignment of hills. Many small streams perpendicular to coastline. Slopes gentle to moderate (5-40%); divides rounded. Coasts and coastal lowlands: In general, hills extend to coasts but lack steep rocky cliffs common in Area 1. In some coastal areas hills end in fairly steep and densely forested slopes; in others they descend gradually into sandy or muddy lowlands. North coast deeply indented by rectangular and irregular bays; shore in large part bordered by coral reef. Forested hills slope steeply to coast along Tjapaloeloe Strait; swamps at mouths of streams. South coast is steep except for sand beach about 1 mile long near Waj Kadai and another extending a few miles east from Mantarara (sQ6589). Coral reefs probably lacking. Streams: Generally small but probably flow most of year. Gradients low; moderate in headwaters. Banks low to moderately high and not steep; muddy and slippery when wet. Channels 50-150 feet wide; muddy, reed-covered flood plain in which streams are entrenched a few feet; beds mud or sand. In narrow coastal lowlands streams flow into impassable swamps. During heavy rainstorms streams will rise several feet but subside rapidly. No navigable streams reported.	Bedrock: West central part probably continuation of granite and crumpled rock (schist) of Area 1. Near T. Fatoebangasa (sL9011) small area of upraised reef limestone. Remainder of Area 2 underlain by gray to dark-gray limy shale, layered or platy, with low sand content. Rock is much less firm than granite or schist; when fresh can be dug readily with pick except for local thin hard layers of sandstone or limestone. Weathers to depth of a few feet; fresh rock seldom appears except in coastal cliffs or banks of short, steep streams. Soil: Soil on granite and schist discussed under Area 1; on reef limestone under Area 4. On shale, sandy or silty clay loam (A-4 or A-6), drainage is poor; slippery and sticky when wet; dries slowly. Dry soil is firm but may be reduced to dust by traffic. In wet weather will rapidly form ruts and deep mudholes; banks of streams slippery and hard to climb. Soils of coastal lowlands similar to those of Area 1. Vegetation: Jungle probably covers most of area; some grassland (alang-alang) may be expected. Lowland vegetation chiefly mangrove and sago in swamps, coconut palms on sandy strips.	Penoe (sL7613), population 164 in 1918, only settlement with more than 100 inhabitants; three others from 50 to 100. All are coastal villages, located near streams used for drinking water. Houses bamboo with thatched roofs. Interior generally uninhabited.	Chief barriers to movement are swamps near coast and dense forest in hills. Movement of motorized units generally restricted to sandy lowlands along coasts. In dry weather foot troops can move inland by way of stream beds; elsewhere extensive cutting necessary. Streams probably can be forded at any time; beds of streams may be muddy; banks slippery. Established routes: Two trails cross from north to south coast; one to west follows stream bed for most of length. Both probably less than 1 yard wide and not maintained. Other trails between settlements in same lowland compartment. Natives generally travel by boat.	Cover from low trajectory fire only afforded by shallow stream valleys of hill region; hasty fortifications may be dug with hand tools. Lowlands exposed to fire from adjacent hills; good cover lacking. Foxholes and trenches easily dug in sandy lowlands; walls must be supported. Concealment: In hills, complete concealment offered by dense forest. Lowlands or small areas of grassland in hills offer no concealment. Observation: Limited to maximum of perhaps 50 yards in forest unless undergrowth is cleared. Some points in bordering hills may give good observation over nearby lowland, or of sea approaches. Observation good in sandy lowland; poor in dense growth of swamps.

(continued)

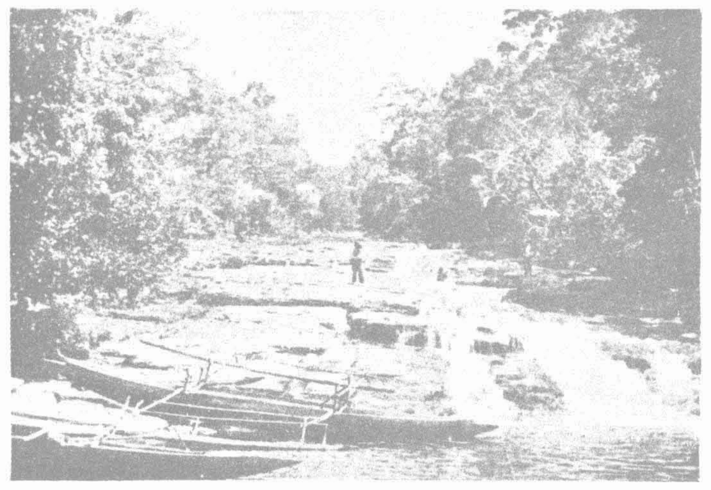
TERRAIN APPRECIATION

SOELA (MOLUKKAS)

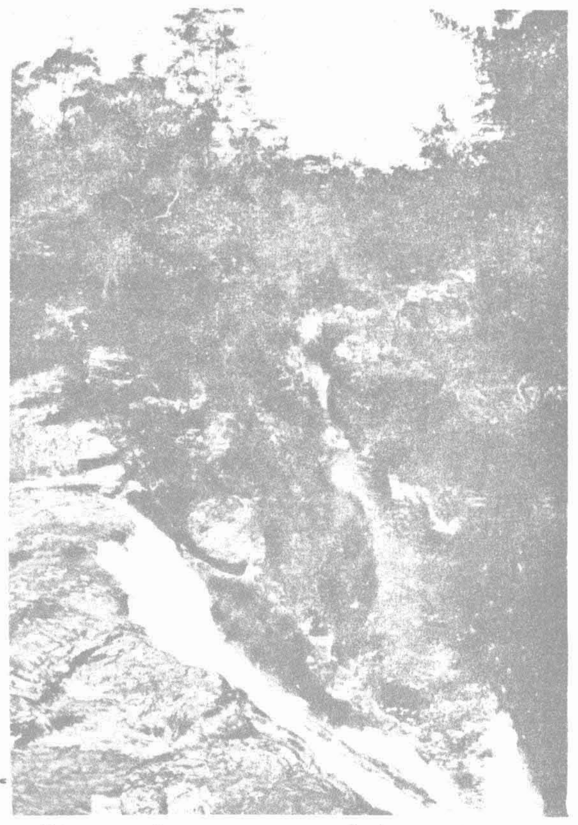
Reliability rating: D

Map Area	Topography	Ground Conditions	Settlements	Movement	Cover, Concealment, and Observation
3 WEST SOELA-MANGOLI	Generally similar to Area 2. Hills: Maximum altitude about 600 feet; average about 200 to 300. Coasts and coastal lowlands: North and south coasts deeply indented. Along Tjapaloeloe Strait, low, sandy coast. Several small, low, mostly swampy islands. Coral reefs along most shores. Vesuvius Bay (View 10) anchorage protected from both northwest and southeast monsoons. Streams: Similar to Area 2.	Similar to Area 2.	Population: (1918) Kena (sR1189) 162; Likoe (sM1100) 52; Wajfoei (sR0394) 43; few inhabitants in other settlements. Houses of bamboo with thatched roofs.	Generally similar to Area 2. Established routes: One trail, probably narrow and not maintained, from north to south coast. In river beds for about half its length.	Similar to Area 2.
4 EAST SOELA-MANGOLI	Mountain and hill country bordered in part by narrow coastal lowlands. Smaller mountain area in west; larger and higher area in east. Hilly country between east-west trending mountains and coast; broad on north, and narrow on south side of mountains. Mountains and hills: Generally similar to Area 1, but has much greater proportion of hill country. Maximum altitude 3,475 feet (1,060 meters); many over 2,000 feet. Hills average about 200 to 600 feet. In west elliptical mountain area rises steeply near south coast; broad hill country extends to north coast. In mountains slopes are steep (20-60% or more), divides sharp and streams in narrow, deep valleys without flood plains. Hills have slopes of 5% to 40%; divides rounded; stream valleys have narrow flood plains. In central part information lacking; may be hill country or somewhat lower continuation of mountains to east. In eastern half mountains form backbone of country. Similar to mountains in western part, but more elongate and higher. Rise steeply near south coast; slope more gradually to the north. Coasts and coastal lowlands: Western part of north coast deeply indented; many small low islands. Mouths of streams swampy; short stretches of sandy beach. In general hills extend to sea, forming moderately steep forested cliffs. Information lacking for rest of north coast; probably more or less continuously cliffed. South coast generally lacks lowland from T. Batoe Kapitan (sR1184) to Tjapaloeloe (sR6189). Some short, low stretches of sand or swamp. From Tjapaloeloe to T. Kausigi (sR9491) nearly continuous stretch of sand beach several hundred yards wide; widest from Tjapaloeloe to Waj tina; narrower to east with local cliffs or swamps. During southeast monsoon (May to August) surf may be heavy. Streams: Similar to those of Area 1. Average annual precipitation probably less in Area 4 because of generally lower altitude. Heavier rainfall on north coast November to March; on south coast May to August. Many streams on either coast may go dry in dry season. Low part in center of area has no high mountains to stop rain-bearing winds and may have high annual precipitation distributed more or less equally throughout the year and larger number of perennial streams. Islands: Lifoematola, east of Soela-Mangoli, typical of parts of hill country except that borders are raised reef limestone. Limestone probably forms bench several hundred feet wide; altitude not known but may be a few to a few hundred feet (View 13).	Bedrock: Area primarily underlain by granite or granite-like rocks and layered, crumpled rocks (schists, phyllites). Granite probably subordinate in extent. Shale along west and central parts of north coast. Raised reef limestone at P. Koro (sM4106), T. Ipapon and T. Botoe (sR6586), and T. Gohadjodjaro (sS0692); also in a narrow belt from T. Aubil (sS1396) around east end of island to T. Sewikonati (sN1301). A peripheral band of upraised limestone also covers about one half of the area of Lifoematola Island. Stream gravels near Waj tina (sR7388) indicate presence of conglomerate, sandstone, limestone, and clay similar to those of Area 1. Soil: Soils on granite and schist similar to those of Area 1; on shale, described under Area 2. Reef limestone may have shallow, discontinuous reddish silty clay or clay soil (A-4 or A-6); when wet forms sticky plastic ground; bearing qualities very poor. Dries fairly rapidly to compact clay which may break down to dust under repeated travel. Where soil is absent surface is rough, jagged and footing poor but ground has high bearing ratio. Soils in coastal lowlands similar to those of Area 1. Vegetation: Less rain forest and moss forest than Area 1. Lower mountain slopes and hills probably covered with dense jungle of trees, rattan, bamboo, lianas. Small coconut plantations on sandy coastal lowland from Tjapaloeloe to T. Kausigi.	Larger settlements are in central part of south coastal lowland: Tjapaloeloe, Oelfola, Mangoli, Ipagapi, Waj tina, and Fagoedoe. Populations (1918) between 200 and 400. Houses bamboo with thatched roofs. All other settlements less than 50 inhabitants. North coast almost completely uninhabited. Settlements in interior probably temporary quarters for forest runners.	Generally similar to Area 1. Tracked vehicles can probably use much of coastal strip from Tjapaloeloe east to T. Kausigi. Lower central transverse area may have gentle to moderate slopes (5-30%) but dense forest cover probable. Established routes: Good trail from Tjapaloeloe to Waj tina, probably 2 to 3 yards wide; maintained; no steep stretches. With some improvements, particularly bridges, passable for wagons. A few poor trails cross area from coast to coast; probably narrow, and not maintained.	Cover: Cover good in steep narrow valleys of mountains; limited in shallow valleys of hill regions; lacking in lowlands. Lowlands open to fire from adjacent hills. Shallow dug fortifications can be constructed with hand tools in hills and lowlands; support for walls necessary in sandy lowland. Concealment: Good in heavily forested mountains and hills; poor elsewhere. Observation: Poor in mountains and hills except those which overlook coastal lowlands. Good in lowlands except in dense growth of swamps.
5 SOELA-SANANA	Mountain range forms continuous divide between east and west coast drainage. Spurs from central range extend to coasts; coastal lowlands generally very narrow or lacking. Many short streams with steep gradients. Mountains: Mountains generally lower than in Areas 1 and 4. Maximum altitude 2,300 feet (700 meters); most crests below 1,500 feet. Several low passes (500 to 700 feet) cross range. Crest of range narrow with steep slopes; in south may be rounded to flat-topped. Flanks of range cut by ravines; intervening spurs sharp, end in cliffs at or near sea. Crest line slopes of spurs moderate to steep (15-50%); steeper near crest of range. Routes crossing lowest passes have gentle to moderate (2-10%) slopes. At south end extensive area with altitudes about 1,000 to 1,200 feet. Coasts and coastal lowlands: Greater part of island fringed by very narrow coastal lowland (Views 15, 18). On east coast, sandy flat $\frac{1}{4}$ to $\frac{1}{2}$ mile wide around town of Sanana (Views 16, 17) (sR7372); mostly occupied by town and coconut plantations. Lowland south of Sanana generally no more than few hundred feet wide, interrupted by spurs which end in cliffed headlands; very few marshy areas. South end of island low and swampy near T. Waka; T. Waka to Tandjoengbaliha mostly rocky and cliffed; T. Waka to Wajgaj little or no lowland. West coast similar to east coast. Lowland 1/8 to 1/4 mile wide near Kabauw; sandy beach backed by swamp. North end of island, from near Sanana around to Molboefa, lowland more extensive, one to two miles wide; mostly mangrove swamp. About 80% of perimeter of island is fringed with coral reef. Sanana has well protected harbor, about 1,000 by 300 feet, minimum depth about 30 feet; entrance about 200 feet wide. Streams: Majority are mountain streams throughout course. Have steep gradients, narrow, deep valleys with rocky walls, falls and rapids. Generally no flood plain; bed of blocks, cobbles, or coarse gravel. Many streams may go dry during dry season , November to March on east coast and from May to August on west coast. May rise several feet during heavy rainstorm at any season; subside quickly. Lower courses of larger perennial streams have moderate to gentle gradients, more open valleys, and beds of sand. In north streams disappear in mangrove swamps.	Bedrock: Area principally underlain by layered crumpled rock (schist); some granite-like rocks in northeast. Area of conglomerate, sandstone, limestone, and clay similar to that of Area 1 in headwaters of W. Fowata (sR7338). Small areas of upraised reef limestone north of Fowata (sR7038) and at Tandjoengbaliha (sR8236). Soil: Soil overlying schist is A-4 or A-6. Conditions of soil may be different from that overlying schist in Area 1 owing to difference in rainfall. Here ground is not so wet, weathering less deep, surface more firm, and slumping or sliding uncommon. More bedrock at or near surface than in Area 1 owing to larger number of closely spaced steep-gradient streams; divides well drained. Soils on conglomerate and associated types treated under Area 1; on reef limestone under Area 4. Coastal lowlands generally similar to other areas. Beach sand derived from schist may have relatively high bearing ratio owing to wide range of grain size. Large swampy area in north generally impassable except along maintained road. Vegetation: Mountains jungle-covered; probably more burned-over areas and secondary growth than other areas. On lower spurs probably considerable areas of open forest or grass (alang-alang). Northern swamp mangrove; inner edge nipa.	Most of population of Soela Islands concentrated in Area 5. Settlements with more than few inhabitants restricted to coastal lowlands. Population (1918) Sanana 3,006 (more recently reported to be smaller), Waj ipa 1,053; majority of others on map between 100 and 600 inhabitants. Houses mostly bamboo with thatched roofs; old stone fort at Sanana. Coconut plantations in and around settlements.	Mountain backbone of island generally impassable for motorized units because of steel slopes and dense forest cover. Passage may be possible over lowest passes along routes of trails; slopes generally less than 10%; probably steep stretches. Travel parallel to coast away from lowlands generally impossible for motorized units because many deep V-shaped valleys cross route. Foot troops can move without great difficulty on lower spurs; streams can be forded except during heavy rains. Established routes: Cart road ten to fifteen feet wide with only a few steep stretches runs from Molboefa (sR6176) along east coast to Tandjoengbaliha (sR8236); passable at any season. Maintenance best on stretch Sanana to Bega (sR7843); can be used by automobiles for about 15 miles south from Sanana. Few good trails cross mountains; best from Bega to Wajnib and from Sanana to Molboefa, both probably cleared and maintained. Crossing can be made in a few hours.	Cover: Afforded by deep narrow valleys in mountains and by less deep but steep-walled valleys near coast. Little or no cover in lowlands except behind spurs which reach sea. Hasty fortifications may be dug with hand tools in sandy lowlands. Concealment: Good in dense jungle in most of area; poor in lowlands and grass-covered hills. Observation: Poor in forested mountains. Spurs may afford good observation over adjacent lowlands and sea approaches.

