

swell sets into it during the southeast monsoon.

Tubi Serang Island lies on the east side of Fak Fak Road near the southeastern end of a 1,600-yard projection of the coast reef; it is wooded, partly with nutmeg trees. It was reported (1963) that the coast reef was extending south and west. Shoal water in the vicinity of Tubi Serang was reported (1958) to have extended in a general southwesterly direction. On the northern side of the island there is a fine beach on which are a few houses.

Metti Metti Reef, lying on the west side of Fak Fak Road, is about one-half of a mile long north and south, narrow, and steep-to. It dries over a great part at low water, and is marked on its east side by a pillar buoy surmounted by a red cylinder. There is a deep passage between the reef and the shore. A drying reef lies $1\frac{1}{2}$ miles westward of the northern end of Metti Metti Reef. In the vicinity of the road the shore of the mainland is fringed by a reef about 350 yards wide.

At the head of the road is a long narrow inlet into which the Sungai Fak Fak empties. Beacons mark the entrance of the inlet. Since the bed of the lower part of the river consists of porous limestone which absorbs the water, the stream is dry at low water for a distance of about one-half of a mile from its mouth. At high water small craft sail up the river to obtain fresh water. This water, however, is unfit for drinking.

6-126 Anchorage can be taken in 24 fathoms about 220 yards off the coast reef. Vessels approaching the anchorage steer a northerly course toward the pier at Fak Fak and anchor when the channel between Ekka and Pandjang becomes open, or when a steep point of land to the eastward is seen midway between the northern point of Tubi Serang and the southern point of Keke Islet.

A light is shown from the head of the pier at Fak Fak from 1800 to 2330.

Tides.—At Fak Fak there is both a diurnal and a semidiurnal tide, but the latter predominates. The spring highs and the spring lows of the two tides do not coincide. The

highest water level occurs between February and April and between August and October, the lowest in January and July. The maximum rise and fall that can be expected are, respectively, about 2.6 feet above and 3.0 feet below mean sea level.

6-127 Fak Fak ($2^{\circ}56'S$, $132^{\circ}17'E$), a village located on the top of a hill, 328 feet high, on the mainland nearly abreast the east end of Pandjang Island, is the capital of the district of West New Guinea. It is the regional administrative center and residence of a Netherlands Government Official. The village had a population of about 2,000 in 1957. Most of the inhabitants are Mohammedans; there is a mosque in the village. Fak Fak is the trade center of this part of New Guinea. Trails lead from the village to Kokas and to Salakiti and Patipi Bays.

Pier.—There is a pier for small craft in the inlet at Fak Fak. Depth at the pier head is reported to be about 12 feet. A steep trail leads up to the village from this pier.

Supplies.—Provisions are scarce and very expensive. Drinking water is unobtainable, but boiler water can be procured from the river.

Communication.—Vessels call regularly. A radio station is maintained at Fak Fak. The village has a post office. Regular air service is maintained via seaplanes.

Hospital.—There is a hospital at Fak Fak.

6-128 Coast.—On the coast southeastward of Fak Fak there are several villages; Wambar, the most important of these, is situated 13 miles southeastward of Fak Fak. Urat Island, 20 miles southeastward of Fak Fak, is separated from the mainland coast by a passage called Pintu Kechil which is only 35 feet wide at its narrowest part and at low water is not navigable even by launches. Pintu Besar, separating Urat from Semai, has depths of more than 11 fathoms and a width of 100 to 200 yards between the drying reefs; it is navigable by small vessels in case of necessity.

Semai rises to a height of 1,581 feet in the center. The island has two Papuan villages; Krabutwiendi, the most important of the two, stands on the western part of the north coast, near Tanjong Tubokmatan.