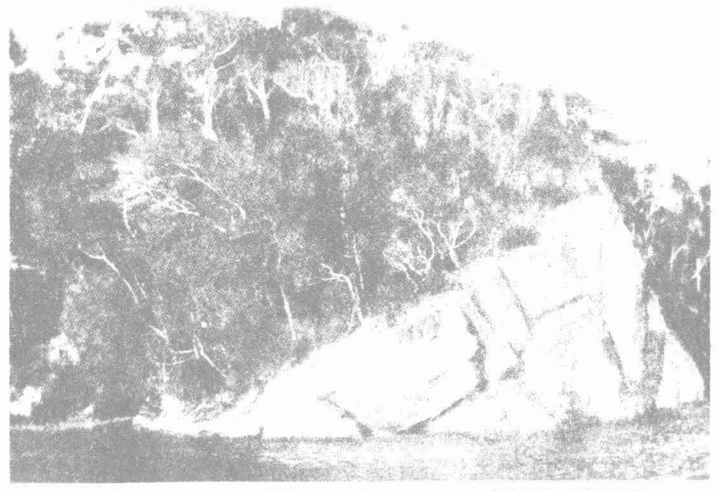
Prepared by U. S. Geological Survey
for Chief of Engineers, U. S. Army.



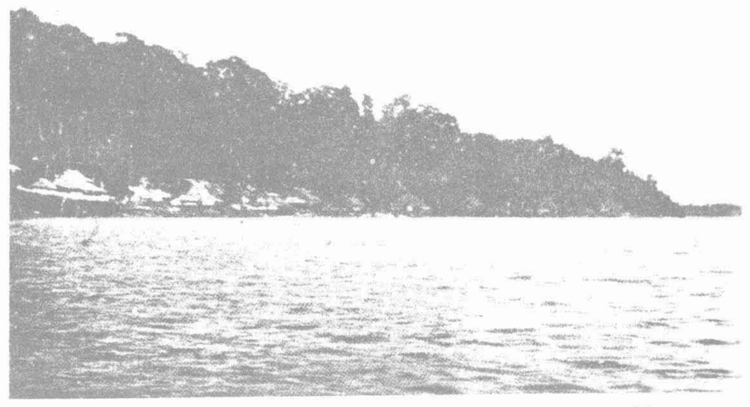
1 Mouth of W. Djoerdjoga, looking southward upstream. Stream flows into Djoerdjoga Bay over gently-dipping ledges of sandstone. (Area 1). (Van Hulstijn, 1918.)



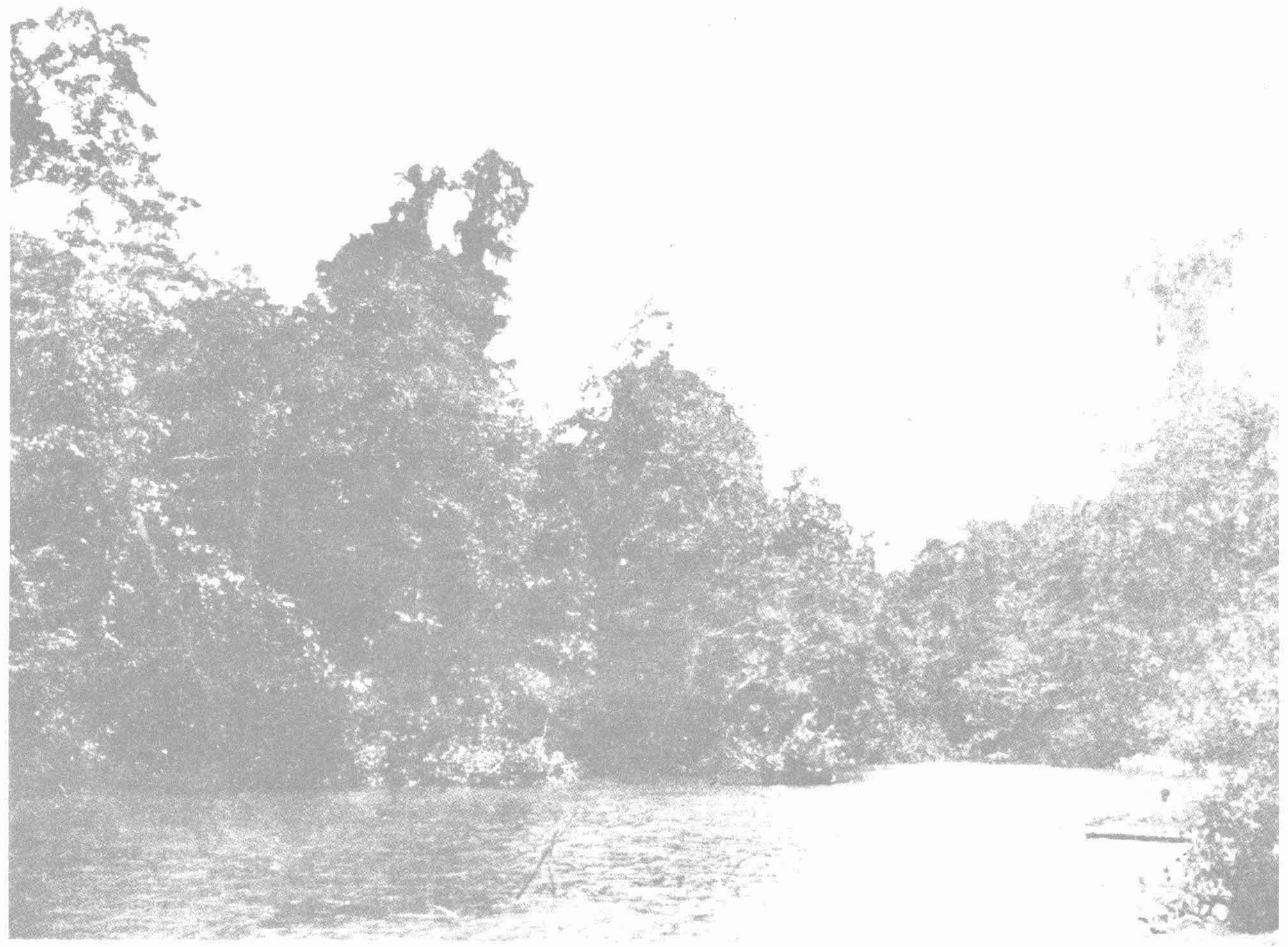
2 Steep slopes, rugged terrain, and dense jungle typical of mountains of Soela Islands. Bedrock exposed only along streams as at these cascades in the upper Djoerdjoga valley. (Area 1). (Van Hulstijn, 1918.)



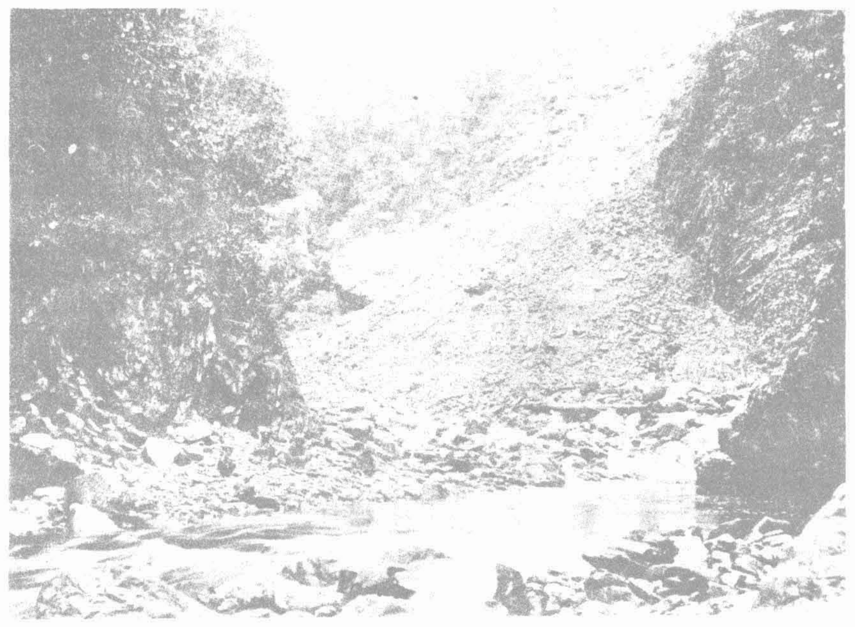
3 Where granite outcrops along shore, rockbound coasts of this type may be expected in Soela Islands. Granite headland at T. Mera, with dense jungle to water's edge on less precipitous slopes. (Area 1). (Van Hulstijn, 1918.)



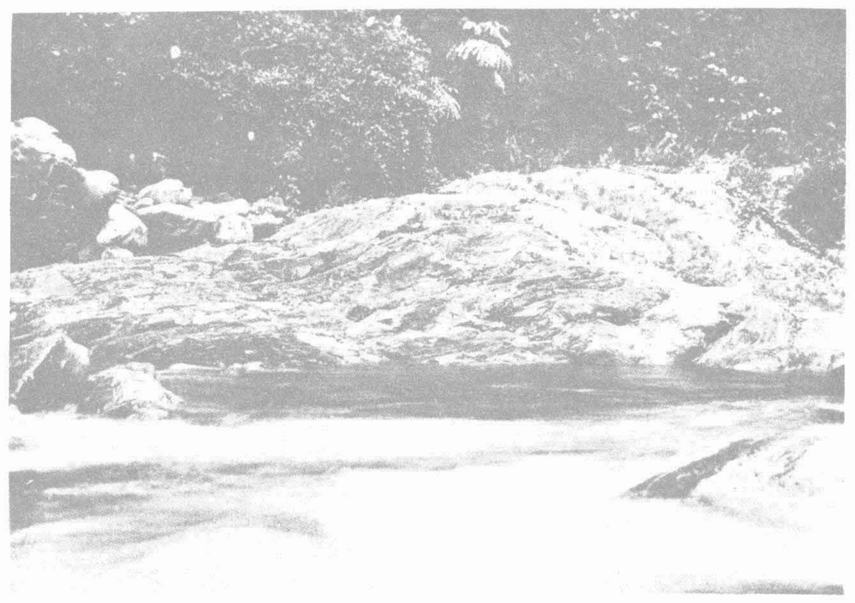
4 Likitobi village in Likitobi Bay. Narrow coastal strip; dense vegetation on slopes behind village. (Area 1). (Van Hulstijn, 1918.)



5 Tangled vegetation on delta of W. Miha. These conditions may be expected where larger streams of Soela Islands empty into sea along low-lying coast. (Area 1). (Van Hulstijn, 1910.)



6 Landslide on steep, jungle-covered, deeply-weathered slope, typical of much of mountainous country of Soela Islands. Rapids in upper Miha valley, with typical boulders and gravels. (Area 1). (Van Nouhuijs, 1910).



7 Rapids and rocky channels typical of upper courses of mountain streams on Soela Islands. Outcrop of thin-layered, flaky rock (schist) in upper Miha valley. (Area 1). (Van Nouhuijs, 1910.)

8 Typical lowlands where low, hilly country slopes to Tjapaloeloe Strait. Coconut palms between uncleared land and shore. Tide-rip in foreground. (Areas 2 and 3). (ONI No. 173 - 749, 1939.)

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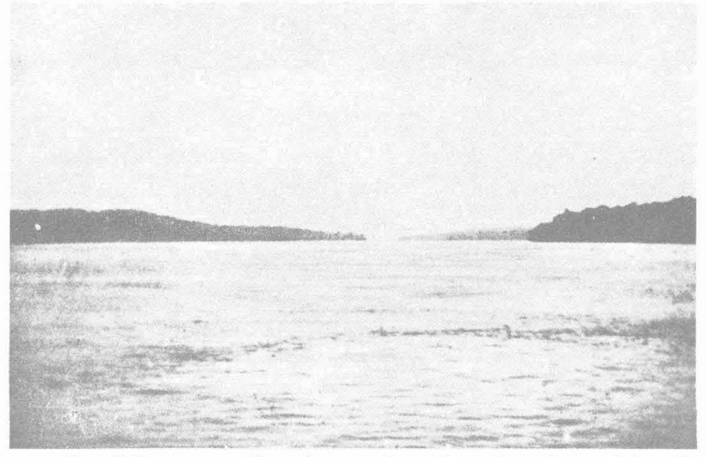
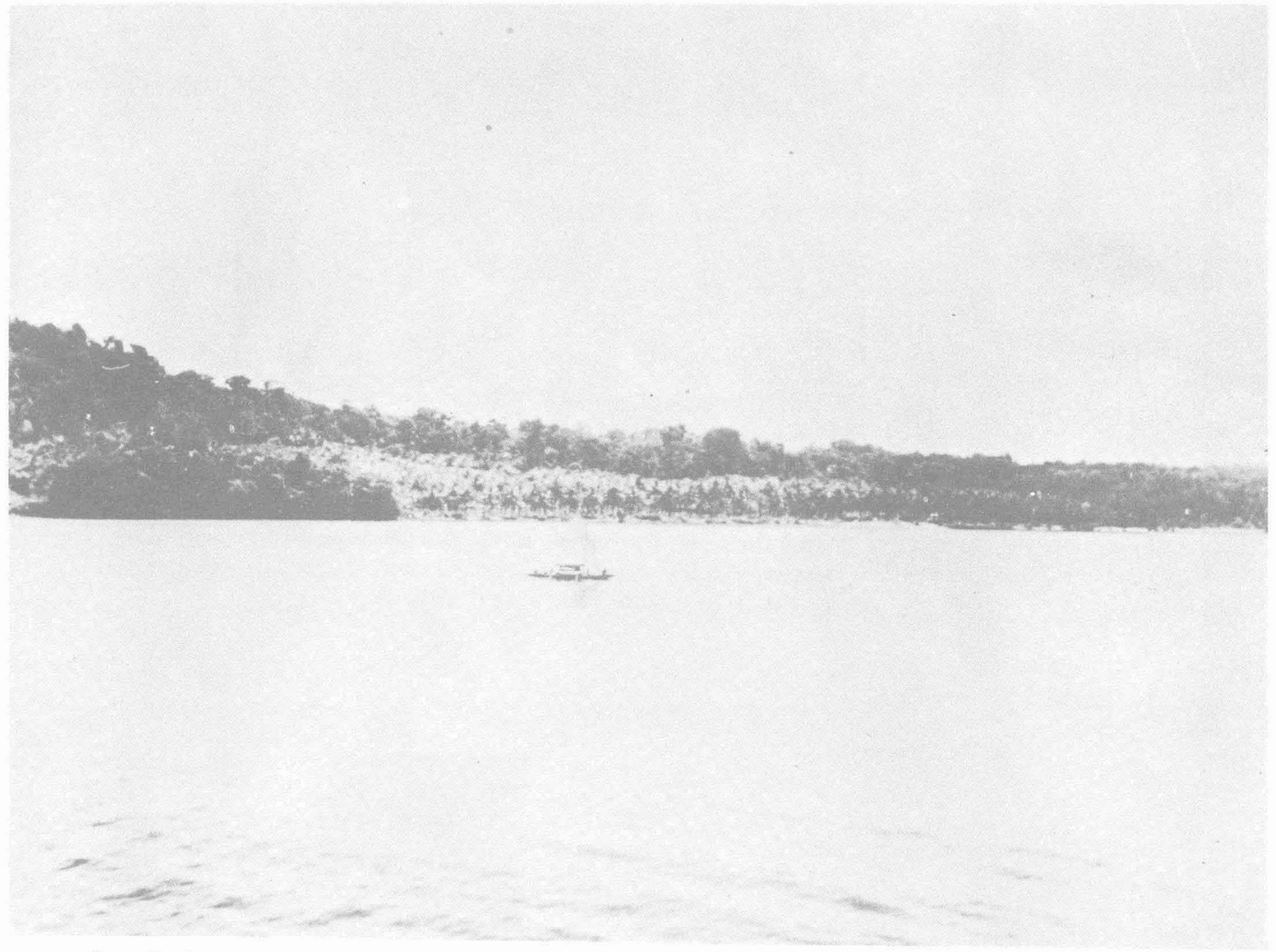
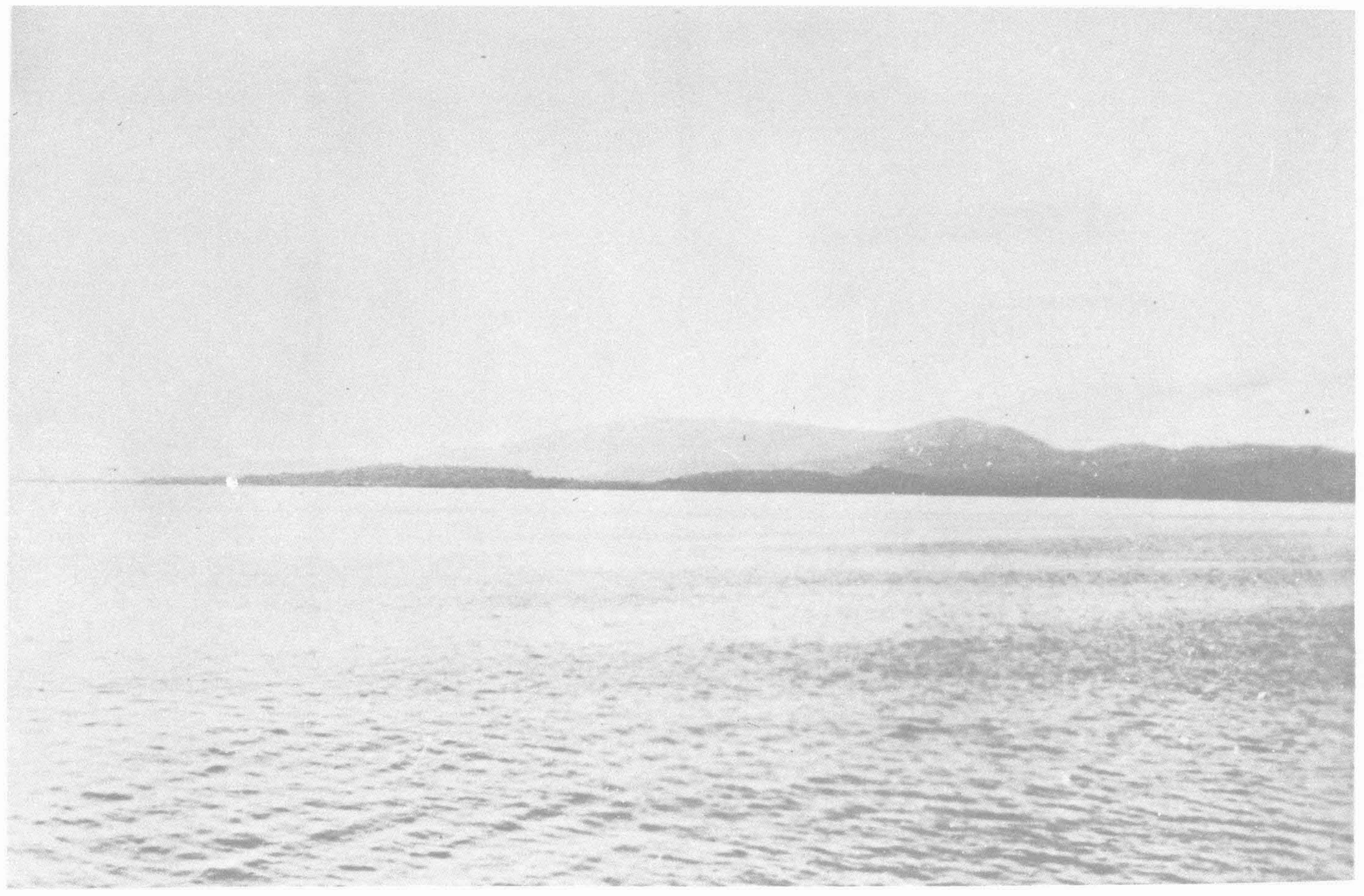


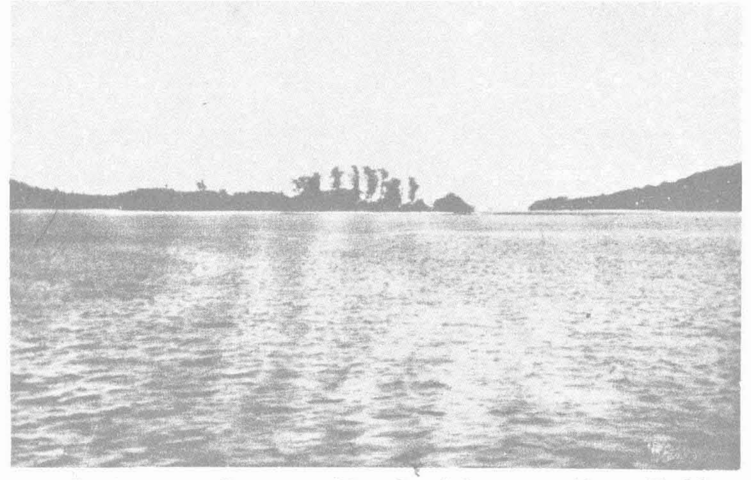
9 Looking north through Tjapaloeloe Strait. (Areas 2 and 3). (Van Hulstijn, 1918.)



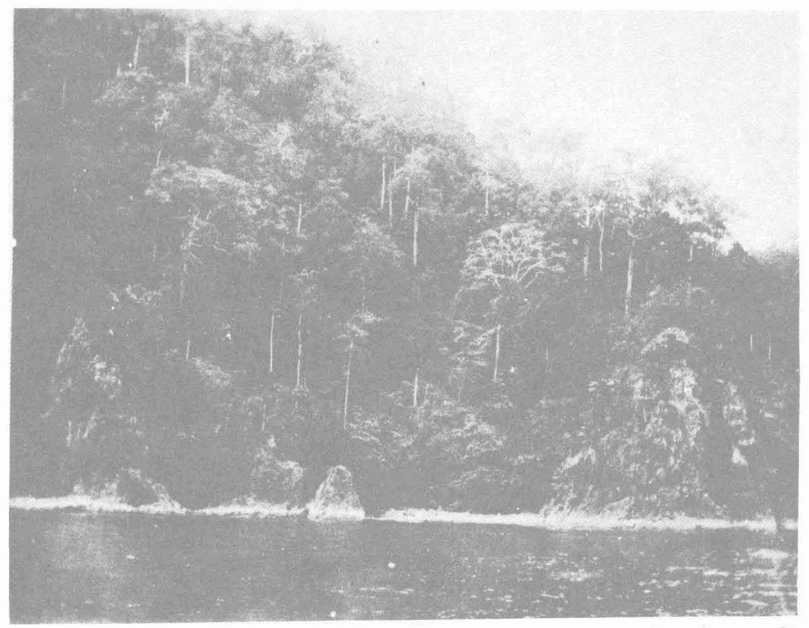
10 Low-lying flats; higher ground of raised reef limestone at left. Typical of some of small islands off coast of main Soela Islands. Coconut palms in clearing at village on Ipa Island, Vesuvius Bay. (Area 3). (ONI No. 173 - 754, 1939.)



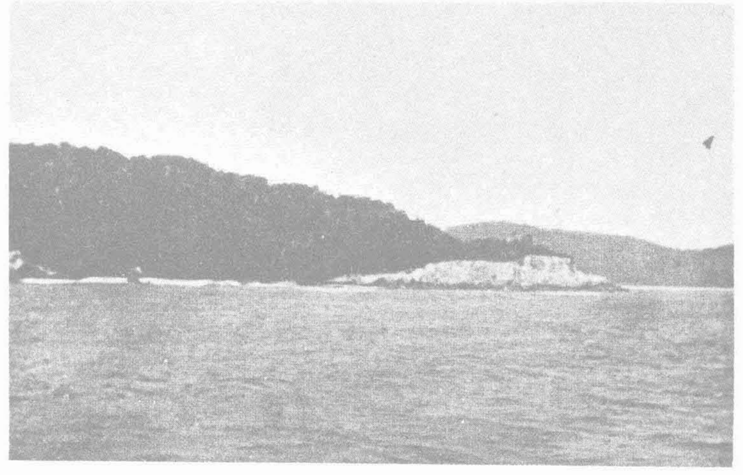
11 Mountains, probably in interior of Soela - Mangoli Island, seen from the north. Dark masses in middle distance probably low-lying islands off coast. (Area 4). (ONI No. 173 - 758, 1939.)



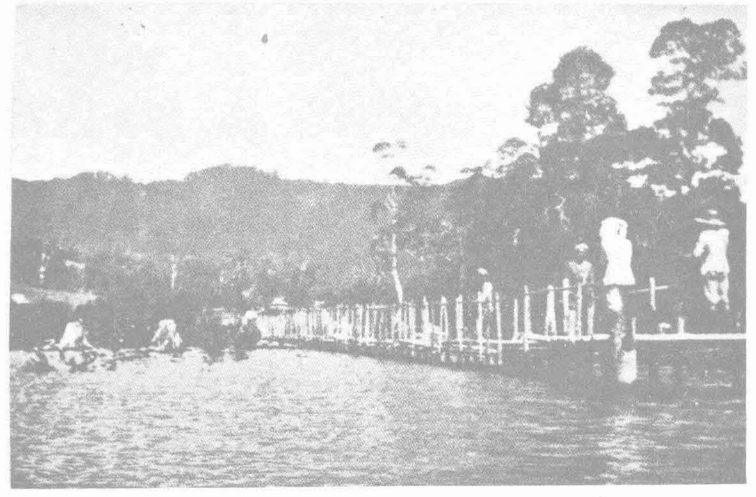
12 Lifoematola Strait, looking north. Tall trees indicate approximate position of Pagama Island. Soela - Mangoli at left; Lifoematola at right. (Area 4). (Van Hulstijn, 1918.)



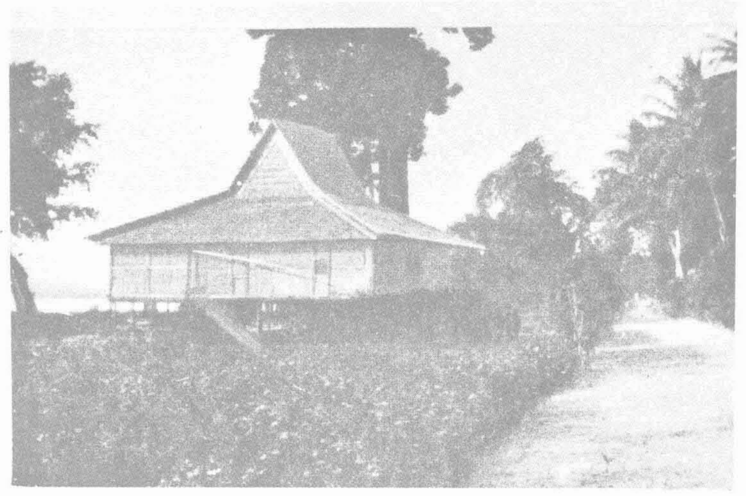
13 Steep slopes of extremely rough raised reef limestone known to be characteristic of much of coast of Soela Islands. May be bare, or covered with tangled jungle growth as seen here. Northwest coast of Lifoematola Island. (Area 4). (Brouwer, 1920.)