6-129 Tanjong Kirana, situated $24\frac{1}{2}$ miles southeastward of Fak Fak, is high;

within a radius of about $3\frac{1}{2}$ miles of the point there are several reefs with depths of 2 to $3\frac{1}{4}$ fathoms over them. A reef which dries at low water is situated 6 miles westward of Tanjong Kirana. These reefs are generally well-marked by discoloration.

Kawar Nuwa, a high, isolated, and very conspicuous islet, is situated 4 miles northwestward of Tanjong Kirana.

6-130 Weri Bay.—On the north side of Tanjong Kirana the coast bends eastward and forms a large bight named Weri Bay into which a stream of the same name empties. This bay affords good anchorage in 22 to 27 fathoms during the southeast monsoon; during the northwest monsoon, however, this anchorage is untenable. On the shores of the bay are several settlements. Except for three dangerous reefs at the head of the bay, near Weri village, the bay is clear of dangers.

6-131 Sebakor (Rijklof van Goens) Bay, between Tanjong Turkanggur, located $5\frac{1}{2}$ miles southeastward of Tanjong Kirana, and Tanjong Tongerai, is divided into two parts by Karas, Faur, and Tuburuasa Islands. The western part of the bay is clear except for a few reefs near the coast, but the eastern part is strewn with dangerous reefs; although there are channels between these reefs, it is not certain that there are not more than are shown on the charts. With good visibility, all of the reefs are marked by discoloration. That part of the bay near the islands is safe, and good anchorage can be obtained everywhere. There are very few inhabitants except on the islands.

6-132 Karas Island ($3^{\circ}28' S.$, $132^{\circ}40' E.$), consists of two fairly high portions connected by a low, narrow strip of land; from a distance it appears as two hills. Mas and Tamisa are the two principal villages on Karas; the inhabitants are Mohammedans and are more or less civilized. There is anchorage off Mas in 30 to 40 fathoms; closer inshore there is danger of fouling the anchor in the coral.

Faur is practically level all over, except for a conspicuous 1,079-foot summit in its southern part. Tuburuasa is about the same height as the northern part of Faur. On the latter island are Kiaba and Wamartopi villages, and on the former are Tuburuasa and Tarak. The native chief at Mas village exercises some authority over these islands.

Reefs.—A reef with a least depth of $3\frac{1}{4}$ fathoms lies 4 miles west-northwestward of the northwest point of Karas Island. A bank, with a depth of $9\frac{1}{4}$ fathoms, the position of which is approximate, was reported, in 1954, to lie about 4 miles west-southwestward of the same point.

A drying reef lies close off the eastern side of Tuburuasa Island in a position about 5.6 miles $076\frac{1}{2}^{\circ}$ from the northern summit of Karas Island.

6-133 Coast.—Between Tanjong Tongerai and Sanggala Bay the coast is high, steep, and rocky, with deep water close to. There is limited anchorage during the east monsoon in the small inlet northward of Tanjong Tongerai. Gunung Baik, situated near this point, rises gradually from the coast to an elevation of 3,452 feet.

There is safe anchorage either northward or southward of some islets that are connected to the shore by a drying reef in a position about 12 miles southward of Tanjong Tongerai. A bank with depths of 23 fathoms over it lies $3\frac{1}{2}$ miles westward of these islets. A reef, with a depth of $3\frac{3}{4}$ fathoms over its north end, was reported in 1950, about 5 miles southwestward of these islets.

6-134 Sanggala Bay.—A peninsula named Mommon projects 3 miles in a northwesterly direction from the coast at a position 21 miles south-southeastward of Tanjong Tongerai, and thus forms Sanggala Bay. This bay can easily be recognized at a considerable distance to seaward by a waterfall which appears as a clear white patch; it is located close northward of the entrance to the bay. There is a detached $4\frac{1}{4}$ -fathom shoal about 1,200 yards westward of the waterfall. Dur-

ing the southeast monsoon there is good anchorage in depths of 16 to 22 fathoms close northward of the waterfall. The greater part of the shores of the bay are steep and high, with occasional patches of sand between the rocks.