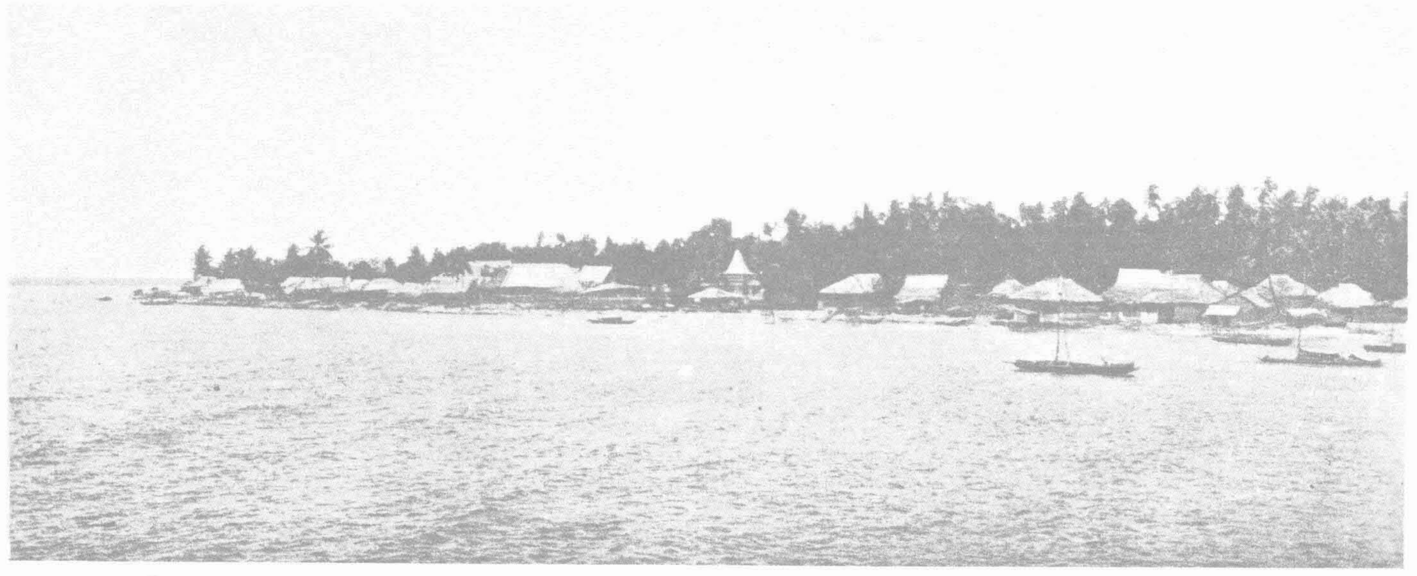
14 Typical raised reef limestone cliffed by undercutting of waves. East coast of small island of Limo, looking north toward south-east coast of Lifoematola Island. (Area 4). (Van Hulstijn, 1918.)



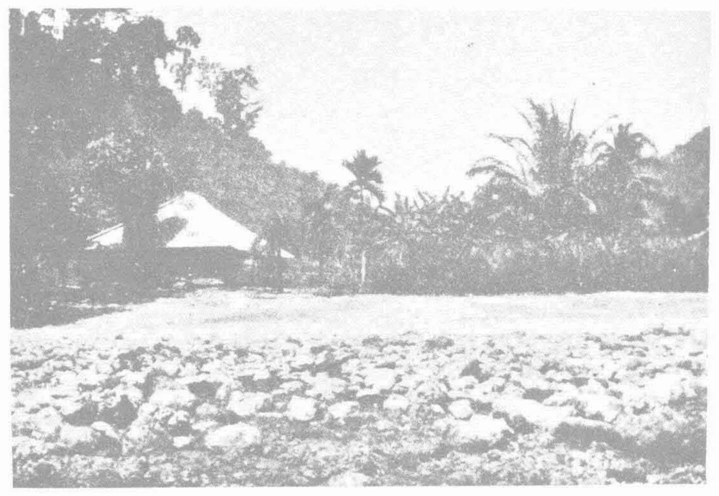
15 Narrow flat, with hills close to shore; typical of coast of Soela - Sanana. Small pier at Pohi-eja. (Area 5). (Van Hulstijn, 1918.)



16 Road, probably on east coast of Soela - Sanana Island, near town of Sanana. (Area 5). (Van Hulstijn, 1918.)



17 Part of town of Sanana, on east coast of Soela - Sanana Island. (Area 5). (Van Hulstijn, 1918.)



18 Narrow flat with steep mountains rising near shore; typical of most of coast of Soela - Sanana. Raised reef limestone in foreground. Near Tandjoengbaliha. (Area 5). (Van Hulstijn, 1918.)

PREPARED BY U. S. GEOLOGICAL SURVEY
FOR
CHIEF OF ENGINEERS, U. S. ARMY

WATER SUPPLY

MOLUKKEN ISLANDS 1:250,000

For use by
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~~CONFIDENTIAL~~

SOELA

FIRST EDITION - AMS 1

SOELA (MOLUKKAS)

SHEET NO. 1

EXPLANATION

🟩 1	Lowlands underlain by gravel, sand, and silt. Ample water supplies obtainable from shallow wells and in most places from streams.
2	Lowlands, in part underlain by coral limestone, and low hilly areas underlain chiefly by dense rocks. Moderate supplies of water obtainable from streams, springs, and wells.
3	Mountainous areas. Moderate supplies of water obtainable from streams and springs. Well drilling not recommended.

Index to Reliability of Contouring

▨	Contouring approximate; generalized from elevations on map and published data.
☐	Little or no information.

Sketch indicates the way the terrain was surveyed; the anchorages for the ships of the K. P. M. and other large steamers, and a diagram of the low tide current close to the coast, based upon information obtained from the native population and local native sailors. Additional information: The detail surveys, starting out from the coastline survey on Soela Sanana, were composed of observations from great distances along the coast, observing at sea towards known points along the shore and known hill and mountain tops. The altitudes were measured with an aneroid barometer, others were determined by the compass clinometer, others with a level compass.

LEGEND

- - - - - - -	Surveyed with the compass clinometer
....	Measured by pacing-off and with the Smalkalder compass.
-·-·-·-·	Estimated distances and boussole compass measurements.
-··-··-··	Surveys done by the mining engineer, Dr. H. A. Brouwer, azimuthal declination 1½°, distance deviation 150 M = 500′ in distance.
⚓	Anchorages for the ships of the Royal Dutch Steampacket Navigation Co.
→	Direction of current
9	Whirl currents

At high tide the direction of the current is reverse, as indicated on the map

Scale 1:1,000,000

Reproduction Division of the Topographical Service, Weltevreden, 1918 (Simplified reprint, 1927).

AMS T561
First Edition 1943
Copied from a Dutch map dated 1927.
Grid and projection added by the Army Map Service, 1943.

Surveyed by the First Lieutenant of Infantry, P. van Halstyn, and the native surveyor, third class, Latamentik, and compiled by the former, further completed with information obtained from the Military Commander of Amboina & Ternate.

LEGEND

———	Bridle path
....	Foot path
- - - - -	Parts along the coast which could be travelled on foot
⚓	Anchorages
⁘	Reefs, sandbanks and rocks
≡	Marsh
⫯	Hot springs
⋎	Marsh palm trees
⁂	Bamboo
∘	Forests
B. =	Mountain
L. =	Mountain
Dj. =	Bay
P. =	Island
T =	Cape
W. =	River
+500	Mountain heights in meters.

Scale 1:250,000

Lambert Conical Orthomorphic Projection
Projection and Grid are approximate.

NETHERLANDS EAST INDIES EQUATORIAL ZONE GRID (Blue)

Projection:	Lambert Conical Orthomorphic
Spheroid:	Bessel
Origin:	Equator and 110°E
False Co-ordinates of Origin	3,900,000 meters East 900,000 meters North
Scale Factor:	0.997

~~CONFIDENTIAL~~

Contour Interval: 100 Meters.

Contouring approximate; generalized from elevations on map and published data.

PREPARED BY U S GEOLOGICAL SURVEY
FOR
CHIEF OF ENGINEERS, U S ARMY

APPROXIMATE MEAN DECLINATION 1943
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 3′ INCREASE

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 116464
2-44 1943

TO GIVE A GRID REFERENCE ON THIS SHEET

LETTER. Must be used for this sheet. Obtain from face of map or from diagram.
FIGURES. IGNORE the SMALLER figures printed near the sheet corners. These are for finding the full co-ordinates, viz 640000
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP viz 640000

POINT SOFAN		LETTERS SQ	
East Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. Estimate tenths Eastwards	5 6	North Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itself on the face of the map. Estimate tenths Northwards	8 6
East	56	North	86
REFERENCE sQ5686		To nearest 1,000 metres	
Unit Square		Metre 10,000 Metres	

Reliability rating: Class C

INTRODUCTION

Topography: Soela Islands Group consists of three principal islands, four much smaller ones, and several islets along the coasts. Three of the islands, Taliaboe, Soela-Mangoloi, and Lifoematola, form a remarkably straight east-west chain 150 miles long and tapering from a width of 30 miles in the west to less than 3 miles in the east. These islands are separated by two straits scarcely a mile in width. Taliaboe and Soela-Mangoloi are each about 70 miles long, Lifoematola is only 8 miles long. Soela-Sanana (Soela Besi), 35 miles long and 5 to 8 miles wide, trending a little east of south, is separated from Soela-Mangoli by a strait 2½ miles wide. Two smaller islands, Sehoe and Kano, are close to the southwest coast of Taliaboe, and another, Masoni, lies 10 miles off its west coast.

Western part of Taliaboe has mountains and plateaus rising steeply from the shore to altitudes of 2,000 to 3,000 feet. The eastern third is a rather low, rolling to hilly, area bounded by steep slopes to the narrow coastal plain. Two mountain masses rise on Soela-Mangoli, one on the western part and one on the eastern part with broad areas of low hilly land between and at the western end. Maximum altitude is reached in the eastern range, 3,480 feet. Lifoematola is a narrow hilly island lying to the east. Soela-Sanana has a rugged mountain ridge running its entire length, culminates in a 2,300 foot peak near south end. In many places beaches are borded by mangrove swamps. Most of the shores of these islands are bordered by steep slopes, with narrow discontinuous beaches alternating with cliffs.

Kinds of material: The rock formations of the Soela Islands are known only from widely spaced traverses. Islands seem to consist predominantly of granite and granite-like rocks, with minor amounts of limy and shaly rock and porous sandstone and conglomerate. One locality in the southwestern part of Soela-Sanana is covered by beds of porous sandstone and sandy shale; similar rocks cover parts of northern Taliaboe and a small area in the southwestern extremity of Taliaboe, and also a part of adjacent Sehoe Island. Coral reefs, raised as much as 300 feet, cover lower slopes of Lifoematola and also the other islands to a lesser extent. In most places reefs are 20 to 100 feet thick and on headlands they are commonly undercut by the waves. Soela-Sanana is almost completely surrounded by living coral reefs; 2 miles wide at the north end of the island. Much of the coast of the other islands is also bordered by living coral reefs of varying width. Along the lower courses of some of the larger streams are alluvial deposits of gravel, sand and silt; however, many of the stream channels are bare rock, with little loose material.

Vegetation: All the islands are densely wooded; with large tropical trees on the slopes above 1,500 feet altitude; and more scrubby growth, including palms and rattans, on the lower slopes. Dense growths of bamboo fill the stream valleys; sago palms and other fresh-water plants occupy the landward parts of swamps whose coastal portions are covered by mangrove. Groves of coconut palms occupy strips along the shores of Taliaboe and Soela-Mangoli, and cover larger and wider areas on Soela-Sanana. Soela-Sanana also has plantations of coffee, maize, rice and sugar cane, and considerable areas of cleared areas of land which has become overgrown with coarse alang grass.

Population: In 1930 total population of islands was estimated to be 20,000; 12,000 lived on Soela-Sanana, 4,000 on Taliaboe and 4,000 on Soela Mangoli. Lifoematola and other small islands were not inhabited. About 18,000 were of Malaysian races; remainder were Chinese, Arabs, and other Eastern races, and a few were Europeans. Sanana village, seat of local government, had a population of about 2,000; of 200 foreigners 20 were Europeans. Several other villages on east coast of Soela-Sanana had populations of 200 to 1,000; the west coast was sparsely inhabited. Likitobi, on the south coast of Taliaboe, had a population of aboug 600; Kena, on an islet at west end of Soela-Mangoli had about 300 people; the north coast of this island was nearly uninhabited. Nearly all the remainder of the population also lived in small coastal villages, but there were a few semi-nomadic tribes in the interior of Taliaboe.

Precipitation: Mean annual rainfall along the coasts ranges from about 70 to 115 inches; it probably increases to about 150 inches in the higher lands. See climate sheet.

Streams: The principal islands are drained by many short streams which flow from the highlands in courses nearly at right angles to the shore. After several hours of heavy rain they become formidable torrents, but usually return to normal within 12 hours. Much of the area of the islands is unexplored and information on streams is meagre.

Of the many streams draining western Taliaboe the Najo, Kaboeta, Niha, Bobang, Haja, Tambona, Menanga and Bona Rivers appear to be the largest. All of these streams have minimum discharges of at least several cubic feet per second. Flow is greatly increased during the rainy season. Many other streams have a perennial flow. Almost all streams are rushing mountain torrents in upper courses but several flow through swampy, narrow alluvial valleys near the sea. On the south coast long-shore currents have built sand bars across mouths of several streams forming fresh or brackish water lagoons. Principal streams in eastern Taliaboe, the Koejoe, Mentenga and Mejang, have perennial flows, but are probably quite small in season of least rainfall. Streams head in low hilly country and flow through marshy valleys near the sea.

Largest streams on Soela-Mangoli, the Auponhia, Seranggohong, Likoe, Mandafoehi, Fatoe, Benowea and Balwa, have minimum flow of a few cubic feet per second. Flow of all is greatly increased in rainy season. All streams head in rugged highlands but lower course of most are bordered by swampy, bamboo-covered, alluvial deposits.

On Soela-Sanana nearly all streams are less than 5 miles long. In upper reaches they flow in deep, steep ravines and are swift and muddy during the long rainy season; but most of them are either dry or carry only a small amount of fairly clear water in the season of least rain. A few streams head in large springs and have perennial flows; among these are the Santosa, Wolanda, and the Sis.

Water supply: Most native houses have primitive shallow wells from which domestic water supplies are obtained. Wells are only a few feet deep so provide only limited supplies of water. Water is clear of suspended matter but is badly polluted. Stream water is used for emergency supplies when wells go dry.

None of the villages of the Soela Islands has an organized municipal supply but many are situated close to the mouths of streams from which they may draw water supplies. Ships putting into these ports at times replenish their water supplies from these sources also. Sanana village is reported to obtain its water partly from shallow wells, but chiefly from the nearby Wolanda River. A few other communities obtain their water, wholly or in part, from shallow wells. Likitobi obtains a considerable part of its supply from a neighboring large spring. Other villages probably are also supplied in part from springs. As there is heavy precipitation during 9 or 10 months of the year, rain water from house roofs (especially from galvanized iron roofs) forms a principal part of the water supply for Europeans and other foreigners.

AREA DESCRIPTIONS

Map Area 1: Abundant supply of surface and ground water available.

Topography: Narrow coastal plains, only a few hundred yards wide, and stream valleys; underlain by gravel, sand and silt. Swampy land near coast covered by mangrove and nipa palm. Along inland part of plains and in alluvial valleys sago palms and bamboo grow. In places, especially on Soela-Sanana, land has been cleared for coconut palm plantations.

Existing water supplies: Numerous perennial streams crossing area will provide most readily available, adequate, source of water for combat forces during operational stage. Stream water is usually muddy or stained by decaying swamp vegetation. Water is also badly polluted with disease producing organisms and must receive complete and careful treatment to prevent epidemics of water-born diseases. Swamp water, although it is difficult to treat, may be used in an emergency.

A few springs of moderate discharge are reported to issue along the inlond border of the coastal plain. Likitobe obtains part of its supply from a large spring, and springs are porbably used by natives elsewhere. Water from springs is usually clear but should be treated before use. Hot springs, which may be of use for water supply, issue on the southeast coast of Taliaboe near Mantarara; others are reported near the northeast coast in the basin of the Madi River.

Most native houses have primitive shallow wells from which domestic water supplies are obtained. These wells are commonly only a few feet deep and are without casing or other improvements. Water obtained is usually clear and cool but is badly polluted with disease producing organisms. Natives appear to develop a natural immunity to diseases borne by local water. Combat forces operating near native habitations can obtain limited supplies from native wells. Water would require no filtering, as would stream water, and could easily be made safe by treatment with calcium hypochlorite. Individuals could treat water in canteens with halazone tablets.

Inner portion of coastal plain and alluvial valleys are believed to be favorable areas for development of larger supplies of water by means of drilled or driven wells. Wells less than 100 feet deep in the unconsolidated sand and gravel of alluvial valleys may yield 20 to 100 gallons per minute. Wells will need casing and sand screens. Water table will be near the surface and centrifugal pumps may be used. To avoid salt water encroachment wells close to the sea should not be sunk too deep nor pumped too heavily.

Map Area 2. Moderate supply of surface and ground water available.

Topography: Low hilly lands lying mainly below an altitude of 600 feet. Much of area is virtually unexplored and unmapped. All is densely wooded.

Existing water supplies: All streams heading in higher mountainous country flow across this area on way to sea. Several large streams head in low hills of eastern Taliaboe and larger areas of hills on Soela-Mangoli. The many perennial streams will provide most readily available source of water for combat forces. In higher parts of area, near heads of streams, some difficulty may be experienced in locating running water. All main streams have perennial flow across lower parts of area. Stream water is usually muddy and badly polluted with disease producing organisms, even in almost uninhabited regions. Water must receive careful and complete treatment to prevent epidemics of water-borne diseases.

Springs in many places will provide from 1 to 10 gallons per minute of clear water; less contaminated, at source, than stream water. Often this water will be safe to use, but should be used without treatment only in energencies. Many of the smaller springs are dry during season of least rain, but usually by digging a few feet water may be made available.

Few inhabitants in this area but most native houses have primitive shallow wells from which domestic water supply is obtained. These wells are commonly only a few feet deep and can provide only a very limited supply of water. Wells usually located in valley bottoms close to streams whose muddy water is used only when wells are dry. Water from native wells is clear and cool but is badly contaminated and must be treated.

Larger supplies for more permanent installations bay be obtained by drilling wells. Al most of the area is underlain by nearly impervious rock, well locations should be selected by competent ground water geologist. In some places, in northern and extreme southwestern Taliaboe, Sehoe Island, and southwestern Soela-Sanana, is thick sandstone series may provide medium to large yields of water. Raised coral reefs may in some places yield moderate quantities of water. Depth to water will be extremely variable, but in most places if wells are drilled in valleys, centrifugal pumps may be used. Casing needed only through weathered rock at surface.

Map Area 3. Moderate supplies of surface and spring water available.

Topography: In western Taliaboe is a little known mountainous region lying mainly at altitudes between 2000 and 3000 feet, but rising to 4340 near center. Region is reported to consist of mountains and plateaus without prominent valleys. Streams heading here rush down steep flanks of highlands on all sides.

Western Soela-Mangoli is a rugged mountainous region which rises to a maximum altitude of 2950 feet. Poorly known region but there appears to be several high ridges separated by deep valleys. Mountainous region of eastern Soela-Mangoli consists of a longitudinal ridge with numerous sharp peaks rising to altitudes of 2300 to 3300 feet.

Soe-Sanana has a sharp mountain ridge running the length of the island. North end has peaks 1280 feet high but height increases toward south where one peak is over 2300 feet high. Several deep narrow passes break across the uniform ridge near the south end.

All of the mountainous areas are heavily forested and virtually uninhabited. No roads exist and the few paths in region are steep and narrow and movement of well drilling equipment will be extremely difficult.

Existing water supplies: Much of this area on Taliaboe has not been explored and drainage systems are not known nor mapped. Region has heavy rainfall (150 inches a year) and perennial streams are probably numerous. These would be most readily available source of water for combat forces. Flow of many may be greatly reduced during short season of least rainfall but it is beleived that water will be available for small forces at all times. Stream water, usually muddy, contains disease producing organisms and must be treated before use.

Several of the largest streams on Soela-Mangoli head in western mountainous area. These streams and many of their tributaries will provide a perennial source of water for combat forces. Streams in eastern highlands are not as large and dependable, but many have perennial flows.

Streams on Soela-Sanana are short and few have perennial flows near their heads. Mountains here do not irse as high, except for isolated pead, and rainfall is not as heavy as in northern islands.

Small springs are numerous in mountainous parts of all islands during rainy season. Flows are small and most probably are dry during season of least rain. Spring water is clear and of low mineral content but may be contaminated with disease producing organisms, so should be treated before use. In emergency it would be better to use spring water without treatment than stream water.

Since mountainous areas are virtually uninhabited it is doubtful if any wells exist. Small supplies can be obtained by shallow wells dug into detritus of valley bottoms. Water from wells would not need filtering but should be chlorinated to be safe for drinking. Rock underlying areas is chiefly impervious granite and granite-like rocks and drilling is not recommended.

Prepared by U. S. Geological Survey
for Chief of Engineers, U. S. Army.

CONSTRUCTION MATERIALS

MOLUKKEN ISLANDS 1:250,000

For use by
War and Navy Department Agencies only
Not for sale or distribution

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SOELA

FIRST EDITION - AMS 1

SOELA (MOLUKKAS)

SHEET NO. 1

Contouring approximate; generalized from elevations on map and published data.

Little or no information.

Sketch indicates the way the terrain was surveyed; the anchorages for the ships of the K. P. M. and other large steamers, and a diagram of the low tide current close to the coast, based upon information obtained from the native population and local native sailors. Additional information: The detail surveys, starting out from the coastline survey on Soela Sanana, were composed of observations from great distances along the coast, observing at sea towards known points along the shore and known hill and mountain tops. The altitudes were measured with an aneroid barometer, others were determined by the compass clinometer, others with a level compass.

LEGEND

- -------- Surveyed with the compass clinometer
- .... Measured by pacing-off and with the Smalkalder compass.
- -.-.-.-. Estimated distances and boussole compass measurements.
- -..-..-.. Surveys done by the mining engineer, Dr. H. A. Brouwer, azimuthal declination $1\frac{1}{2}$°, distance deviation 150 M = 500′ in distance.
- ⚓ Anchorages for the ships of the Royal Dutch Steampacket Navigation Co.
- → Direction of current
- 𝟗 Whirl currents

At high tide the direction of the current is reverse, as indicated on the map

Inferred geology: interpretation and generalization based on Brouwer, 1920.

EXPLANATION

1 Type of bedrock not known.

2 Coastal sediments, mostly unconsolidated: sand, gravel, muck (Recent), and probably some reef limestone (Cenozoic).

3 Raised reef limestone (Cenozoic, probably mostly Quaternary).

④ Conglomerate, sandstone, limestone, and soft clay, with some thin layers of lignite (Cenozoic).

5 Mostly limy shale, in places underlain by conglomerate and sandstone; some limestone (Jurassic and some Cretaceous).

⑥ Granite, granite-like, and volcanic rocks (igneous).

7 Flaky, thinly-layered rock (schist and phyllite), with some layered granite-like rock (gneiss).

8 Bedrock reported to include Units 6 and 7 above.

Reproduction Division of the Topographical Service, Weltevreden, 1918 (Simplified reprint, 1927).

AMS T561
First Edition 1943
Copied from a Dutch map dated 1927.
Grid and projection added by the Army Map Service, 1943.

Surveyed by the First Lieutenant of Infantry, P. van Halstyn, and the native surveyor, third class, Latamentik, and compiled by the former, further completed with information obtained from the Military Commander of Amboina & Ternate.

LEGEND

———	Bridle path
....	Foot path
--------	Parts along the coast which could be travelled on foot
⚓	Anchorages
⁘	Reefs, sandbanks and rocks
≡	Marsh
↥	Hot springs
✓	Marsh palm trees
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○	Forests
B. =	Mountain
L. =	Mountain
Dj. =	Bay
P. =	Island
T =	Cape
W. =	River
+500	Mountain heights in meters.

Scale 1:250,000

5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 Kilometers
5000 0 5000 10000 15000 20000 25000 30000 Yards

Lambert Conical Orthomorphic Projection
Projection and Grid are approximate.

NETHERLANDS EAST INDIES EQUATORIAL ZONE GRID (Blue)

Projection:	Lambert Conical Orthomorphic
Spheroid:	Bessel
Origin:	Equator and 110°E
False Co-ordinates of Origin	3,900,000 meters East 900,000 meters North
Scale Factor:	0.997

~~CONFIDENTIAL~~

Contour Interval: 100 Meters.

Contouring approximate; generalized from elevations on map and published data.

GN
3°30′
TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION 1943
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 3′ INCREASE

PREPARED BY U. S. GEOLOGICAL SURVEY
FOR
CHIEF OF ENGINEERS, U. S. ARMY

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 116464
2-44
1943

TO GIVE A GRID REFERENCE ON THIS SHEET
LETTER. Must be used for this sheet. Obtain from face of map or from diagram.
FIGURES. IGNORE the SMALLER figures printed near the sheet corners. These are for finding the full co-ordinates, viz. 640000
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP. viz. 640000

POINT SOFAN		LETTERS SQ	
East Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. *Estimate tenths Eastwards*	5 6	North Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itself on the face of the map. *Estimate tenths Northwards*	8 6
East	56	North	86
REFERENCE sQ5686		To nearest 1,000 metres	
Unit Square		Metre 10,000 Metres	

SOELA, SHEET NO. 1
S133-E12410/50x220

Reliability rating: Class C

Introduction

Few people, other than natives, have penetrated the interior. Several reports deal with trips afoot along stream courses and coast. Very little is known about bedrock outcrops. Most map units are based on pebbles found near stream mouths. A dense cover of tropical vegetation and deep weathering may be expected, except on steeper slopes. Sand is found in beach deposits; sand and gravel along streams. Unweathered rock crops out along some parts or streams and in coastal cliffs. Some outcrops provide rock suitable for crushed rock, riprap, and masonry. Some rock may be suitable for cement. Limestone suitable for lime is present.

There is no local source for oil or good coal. The only mineral fuel is a 10-inch bed of slack and crumbly lignite. Wood for fuel is abundant in the Soela group.

The nearest sources of mineral fuel are the oil fields of east Ceram, east Java, southeast Borneo, northwest New Guinea, and Timor; and the coal fields of east Borneo and Sumatra. There are abandoned coal mines on the island of Laoet off the southeast tip of Borneo.

Palm, bamboo, soft- and hardwood timber are plentiful and suitable for piling, bridges, buildings, and road construction. Oil, tar, and asphalt must be imported.

The geology is poorly known. On Taliaboe, Brouwer, has made one traverse across the island and two short trips inland. He made three traverses across Mangoli. One outcrop in south Soela Sanana has been studied superficially. Coastal observations have been made on all three islands. Stream gravels have been collected from various points for laboratory studies. No further information reported.

The accompanying map (1:250,000) shows construction materials and geologic outcrops recorded in Brouwer's report (1920). The smaller inset map (1:1,000,000) shows the geology for the whole area as inferred from the published information.

Map Unit	Description	Accessibility	Engineering Properties	Suitability		
				Sand and Gravel	Crushed Rock, Riprap, and Masonry	Lime and Cement
1 Bedrock not known.	No reports on these areas. Inferences based on gravels from streams draining them, and on rocks of adjoining areas.	Not known.	Not known.	Not known.	Not known.	Not known.
2 Coastal sediments, mostly unconsolidated. (latest Cenozoic).	Muck and silt in coastal swamps. Gravel and sand with more or less quartz may be found along streams draining areas of Map Units 6, 7, and 8 and on beaches near these streams. Most beach sands and sands along streams draining areas of Map Units 3, 4, and 5 probably limy. Probably some raised reef rock (mainly limestone) included in this unit.	Sand most available from beaches and under shallow waters off low-lying coastal areas. The best beaches reported are the following: On Taliaboe near T. Marikasoe (rP9818), some sand dunes behind beach east of this cape, are covered by scanty vegetation; on Soela-Mangoli on south coast between Tjapaloeloe (sR6189) and T. Kausigi (sR9491). Gravel may be found in bars and banks of streams in hilly and mountainous country on all islands. Gravel and coarse sand probably present along coast of Soela-Sanana where many short streams from mountains empty into sea. Better coastal roads and trails on Soela-Sanana make coastal sediments easier of access by land than on Taliaboe and Mangoli. Mud and silt in coastal swamp.	Swamp muck very unstable when wet, hard to work, requires extensive support, and has very poor bearing ratio. Sand unstable when wet, requires support. Sand and gravel easily worked by hand tools, drain well, and have good bearing ratio.	Suitable material. Two types of sand: (1) Limy beach sand, white to buff-colored; wears to dust at surface under heavy traffic, satisfactory for concrete. (2) Sand, associated with gravel along streams and near mouths made up of quartz grains with fragments of other minerals, have wide range in color, more durable than limy sand.	Some clay-free gravel excellent source of crushed rock, but quantities may be very limited. Not suitable for riprap and masonry.	Not suitable.
3 Raised reef rock (mainly limestone) (late Cenozoic).	Forms discontinuous benches on seaward-facing slopes along coast. Benches found up to 500 feet above sea level, but most are much lower. Poorly bedded limestone is cream-color to yellow-brown; weathers gray on surface; includes some clayey, sandy, and gravelly material. Surface is generally rough and jagged. (See Terrain Views 13, 14, and 18.)	Limestone easily secured along coast. Overburden of stony soil, or loose blocks of limestone, may be thin or lacking; little stripping needed.	Surface-hardened zone which in some places reaches water table may call for blasting, difficult to work with hand tools. There is deep weathering and decay in some places; this overburden is highly unstable and not suitable for construction. Moist unweathered rock may be easily worked when freshly exposed; soon hardens, making excellent construction material. Generally permeable. Has good bearing ratio. Surface exposed to heavy traffic wears to dust. Cuts not likely to develop slides. Fills likely to remain stable.	Not suitable.	Can be used for crushed concrete aggregate, road metal, or airfield surfacing, but crumbles and becomes dusty during crushing or where wearing surface is exposed to heavy traffic. Wearing surface is dusty when dry, covered with slippery paste when wet. Makes good water-bound macadam for light and moderate traffic. Ideal for riprap, light masonry, and coarse fraction in fills.	Probably suitable for lime. May be suitable for cement; but large bodies of limestone of uniform composition are rare.
4 Conglomerate, sandstone, limestone, and soft clay (middle Cenozoic).	All these rock types are generally limy and poorly compacted; distribution limited. Probably to be found in outcrops other than four reported to date. Includes some paper-thin layers of lignite; and a 10-inch bed of poor-quality lignite at one place (sR7439).	Rock crops out at localities shown on map. Volume not known.	Easily worked by hand tools. Quality of rock and clay not known. Other units probably better sources for all materials except lignite.	Poor source.	Not suitable.	Not suitable.
5 Mostly limy shale, in places underlain by conglomerate and sandstone and some limestone (Jurassic); and limestone (? Cretaceous).	Some conglomerate and sandstone is made of quartz, some of quartz and feldspar, and some of limy fragments. Limy shale, shaly limestone, and limestone have variable clay content. No information on thickness of beds. Soil cover generally deep. (See Terrain View 1).	Quartz sandstone with variable amounts of impurities such as feldspar crops out near coast at mouths of W. Djoerdjoga (sL4115), W. Pitaro (sL4015), W. Baloan (rP9918), and W. Fatoe (sM0365). Limy sandstone best exposed near T. Marikasoe (rP9818). Limy shale, with some interbedded limestone, most readily available on the coast of Taliaboe near the mouths of the W. mBono (sL5512) and W. Najo (sQ4989); on the coast of Mangoli near the mouths of the W. Sangatoemba (sR1390), W. Likoe (sM1200), and W. Fatoe (sM6503). Unit 5 not reported on Soela Sanana.	Limestone and sandstone drain readily; side walls of excavations require minimum support; joints and bedding planes aid in quarrying; blasting probably necessary. Limy shale with high clay content probably has developed deep residual soil; much stripping and support necessary in weathered zone; poorly drained where clay content is high; may be worked by power equipment or by hand where deeply weathered. Rock layers dip from 10° to 30° near coast; up to 90° in mountains. Landslides may be expected on steep slopes where clayey varieties predominate.	Not suitable.	Limestone is most satisfactory source. Harder quartz sandstone would be usable. Limy shale not suitable.	Homogeneous limestone, suitable for lime and cement, may be present. Limy shale probably can be used for cement, if large-scale production is not contemplated.
6 Granitic rocks and volcanic rocks (? Paleozoic).	Map areas show the limited outcrops which have been reported. Stream gravels and boulders found in areas of Unit 8 indicate wider distribution.	Most accessible outcrops between rU9676 and sQ6487, and between Dj. Sabandar (sM9901) and Dj. Koemotadomoehoe (sN1000). Under low-altitude tropical conditions a fairly deep clayey soil, and thick weathered zone may be expected. Fresh rock crops out only in sea cliffs, and some stream cuts.	Weathered rock easily removed by power equipment. Drilling and blasting necessary in excavating fresh rock. Where fractured, drains readily and is more easily quarried. Excavations in fresh rock require minimum support. Unweathered rock has excellent bearing-ratio and hard surface.	Bedrock not suitable.	Fresh rock an excellent source.	Not suitable.
7 Thinly-layered rock (schist and phyllite) some granite-like rock (gneiss). (? Paleozoic)	Highlands of Taliaboe and Mangoli mostly made up of this rock. Unit 7 predominates in greater part of Soela-Sanana. (see Terrain View 7.)	Most easily accessible on Soela-Sanana; also at places along eastern half of south coast of Soela-Mangoli. Probably deeply weathered, calling for extensive stripping.	Somewhat similar to Unit 6, but better adapted to slab quarrying and less suitable for other purposes when 6 is available. Layered structure aids in quarrying and trimming. Weathered areas probably have heavy clayey cover, and on steep slopes landslides may be expected.	Not suitable.	Fresh rock adequate, but most suitable for masonry and riprap.	Not suitable.
8 Units 6 and 7 not differentiated.	As in Units 6 and 7 above. (See Terrain Views 2 and 6.)	As in Units 6 and 7 above.	As in Units 6 and 7 above.	As in Units 6 and 7 above.	As in Units 6 and 7 above.	As in Units 6 and 7 above.