A little to the northward of the waterfall there are two islets on a reef. Some islets and reefs lie off the north point of Mommon; inside the bay are three detached reefs. Anchorage can be taken inside the bay, either northward or southward of a drying reef that lies about $1\frac{1}{4}$ miles northwestward of the head of the bay. A good mark is afforded by three high rocky islets that lies about one-half of a mile off the west side of Mommon Peninsula; they are visible for some distance from both the northward and the southward. The remainder of the islets under the coast are less conspicuous. A reef with a depth of less than 3 fathoms extends for one-half of a mile from the northwestern point of the peninsula.

6-135 Wap Bay ($3^{\circ}58'S.$, $132^{\circ}49'E.$), is obstructed by three islands that lie on a large connecting reef across its entrance, and there is room in the bay for only one vessel. A 1-fathom shoal lies in a position about 500 yards northward of the northwestern island that obstructs the entrance to the bay. Anchorage can be taken in the bay in a depth of 28 fathoms, but during the southeast monsoon even the inner part of the bay is exposed to swells. There are several islets near the head of the bay; northward of the easternmost islet is an inner bay which, however, is accessible only to very small boats.

6-136 Cape van den Bosch is steep and high and was reported (1961) to be a good radar target up to a distance of 30 miles. About 1 mile northward of the cape is a low

stretch of coast behind which the land rises steeply. Between this low land and Wap Bay there is deep water right up to the shore. About 2 miles northward of the cape, where the coast is less steep and is fronted by a drying reef, there is a fairly good anchorage, sheltered against the southeast monsoon. A small river, which dries at the mouth, flows out behind an islet on the south side of the low portion.

6-137 Coast.—The coast from Cape van den Bosch to Tanjong Bohia, situated about 102 miles eastward of the cape, forms part of Kumawa and Kowiai Provinces; Kamrau Bay divides the two provinces. The entire area comes under the Ambon Residency, and the native power is vested in the Rajah of Namatotte.

Between Cape van den Bosch and Tanjong Usau the coast consists of high, densely wooded land that terminates in cliffs which descend sheer into the sea. Eastward of Tanjong Usau the coast is low as far as Tanjong Simora, after which it again becomes high and rocky with densely wooded mountains in the interior. The principal islands off the coast between Cape van den Bosch and Tanjong Bohia are Adi, Namatotte, Aidoema, and Kajoe Merah.

The Kowiai coast has many indentations, the most important of which are Kalmana, Bitsjaroe, Triton, Kajoe Merah, and Laka-hia Bays.

Inasmuch as the highland in the interior affords no conspicuous points, the principal landmarks along this coast are the headlands and islands. Further conspicuous landmarks are the flat hill, 810 feet high, on the southern extremity of Namatotte, the Lamansiere Range, the two pointed summits on Kajoe Merah, and Bohia Hill. In the Kumawa dis-

trict there are three fairly large rivers, the Karoefa, the Borowai, and the Ombwallar; there are no important rivers in the Kowiai district.

6-138 Anchorages.—In the west monsoon there is good anchorage anywhere between Cape van den Bosch and Tanjong Simora ($3^{\circ}40'S.$, $133^{\circ}41'E.$), during the east monsoon the only safe anchorage is off the west coast of Adki, or on the ridge that connects Nusa Wulan to the mainland coast. Eastward of Bitsjaroe Bay the only available anchorage is close under the coast, and even there the depths are usually very great.

6-139 Winds and weather.—The following particulars concerning the weather were obtained during the survey of this part of the coast, between April 1910 and the end of March 1911:

Dense clouds and light winds from all quarters accompanied the change period at the beginning of April, followed by sharp westerly squalls. Easterly winds gradually prevailed and, at the end of April, the southeast monsoon was established, with general east-southeasterly winds varied by westerly, southwesterly, and southerly gales. In the middle of July the wind increased in force and veered more to the southward. During September the southeast monsoon gradually reached its strength, and at the end of that month very fine weather set in with the change.