Prepared by U. S. Geological Survey
for Chief of Engineers, U. S. Army.

ROAD AND AIRFIELD CONSTRUCTION

MOLUKKEN ISLANDS 1:250,000

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~~CONFIDENTIAL~~

SOELA

FIRST EDITION - AMS 1

SOELA (MOLUKKAS)

SHEET NO. 1

Contouring approximate ; generalized from elevations on map and published data.

Little or no information.

Sketch indicates the way the terrain was surveyed; the anchorages for the ships of the K. P. M. and other large steamers, and a diagram of the low tide current close to the coast, based upon information obtained from the native population and local native sailors. Additional information: The detail surveys, starting out from the coastline survey on Soela Sanana, were composed of observations from great distances along the coast, observing at sea towards known points along the shore and known hill and mountain tops. The altitudes were measured with an aneroid barometer, others were determined by the compass clinometer, others with a level compass.

LEGEND

- -------- Surveyed with the compass clinometer
- .... Measured by pacing-off and with the Smalkalder compass.
- -.-.-.-. Estimated distances and boussole compass measurements.
- -..-..-.. Surveys done by the mining engineer, Dr. H. A. Brouwer, azimuthal declination $1\frac{1}{2}$°, distance deviation 150 M = 500′ in distance.
- ⚓ Anchorages for the ships of the Royal Dutch Steampacket Navigation Co.
- → Direction of current
- 𝟗 Whirl currents

At high tide the direction of the current is reverse, as indicated on the map

EXPLANATION

Areas possibly suitable for airfields or flight strips.

Scale 1:1,000,000

EXPLANATION

Large numbers and heavy lines indicate map areas described in accompanying table:

1. West Taliaboe
2. East Taliaboe
3. West Soela-Mangoli
4. East Soela-Mangoli
5. Soela-Sanana

Reproduction Division of the Topographical Service, Weltevreden, 1918 (Simplified reprint, 1927).

AMS T561
First Edition 1943
Copied from a Dutch map dated 1927.
Grid and projection added by the Army Map Service, 1943.

Surveyed by the First Lieutenant of Infantry, P. van Halstyn, and the native surveyor, third class, Latamentik, and compiled by the former, further completed with information obtained from the Military Commander of Amboina & Ternate.

LEGEND

- Bridle path
- Foot path
- Parts along the coast which could be travelled on foot
- ⚓ Anchorages
- Reefs, sandbanks and rocks
- Marsh
- Hot springs
- Marsh palm trees
- Bamboo
- Forests

B. = Mountain
L. = Mountain
Dj. = Bay
P. = Island
T = Cape
W. = River
+500 Mountain heights in meters.

Scale 1:250,000

5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 Kilometers
5000 0 5000 10000 15000 20000 25000 30000 Yards

Lambert Conical Orthomorphic Projection
Projection and Grid are approximate.

NETHERLANDS EAST INDIES EQUATORIAL ZONE GRID (Blue)

Projection:	Lambert Conical Orthomorphic
Spheroid:	Bessel
Origin:	Equator and 110°E
False Co-ordinates of Origin	3,900,000 meters East 900,000 meters North
Scale Factor:	0.997

~~CONFIDENTIAL~~

Contour Interval: 100 Meters.

Contouring approximate ; generalized from elevations on map and published data.

PREPARED BY U. S. GEOLOGICAL SURVEY
FOR
CHIEF OF ENGINEERS, U. S. ARMY

GN
3°30′
TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION 1943
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 3′ INCREASE

ARMY MAP SERVICE, U. S. ARMY, WASHINGTON, D. C., 116464
2-44 1943

TO GIVE A GRID REFERENCE ON THIS SHEET

LETTER: Must be used for this sheet. Obtain from face of map or from diagram.
FIGURES: IGNORE the SMALLER figures printed near the sheet corners. These are for finding the full co-ordinates, viz. 640000
USE ONLY THE LARGER FIGURES PRINTED IN THE MARGIN OR ON THE FACE OF THE MAP, viz. 640000

POINT SOFAN		LETTERS SQ	
East Take West edge of square in which point lies, and read the figure printed opposite this line on North or South margin or on the line itself on the face of the map. Estimate tenths Eastwards	5 6	North Take South edge of square in which point lies, and read the figure printed opposite this line on East or West margin or on the line itself on the face of the map. Estimate tenths Northwards	8 6
East	56	North	86
REFERENCE SQ5686		To nearest 1,000 metres	
Unit Square		Metre 10,000 Metres	

SOELA, SHEET NO. 1
S133-E12410/50x220

Reliability rating: Class D

INTRODUCTION

The three elongate and mountainous islands of the Soela group are in general relatively unknown except for parts of their coastal regions. Hills and mountain spurs commonly extend to the coast from the interior heights to interrupt the continuity of the narrow coastal lowlands. No part of the islands is more than 12 miles from the coast and most parts are less than 5 miles. As all settlements are in the narrow coastal belt, few trails penetrate to the interior mountains. On Taliaboe and Soela-Mangoli few trails cross the mountains from the north to south coasts. Most communication routes follow the coast and are probably little used by the natives as coastwise movement is generally by outrigger prau (canoe). Only on Soela-Sanana, the most populous island, are trails well-maintained; some coastal trails are reported suitable for light motorized traffic.

Information on location and character of trails and paths has been primarily derived from the base map (A.M.S. T561), copied from a Dutch map of 1927. An inset sketch map indicates that the trails and paths shown are those which were used in the preparation of the map and are not necessarily the only or the best routes available. The possibility that there are many more paths, or that some shown no longer exist, must be considered in the strategic planning.

No airfields are known on these islands. In all probability there are no available sites suitable for the establishment of airfields with runways of 6,000 feet or more. Single flight strips may possibly be located in coastal areas, but aerial photographs or maps of sufficient detail for the location of such strips are not available.

AREA	TOPOGRAPHIC SETTING	EXISTING ROADS AND AIRFIELDS	ROAD CONSTRUCTION	AIRFIELD CONSTRUCTION
1 **West Taliaboe**	Mountainous west part of Taliaboe rises to maximum altitude of more than 4,000 feet, several to peaks to more than 3,000 feet. In east, is east-west ridge of high peaks; details of mountainous terrain in west not known. Western mountains are probably a complex region of deep, narrow valleys and possibly rough accordant summits. Generally, mountains have steep slopes; ridge crests sharp. In deep mountain valleys flood plains are narrow or lacking. Along escarpment marking east margin of area, mountains slope steeply to hill lands of Area 2. Elsewhere, mountain spurs merge with coastal hill land which has relief of more than 500 feet. Coastal lowlands narrow, in part swampy; a few mangrove swamps, especially along northwest coast. Beaches mostly sandy, interrupted by rocky headlands. Small deltas at mouths of larger streams. Many short streams descend from interior highlands to coastal lowlands. Stream beds commonly dry during dry season. Small islands off north and west coasts; smaller ones generally low and swampy. Sehoe rises to height of more than 1,400 feet (425m.); from some approaches has shape of volcanic cone. Adjacent Kano Island has altitude of more than 450 feet (140 m.). Masoni believed to be in part swampy, in part lowland of slight relief.	No trails or tracks in West Taliaboe appear to be suitable for motorized movement. Routes along coast classed as suitable for foot travel; are probably poor trails which are not maintained, as native coastwide travel is primarily by outrigger prau (canoe). Coastal trails do not completely encircle West Taliaboe; commonly do not cross swampy areas or steep mountain spurs which extend to shore as rocky headlands. Two trails in east part of area cross mountains from north to south coasts. In coastal areas they follow stream valleys; cross mountain ridge marking east-west stream divide at altitudes of more than 3,000 feet. These trails may be no more than cleared footpaths through jungle vegetation and along stream banks where rocky stream bottoms, steep gradients, and waterfalls may make stream beds impassable. Three days of fair weather necessary to cross island by trail from Tano to north coast, a distance of almost 20 miles. Small islands off north and west coasts are in part encircled by coastal trails. No airfields are reported in this area.	Alignment and grades: Roads along coasts can generally be constructed with low grades (less than 3%), long tangents, and large radius curves. Roads crossing mountain spurs and hills which interrupt coastal lowlands will have steeper grades and may require hairpin curves and sidehill cuts. Low marshy coasts and deltas may in part be by-passed along inland margin of area at base of hills and mountain spurs. Along some parts of coast trails follow low elevated coastal bench of coral limestone. Where coast is low sandy beach, lined with coconut palms, highest ground is commonly low sand ridges parallel to shore. Roads crossing interior mountains can generally follow streams in coastal areas where grades are low and flood plains are relatively wide. In mountains, roads along ridge crests will have lowest grades (rarely more than 15%), moderately long tangents, and broad radius curves. Steepest grades are on slopes to ridge crests and near mountain summits; may be 20% or more. Hairpin curves and sidehill cuts necessary only on steep slopes. Streams and crossings: Streams generally small and shallow; can be forded except immediately after unusually heavy rainfall. Streams of north coast especially subject to floods from November to March, during period of northwest monsoon; streams of south coast especially subject to floods during period of southeast monsoon, from May to Sept. When in flood, streams may have swift currents, and in coastal lowlands may spread over large areas. Floods probably of short duration. Cuts along stream banks may be necessary in coastal areas. Small mountain streams may generally be forded at all seasons. Clearing problems: Low coastal areas generally covered with dense vegetation: mangrove, nipa-nipa, pandanus, coconut palms and coconut plantations. Mountain valleys choked by dense rain forest with large trees and many clinging vines. Ridge crests may have somewhat less vegetation than valleys. At higher elevations, commonly cloud-enveloped, moss forests have ground carpet of thick moss; trees covered by moss and parasitic plants. Palms and other trees along coast can be easily removed by standard equipment; rain forest more difficult. Will require cutting of undergrowth and tangle of vines before removal of large trees, many of which have large buttressed roots and are more than 100 feet high. Foundation and subgrade: Low coastal regions have poor drainage; poor foundation. Where coast is bordered by low sand ridges and elevated coral limestone benches, foundations are relatively good. Sand may be stabilized by addition of clay binder. Corduroy log and corduroy fascine may be necessary in swampy lowlands. Sidehill cuts may be required in mountains where decayed bedrock may necessitate blasting only at depth, except in areas underlain by limestone, where bedrock is usually firm at surface. In mountains, foundation problems are few because of adequate drainage and stable soils. Soils of mountains relatively stable when exposed in cuts; will not slump easily despite heavy rainfall. Materials available for construction: Sand and gravel available on beaches and in streams of coastal lowlands. Dune sands of west part of north coast and near Bay of Likitobi readily available. Clay and silt for binder available in coastal lowlands, especially in delta areas. Limy shale, limited amounts of sandstone, and conglomerate probably suitable for road metal, may border mountains in north and west and near delta of Waj Miha on south coast. Bedrock of interior mountains may be thinly layered and crumpled or granite-like. These rocks may be deeply decayed and generally unsuited for road metal. Abundant local supplies of timber for corduroy log and corduroy fascine roads; probably local supplies of bamboo.	Possible sites: No suitable sites known. Central mountains believed to be entirely unsuited for airfield sites because of relatively high relief and steep slopes. In coastal regions, airfields might possibly be located on delta of Wja Miha. Single flight strips may possibly be located on low sandy coastal spit near Bay of Likitobi or on lowlands along west and north coasts. Lack of information prevents definite selection of sites suitable for airfields or flight strips. Island of Masoni should be considered as possible airfield site. Clearing and grubbing: Vegetation in coastal areas may be easily cleared by standard equipment. Coconut palms easily removed; because of poor footing, swamp vegetation is more difficult to clear with standard equipment. Grading: Coastal sites will probably need little grading. A fill of sand, gravel, and clay binder may be necessary for swamps and small depressions. Graders generally sufficient for all problems of grading and fill. Uplifted coral terraces may need relatively small amount of grading or fill. Foundation and subgrades: Low coastal and swampy tracts will require subgrades and artificial drainage. Controlled mixture of graded fill may be suitable for stabilization. Uplifted coral limestone benches provide excellent foundation with good natural drainage. Materials available for construction: Abundant sand and gravel available in streams and on beaches. Coral limestone may be abundant along parts of coast. Limy shale, some sandstone, and conglomerate in mountain foothills; granite-like and thinly layered and crumpled bedrock, usually deeply weathered, available in mountains; all generally of poor quality for construction. Soils for binder in stabilization available on coastal lowlands and mountain slopes. Water supply from streams may be limited in dry seasons. Shallow wells on coastal lowlands will provide limited supplies of fresh to brackish water.
2 **East Taliaboe**	Hilly east part of island has moderate relief; maximum altitude probably about 1,000 feet. Slopes moderate, probably from 5 to 40%; rarely steeper. Hill summits may be more or less accordant. No known regional trend of hills and valleys. Streams are small, probably perennial; flood plains generally narrow, except near coast. Coastal lowlands generally divided into compartments by hills and rocky headlands. North coast irregular with many small bays and coves. Beaches in part marshy, in part sandy with coconut palms. Some parts of coast may be an uplifted coral-limestone bench; best developed at T. Fatoebangasa (sL9311) and along Tjapaloeloe Strait; possible distribution elsewhere not known.	Paths or trails along part of north and south coasts; not continuous around island. Are probably not maintained because most of local travel is coastwise by native prau. Coastal trails probably do not cross swampy areas and may in part be interrupted by rocky headlands and hilly areas. In west part, a short footpath joins headwaters of Waj Mejang and Waj Koejoe; highest altitude along route is 725 feet (220 m.) at divide between headwaters of streams. Throughout most of distance, footpath presumably follows stream channels. To east, a footpath, probably not maintained, crosses island from north to south coast along a ridge crest from the mouth of the Waj Mantenga to village of Waj Kadai at mouth of Waj Poto. Highest point on trail about 560 feet (170 m.) above sealevel. According to available map information, this trail follows ridge crests and not valley bottoms. No other trails known to cross island. No airfields reported in East Taliaboe.	Alignments and grades: Coastal routes of communication similar to those of Area 1; present same problems of alignment and grade. Interior hill land ridge crests are more desirable for construction of roads than valley bottoms as drainage is better, grades probably more gentle, and vegetation less dense. Valley bottoms may in part be rocky with narrow constrictions. Grades necessary between ridge crests and valley bottoms gentle to moderately steep (probably 5 to 40%) and will need hairpin curves only rarely. Main drainage divide of region may follow east-west divide between headwaters of streams draining to north and south coasts; roads may be able to follow north-south inter-stream crests which avoid major stream crossings. Sidehill cuts necessary only on steeper slopes between ridge crests and valley bottoms. Streams and crossings: Streams generally small and shallow; gradients low. Streams can probably be forded throughout year except immediately following periods of unusually heavy rainfall. Seasonal variation in distribution of precipitation on north and south coasts not marked. Stream channels probably incised in alluvium of narrow flood plain and coastal lowlands. In places cuts may be necessary at stream banks. Bridging of streams probably not necessary except at mouths. Clearing problems: Central hill land probably covered with tropical forest; coconut palms and nipa-nipa along coast. No information on extent of coastal mangrove swamps. Clearing problems generally similar to those of Area 1. Foundation and subgrade: In general similar to Area 1. Material available for construction: Coastal area similar to Area 1. Hill land underlain by limy shale, some sandstone and conglomerate. Sandstone and conglomerate may be deeply decayed and generally unsuited for construction purposes unless obtained from depth where decay is least. Limy shale may possibly be suitable for road metal. Granite-like rocks probably lacking.	Possible sites: No sites suitable for airfields are known. It is probable that hilly interior lacks flat areas sufficiently large for use as airfield sites. Some coastal lowlands may be suitable for landing strips, possibly airfields. Location of suitable areas not known but may possibly be along west part of south coast, along Tjapaloeloe Strait and along low swampy parts of north coast. Low hills backing coastal lowlands probably not obstacles for required angle of approach. Coastal areas easily accessible from shore. Clearing and grubbing: Similar to coastal part of Area 1. Grading: Similar to coastal part of Area 1. Foundation and subgrade: Similar to coastal part of Area 1. Materials available for construction: Similar to coastal part of Area 1. Hill land underlain by limy shale, some sandstone and conglomerate; granite-like rocks probably absent. Sandstone and conglomerate deeply decayed at surface; may be suitable only for fill. Limy shale may possibly be suitable for use as crushed aggregate and as subgrade for airfields.

(continued)

ROAD AND AIRFIELD CONSTRUCTION

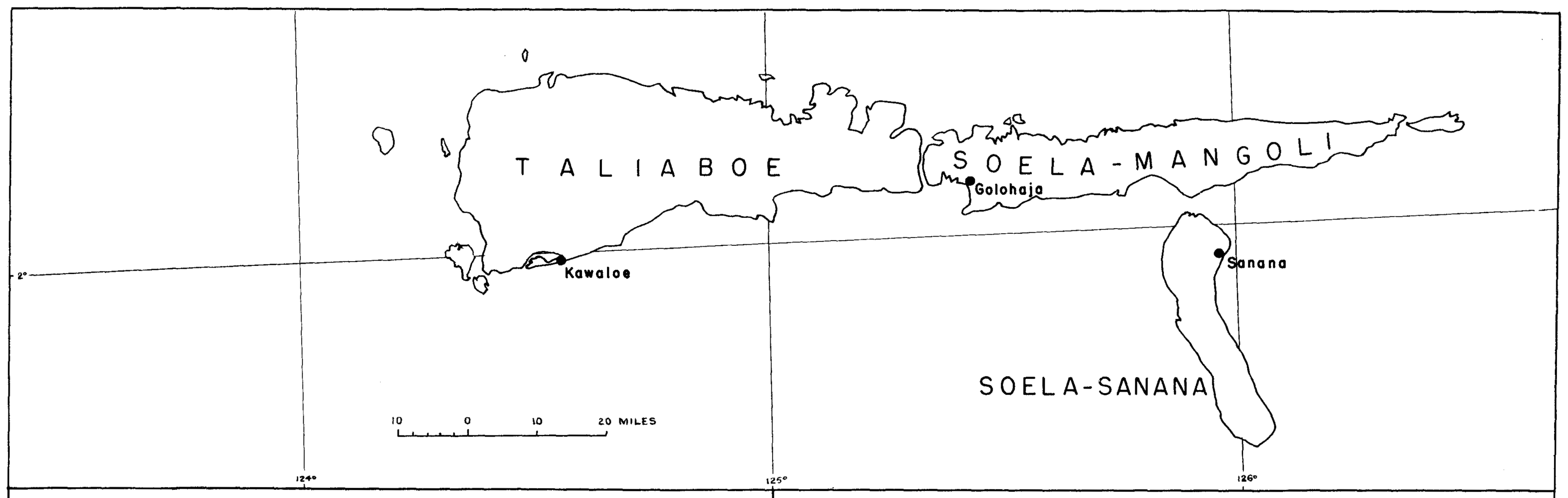
SOELA (MOLUKKAS)

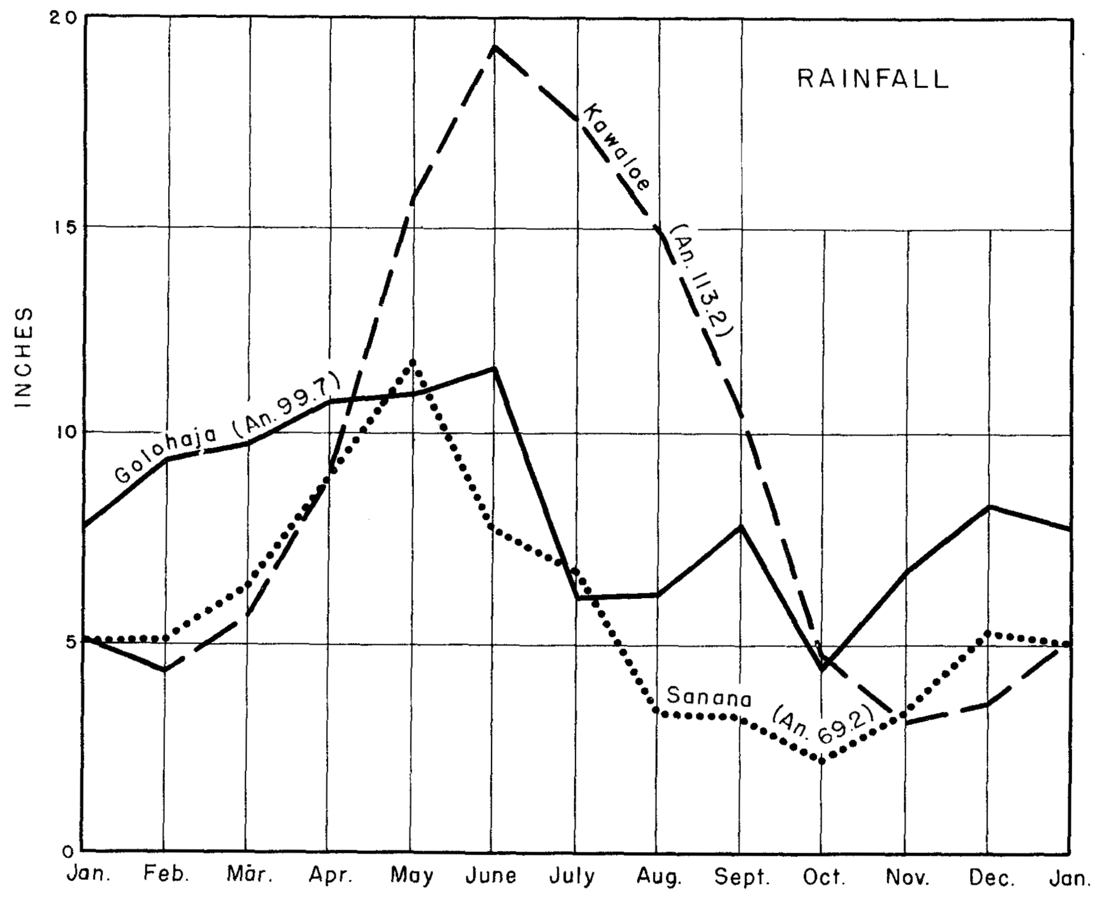
AREA	TOPOGRAPHIC SETTING	EXISTING ROADS AND AIRFIELDS	ROAD CONSTRUCTION	AIRFIELD CONSTRUCTION
3 West Soela-Mangoli	Low hill land, similar to that of Area 2. Maximum altitude about 600 feet; average about 250 feet. Narrow coastal lowlands, in part interrupted by hills and rocky headlands, extensive swamps, in part mangrove. North and south coasts irregular; many small coves, a few sandy and rocky islands. Details of topography not known. Streams small and of little importance.	Paths and trails few; good routes of communication entirely lacking. A few short stretches of paths follow north coast and north part of Tjapaloeloe Strait; are interrupted by swamps. These paths are probably not maintained and may only connect villages with coconut and nipa-nipa groves. A single path crosses island from north to south coasts, from Likoe on north coast to Sangatoem Bay on south coast. Highest point on trail is about 425 feet (130 m.) above sealevel, presumably at divide between north and south flowing streams. In large part path follows stream courses. No known airfields.	Alignment and grades: Similar to Area 2. Streams and crossings: Similar to Area 2. Clearing problems: Similar to Areas 1 and 2. Foundation and subgrade problems: Similar to Area 2. Materials available for construction: Similar to Area 2.	Possible sites: No known airfield sites. Although details of topography are not known, it is possible that landing strips or airfields might be constructed in coastal regions, especially along northwest coast where land is low and swampy. Small landing strips might be located along Tjapaloeloe Strait. All areas would be readily accessible from the sea. Adjoining hill land will provide no obstacles on glider grades. Clearing and grubbing: Similar to Area 1. Grading: Similar to Area 1. Foundation and subgrade: Similar to Area 1. Materials available for construction: Similar to Area 2.
4 East Soela-Mangoli	East part of Soela-Mangoli composed of an east-west mountain range which to north and south descends to low hills and narrow coastal lowland. Central belt of hill land (av. altitude about 1,000 feet) separates western mountains (max. altitude about 2,800 feet) from eastern mountains (max. altitudes about 3,500 feet). East part of island and adjacent Lifoematola Island are hill country similar to West Soela-Mangoli (Area 3). Generally mountain peaks are sharp, ridge crests narrow, slopes steep. Short streams flow in deep, narrow valleys to north and south coasts. Flood plains narrow or lacking; gradients steep; may possibly be dry during dry season. Narrow coastal lowlands, in places interrupted by rocky headlands and low hills, are backed by low hills and mountain spurs. West part of north coast and extreme east part deeply indented with small bays and coves; short stretches of sandy beach. Long, regular coast between Waj Fatoe (sM6504) and Waj Koema (sN 1100) reported to be backed by forested hills; may be cliffed coast. South coast generally narrow lowland, sandy beaches, backed by low hills. Narrow strait separates Soela-Mangoli from Lifoematola, a low island bordered by upraised benches of coral limestone; island interior probably similar to hill lands of Soela-Mangoli.	Small unmaintained coastal trails follow greater part of north and south coasts; in west are commonly discontinuous or lacking. Most important maintained trail on island follows south coast from Waj Tafoj (sR6189) to Waj tina (sR7488). May be suitable for light motor traffic; small streams probably fordable except following heavy rains. Four trails cross island from north to south coasts. In west part a short, probably unmaintained trail crosses low divide (sR2394) at 825 feet (250m.) between headwaters of Waj Auponhia and Waj Tabakoe. Alternate trail crosses higher mountain pass (1,600 feet, 490m.) from Boeja (sR2987) on south coast to headwaters of Waj Tabakoe; does not appear to follow stream valley. To east, small trail connects headwaters of Waj Boenono and Waj Balwa; crosses low divide (625 feet, 190m.). Throughout most of length this route follows small streams. Two trails from Oelfola (sR6487) and Mangoli (sR6887) on south coast, cross mountain divide at 1,650 feet (500m.) to headwaters of Waj Fatoe which flows to north coast. Of the two routes, that from Mangoli may be best; probably more used and in better condition, than trail from Oelfola. Distance across island at this point about 11 miles. Near east end of Soela-Mangoli, small trail connects headwaters of south flowing Waj Bisao and north flowing Waj Benoewa across divide at 660 feet (200m.). Distance across island at this point about 4 miles. No trail known on Lifoematola. No airfield reported in this area.	Alignment and grades: In coastal areas conditions are similar to those of Area 1. Routes crossing island from north to south coasts may have average grades to 10%, generally less. From coastal areas roads may have lowest grades and best alignments by following stream valleys into mountains, then climbing by steeper grades to mountain ridges where grades are generally low and conditions more suitable for road construction. Streams and crossings: Generally similar to Area 1. Most streams fordable throughout year. In coastal areas larger streams may be somewhat incised in lowlands. Clearing problems: Similar to Area 1. Foundation and subgrade problems: Similar to Area 1. Materials available for construction: Granite, granite-like, and crumpled and layered rocks suitable for road construction available throughout most of area. Deeply decayed surface layers are not as suitable as less weathered, underlying material. Adequate supplies of sand and gravel from streams and beaches. Coral limestone in some coastal areas, especially at east end of island and on Lifoematola. Abundant supplies of timber.	Possible sites: No areas known to be suitable for airfield sites. Emergency landing strips may be developed in some coastal areas, especially at eastern end of island. It is improbable that area has any sites suitable for airfields capable of use by larger planes. Clearing and grubbing: Similar to coastal part of Area 1. Grading: Similar to coastal part of Area 1. Foundation and subgrade: Similar to Area 1. Materials available for construction: Similar to Area 1.
5 Soela-Sanana	Elongate mountainous island; north-south length about 35 miles, width 6 to 9 miles. Ridge of high peaks with altitudes from about 1,300 to 1,600 feet (400 to 500m.) forms island backbone and main drainage divide. A single peak with altitude of 2,300 feet (700m.) is highest point on island. Narrow, coastal lowlands are in part swampy; in part have low sandy beaches. Coastal lowlands in part constricted, in part separated into units of different lengths by rocky stretches where mountain spurs extend to coast. Coastline generally regular with only three small sheltered bays (Sanana, Foekoeweoe, and Kabauw). Mountain slopes steep; in part may be more than 100%. Streams short; flow from central drainage divide to sea on east and west. Stream valleys are deep, narrow, and steep-walled; interstream divides are sharp-crested ridges. Flood plains generally absent except in short coastal reaches.	Coastal trails completely encircle island; connect small coastal villages. Trail south of Sanana for 12.5 miles (20km.), probably to Fat Iba, is reported to be suitable for auto traffic, but may be passable only during dry season. Trail continues south to Tandjoengbaliha as maintained track which possibly may be suitable for motorized traffic during dry season. Where maintained, trails may be cleared of vegetation to widths of as much as 10 feet. Trail from Sanana around north end of island follows coast to Kabauw on west side of island; continues south to Sekom, and may be maintained. Small bridge reported to cross mouth of bay at Kabauw. Numerous footpaths cross island from east to west coasts. Commonly follow ridge crests to low passes in main divide; less commonly follow courses of streams from coast into constricted mountain valleys before climbing to ridge crests. In general routes of communication are best developed in northern part of island. No airfields are reported to exist on Soela-Sanana.	Alignment and grades: Roads can be constructed with greatest ease on outer margin of coastal lowlands where low ridges, covered with coconut palms generally are parallel to shore. Where coast is swampy lowland, as near Kabauw and at north end of island, roads can be constructed with greatest ease on inner margin of coastal lowland, where ground has best drainage. Mountain spurs extending to coast may be by-passed on low marginal benches between open water and nose of spur, or crossed with moderately steep grades and hairpin curves. Side-hill cuts will commonly be necessary. Because of regularity of coast, alignments of roads may be by long tangents and large radius curves. All grades low, except where roads cross mountain spurs where grades may be moderately steep (to 20%, rarely more). Trails along routes where roads can be constructed across central divide generally follow ridge crests, less commonly lower courses of small streams in coastal lowlands and adjacent mountains. Local irregularities may necessitate curves of moderate radius on ridge crests and in valleys, short radius curves on steep valley walls. In general, grades along lower stream courses and on ridges will be less than 10%, but will be much greater on slopes between valleys and ridge crests. Hairpin curves may be used to lower average road gradient. Streams and crossings: Small streams which cross lowlands can be forded except immediately after unusually heavy rainfall. Beds are commonly sandy and gravelly, some boulders and cobbles. Banks at inner margin of coastal lowland may in part be several feet high and require short dugways. Only streams in swampy northern part of island, where beds are muddy; may hinder cross movement of motorized vehicles. Small streams in mountains may generally be forded at all seasons. Clearing problems: In low, coastal areas, roads must be cut through mangrove and swamp vegetation of nipa-nipa and pandanus. In mountains, roads must be cut through dense tropical rain forest of large trees and thick undergrowth. Coconut palms of coastal plantations probably planted in rows so that they will not hinder movement of vehicles. Palm trees can be easily removed by standard equipment. Foundation and subgrade: Foundation commonly poor in coastal regions because of poor drainage. Small ridges parallel to coast have best subgrade and drainage. Foundation in large part sand (quartz and coral) and minor amounts of gravel; may be mechanically stabilized by addition of clay binder from adjacent lowlands. Corduroy log and corduroy fascine may be required in swampy areas. In mountains sidehill cuts may be necessary. Decayed bedrock of mountains can generally be excavated with hand tools or ordinary dozers; only deepest excavations will require blasting. Foundation problems in mountains few because of adequate drainage and stable soils. Exposed sidehill cuts will not slump or gully easily despite heavy rainfall. Materials available for construction: Sand and gravel available on beaches and in stream valleys through island. Clay for binder available in coastal lowlands, especially along north and south coasts, and near Kabauw on west coast. Bedrock of central and north parts of island is largely decayed layered and crumpled dark micaceous rock. Only fresh rock obtained at depth suitable for construction. Granite-like rock in northeast part of island deeply decayed at surface; less decayed at depth and suitable for road metal. Some sandstone and conglomerate in south part of island; probably poorly consolidated and deeply decayed but may be suitable for road metal. Distribution not known. Coral reef limestone available at Fowata (sR7039), Tandjoengbaliha (sR8236), and possibly other places along coast and on reefs of north coast; is suitable for road metal. Abundant local supplies of timbe for corduroy and light construction; some local supplies of bamboo.	Possible sites: No areas suitable for airfield sites known on Soela-Sanana, although narrow landing strips may be built along coast. Emergency landing strips might be located near Sanana, on north coast, and on west coast near Kabauw. Narrowness of coastal lowlands, possible local obstacles, and swampy ground probably limit the number of suitable airfield sites on island. Clearing and grubbing: Emergency sites will have to be cleared; vegetation consists primarily of mangrove and nipa-nipa palms, coconut palms, and bamboo. Clearing may be easily accomplished by dozers except where poor footing of swamps hinders movement of dozers. Grading: Coastal sites, cleared of vegetation, will probably need only fill of sand, gravel, and clay from adjacent areas. Graders can spread material. Foundation and subgrade: Subgrades of transported fill will require artificial drainage. With proper mixing of fill components, soils can be stabilized. Materials available for construction: Sand and gravel readily available on beaches and in stream channels. Dark, thinly-layered and crumpled bedrock underlies adjacent mountains; when deeply decayed is unsuited to construction. Granite-like rock present in northeast part of island. May be deeply decayed at surface and unsuited for construction. At depth, where less decayed may be suitable. Soils for stabilization available on adjacent coastal lowlands and mountain slopes. Water supply from small streams and shallow wells adequate for construction purposes in coastal areas.