The west monsoon began at the end of November with much less force than that of the east monsoon, and land and sea breezes succeeded each other regularly. The general direction of the wind was west-northwest, although considerably influenced by the contour of the land. The change set in about the middle of February with calms and fair weather.

The east monsoon brought cool weather

and considerable rainfall. The west monsoon was warmer and drier.

Tidal currents.—The flood current sets to the eastward between Cape van den Bosch and Tanjong Usau and to the west-northwestward along the north and south sides of Adi Island; the direction of the ebb current is opposite to that of the flood. These currents, meeting in Nautilus Strait, set up strong confused currents with swirls, and make the greater part of the strait appear to be filled with breakers.

There are no tidal currents of any importance elsewhere except in the northern part of Kamrau Bay and in the narrow entrance to Argoeni Bay, where a strong ebb current causes heavy tide rips.

6-140 Nusa Wulan ($4^{\circ}07'S.$, $132^{\circ}47'E.$), is a small inhabited island lying close to the shore between Cape van den Bosch and Tanjong Papisoi; it is connected with the coast by a ridge with depths of less than 10 fathoms. During the east monsoon there is safe anchorage in a depth of $7\frac{1}{2}$ fathoms between Nusa Wulan and the mainland; with the west monsoon anchorage can be taken close under the east shore of Tanjong Papisoi, westward of the Derdi Reefs.

The small Derdi Islets lie on a drying reef close to the coast immediately eastward of Tanjong Papisoi; there are two more islets northwestward of them.

6-141 Adi is a low, narrow island 23 miles long in a northwest and southeast direction. There are some hills in the western part of the island, but they have no conspicuous summits. The island is uninhabited for the greater part of the year; Manggawitu village, on the north side of the island, consists only of a few dwellings used by people from Keliwala and Karawatu when they visit Adi to make proas. In the east monsoon there is good anchorage off the west coast.

The southeastern extremity should be given a wide berth.

Dangers.—There are four dangerous reefs to the northward of Adi. Between the westernmost, which dries 5 feet and Tanjong Loematta there is a narrow passage which is obstructed by a $9\frac{1}{4}$ -foot patch. The other three reefs, the easternmost of which lies $5\frac{1}{4}$ miles northward of Tanjong Watukebo, have depths of $6\frac{1}{2}$ to $8\frac{1}{4}$ feet. A rock awash lies about $6\frac{3}{4}$ miles north-northeastward of Tanjong Watukebo.

Toembœ Toembœ Islet, which is encircled by an extensive drying reef, lies about 5 miles southward of Adi. There are a number of reefs between this islet and Adi, but the depths over all of them are more than 3 fathoms; the south coast of Adi is otherwise clear.

6-142 Nautilus Strait separating Adi Island from the mainland coast, has a width of 4 miles, between Tanjong Kainara and Tanjong Oesau, and depths of 7 to 27 fathoms. In the northeastern part of the channel are several islets, among which are Urobi, with a small rocky islet westward of it, Unoga, and Noes Tiga; Simla reef lies northwestward of Unoga (Oenoga). Farther eastward are two low inhabited islands, Karawatoe and Keliwala, which are surrounded by a fairly wide coral reef and have depths of $1\frac{1}{2}$ to $3\frac{1}{4}$ fathoms between them. There are several shoal patches between the two islands and the mainland which extends southwestward from the mouth of Sungi Karoefa.

Directions.—A vessel approaching Nautilus Strait from westward should keep the southeast end of Oerobi in line with the northwesternmost point of Karawatoe, bearing 067° , until Tanjong Oesau ($04^\circ 04' S.$, $133^\circ 14' E.$) is abaft the beam and bearing 271° . Thence the vessel should bring this point astern on this bearing and pass between Oerobi and the dangers northward of Adi. Care should be taken not to deviate from this line, as the current sets across the channel in the vicinity.

During the northwest monsoon there is good anchorage everywhere; in the east mon-

soon there is no safe anchorage until the direction of the wind shifts more to the southward, when there is a good berth close under the north coast of Karawatoe or Keliwala.

6-143 **Swept channel.**—A channel with a least width of 1,300 yards, leading through Nautilus Strait, has been swept to depths of 33 and 20 feet within the limits shown on the chart. This channel is entered immediately northwestward of Tanjong Kainara, thence it leads in a northeasterly direction, passing southeastward of Urobi (Oerobi) Island, and northwestward of Karawatu and Keliwala Islands.

A 5 fathom patch lies about 800 yards southwestward of the southwest end of Urobi. There are several shoals, with depth of $3\frac{1}{4}$ to $4\frac{1}{2}$ fathoms, within 3 miles westward and north-northeastward of this same islet.

A $2\frac{3}{4}$ -fathom shoal is located in a position about $3\frac{1}{4}$ miles 151° from the easternmost rock of Noes Tiga. An 11-foot shoal is located on the northwestern side near the northeastern end of the swept channel. A $3\frac{1}{2}$ -fathom patch, dragged to a depth of 20 feet, lies in midchannel near the northeastern end of the swept channel. A pinnacle rock, dangerous to navigation, lies about $6\frac{3}{4}$ miles 052° from the western end of Keliwala Islet.

A 16-foot patch swept to about 13 feet lies about 13 miles northeastward of Keliwala Island. A 17-foot shoal swept to 15 feet lies about 12 miles northeastward of Keliwala Island. About $3\frac{1}{4}$ miles southeastward of the 17-foot shoal is a 21-foot shoal swept to a depth of 17 feet.

Currents.—Within Nautilus Strait and southward of Adi, the flood current sets eastward and the ebb west-northwestward with velocities up to $1\frac{1}{2}$ knots. Sometimes, the sea breaks over the entire length of the strait due to the confluence of 3 currents from different directions.

6-144 **Sungi Karoefa** ($3^\circ 53' S.$, $133^\circ 23' E.$

drains the wide marshy area between Sebakor and Kamrau Bays. The ebb and flood currents were observed to occur regularly on the river, even during

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neap tides, as far up as the survey vessel went.

Vessels not more than 164 feet in length can navigate the Karoefa for 16 miles from the mouth. Beyond that point, although there is sufficient water for some miles more, the narrowness of the channel proves an obstacle. On the bar off the entrance to the river there was, in 1959, a depth of 10 feet at low-water springs, but this is equivalent to 15 feet at mean sea level and 16 feet at high-water springs. H. O. Chart 6110 shows a depth of 9 feet at lowest low water on the bar. High water occurs about 20 minutes earlier on the bar than at Kaimana.

Vessels will cross the bar safely by following these directions: Bring the northern extremity of Keliwala Island into range with Tagiri village and steer for it until a sounding of $2\frac{3}{4}$ fathoms is obtained. Then haul to the northward until some stakes placed on the edge of the drying shoal near Tagiri village are seen; these stakes can be passed close-to. On the north side of the channel is a small, very dangerous boulder which uncovers at low water. The water in the river is so muddy that no discoloration can be counted on to point out the dangers. There are two isolated reefs in the river, but they can safely be passed by holding to the north bank. For the greater part of the way the banks are covered with mangroves, but every now and then a solid piece of ground covered with a different sort of vegetation is seen. These solid banks, together with the numerous creeks which discharge into the river, are its only conspicuous features.

Above Kanaka village, which is used as temporary shelter for people engaged in building proas, there are no signs of human habitation along the river.

Anchorage.—Anchorage can be taken in 22 to 26 feet, anywhere on the mud flat, which extends over 5 miles offshore between the entrance of Karoefa River and Kamrau Bay, during the northwest monsoon.