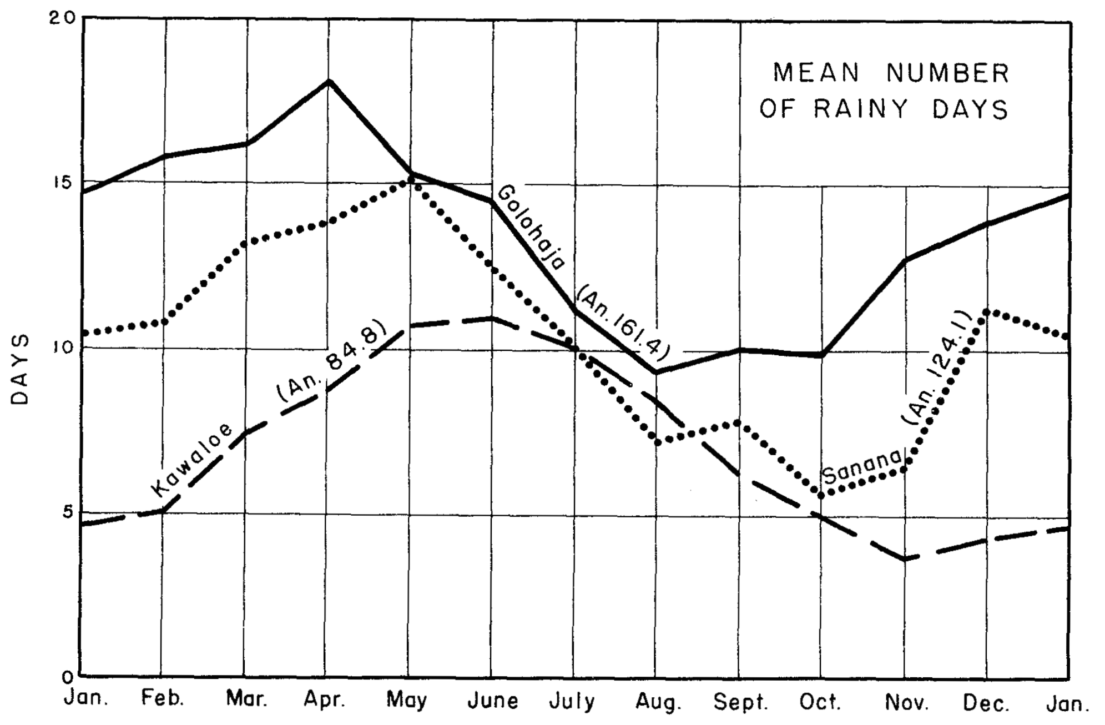
Prepared by U. S. Geological Survey
for Chief of Engineers, U. S. Army.

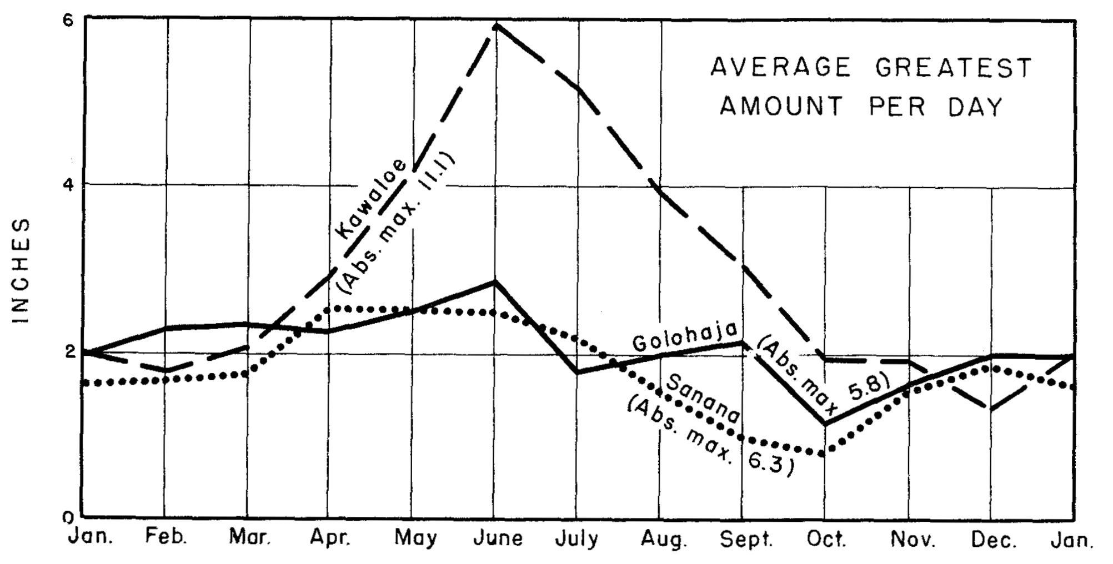
SOELA (MOLUKKAS)

CLIMATE









The Soela Islands lie between 130 and 170 miles south of the Equator. Though climatic data for the islands themselves are extremely few, the available data can be supplemented by many shipboard observations made in the surrounding seas. To be expected are light monsoonal winds with seasonal shift in direction, moderate to high rainfall, high temperature with little seasonal variation, and high humidity.

The islands lie in the area of typical monsoonal winds. From the middle of May to the middle of September a steady more or less constant breeze blows from the southeast or south-southeast, with the greatest strength and constancy in July and August. From the middle of November to the middle of March the wind comes from the northwest or north-northwest, with a maximum in January and Feb. A month or more of very light and variable winds are characteristic of the time of change in direction; during either monsoon there may be rare days of calm. Though the wind in the daytime is fairly steady it is seldom strong; velocities of about fifteen miles per hour, enough to make the sea rough for small boats, may be expected. About 7 or 8 PM the wind dies down and does not again attain its full strength until 9 or 10 AM. Storms, like those of the northern temperate region, and typhoons are rare. Since the velocity of the monsoonal wind is not high, local topographic features, especially mountains, may generate winds with greater strength than the monsoon. In the coastal areas of Taliaboe and Soela-Mangoli, where mountains descend steeply to the sea, there are land breezes at night, and these are said to be definitely chilling. During the daytime, at any season, there may be sea breezes.

Rainfall records taken over a 10 year period are available for 3 stations. Sanana has a moderate annual precipitation of 70 inches; Kawaloe and Golohaja show considerably higher figures of 114 and 99 inches. Kawaloe has a very pronounced maximum during the southeast monsoon (May to August); during the northwest monsoon it is in the rain shadow of the high mountains of Taliaboe. Sanana, sheltered behind the mountains of Soela-Mangoli during the northwest monsoon, shows a similar but less pronounced maximum and minimum. The greater absolute amount at Kawaloe may be explained by the nearness of the station to high mountains. Golohaja has no mountain barriers either to the north or south; its rainfall is more or less equally distributed over the year.

Temperature data for the islands are not available except for the one partial record given in table below. This record, based on an unknown number of observations, is for the months of June, July, and August only, the warmest months in the town of Sanana.

Temperatures at Sanana (June, July, and August)

	Maximum	Minimum	Average (in degrees F)
7 AM	79	70	74
2 PM	90	83	86
9 PM	81	72	76

For the islands as a whole an estimate of expected temperatures may be made from shipboard measurements of the air temperature just above the surrounding seas. This varies only from 81°F (August) to 84°F (January), essentially the temperature of the sea water. The coastal temperatures to be expected in the islands will, on the average, fall 1° to 3°F below the figures given above since in the daytime, when the steady wind is blowing from the sea, the heating effect of the land is somewhat minimized; at night, when there is a calm, cooling to 5 or 10° below the daytime temperatures is common. The day-night temperature range is much greater than the seasonal variation, which is probably no more than 2 or 3°.

Humidity is always high. In the driest months it will seldom if ever fall as low as 70%; most monthly averages will be 90% or higher. The daily range may be from 80 or 85% during the daytime to 100% just before sunrise when dew may form. Local winds descending from the mountains may help to lower the humidity and alleviate suffering from the combination of high temperature and humidity. This combination is likely to be particularly enervating in deep valleys away from the coast where the valley walls and heavy vegetation cover shut off the breeze without effectively reducing the heating power of the sun. Travel along such routes is likely to be more arduous than that along ridges and divides.

A cumulus cloud cover often forms at 9 or 10 AM over the higher parts of the islands. In the early morning the low coastal parts of northern Taliaboe and Mangoli often have fog.

(For more detailed data on climate and weather see other intelligence sources.)

Prepared by U. S. Geological Survey
for Chief of Engineers, U. S. Army.