A rock awash lies about 5 miles eastward of Tagiri village.

6-145 Kamrau Bay

—Northward of the mouth of Sungi Karoefa there is a wide bight in the northern part of which is the entrance to Kamrau Bay. This bay, which trends north-northwesterly divides the districts of Kumawa and Kowiai. At the entrance, on an extensive bank, lie Madais Besar and Madais Kechil, low, wooded islets that are covered with high trees; between these islets is a large rock that is overgrown with vegetation. Noes Toemba, a rock 157 feet high, to the northwestward of Madais Besar, is connected to Tanjong Taronmeta by a drying reef. Serotte Islet lying northeastward of Madais Besar on the northern end of a long, narrow ridge that runs in the direction of the navigable channel, is low but covered with high trees.

Westward of the Madais Islands the bay is shoal, but there is a navigable channel on either side of Serotte Ridge; since there are two reefs of $2\frac{1}{4}$ and $2\frac{3}{4}$ fathoms and a drying sand patch in the northern end near Serotte, the western of these two channels is not recommended. In the eastern channel, leading close along Tanjong Simora ($3^{\circ}40' S.$, $133^{\circ}41' E.$), deep draft vessels must take great care to avoid the foul ground westward of that point.

A 2-fathom shoal lies about $1\frac{1}{2}$ miles westward of Tanjong Simora. In this vicinity an area has been swept to depths of 13 feet, and other areas lying off Tanjong Simora have been swept to depths of 17, 18, 21, and 28 feet. For the limits of these areas refer to the charts.

Two detached shoals of 13 and 11 feet, each swept to depths of 10 feet, lie about midway between Tanjong Simora and Madais Kechil. A buoy is moored close off the edge of the reef extending southeastward from Serotte.

Westward and northwestward of Serotte an area has been dragged to depths of 21

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and 16 feet, within the limits shown on H. O. Chart 6113. Eastward of Serotte there is a smaller area dragged to 18 and 16 feet.

Caution.—An area in the approaches to Kaimana and Kamrau Bays is dangerous due to mines. It lies between the parallels of $3^{\circ}38'$ S., and $3^{\circ}43'$ S., and between the meridians $133^{\circ}38'$ E. and $133^{\circ}41'$ E.

The flood tidal current sets into Kamrau Bay with velocities of 2 to $2\frac{1}{4}$ knots, and the ebb sets out with velocities of 2 to $2\frac{1}{2}$ knots.

From Tanjong Simora steer first to the northward and then to the north-northwestward so as to pass close along the east side of Serotte. Northward of Serotte the western side is very steep and the lead is not of much use; a partially drying bank extending along the east side makes navigation rather difficult. A reef with a least depth of 4 feet lies in front of the entrance to Argoeni Bay, and there is a dangerous shoal with a least depth of $1\frac{1}{2}$ fathoms southwestward of the reef that extends from Sjiirnusu Island. The water in Kamrau Bay is so muddy that the reefs are not marked by discoloration, but, since the mud bank on the western side dries at low water, the navigation of the northern part of the bay offers no difficulties.

Sungi Ombwallar and Sungi Irimawa empty into the northwestern part of Kamrau Bay, but they are less actual rivers than overflows from the extensive marshes in this district. As far as these rivers were surveyed the water remained salt and the flood and ebb currents were observed to succeed one another regularly as in Kamrau Bay. The banks, except for a few slightly higher places, consist of densely overgrown marsh land that is intersected by small creeks and is flooded at high water.

The Ombwallar is navigable for some distance, and with the assistance of the chart is fairly easy to navigate. The Irimawa has only a narrow central channel with extensive mud banks on either side; these banks seldom dry and, as the sides of the navigable

channel are steep and the water muddy, the river is difficult to navigate. There are no important villages in this neighborhood.

6-146 Argoeni Bay ($3^{\circ}27'$ S., $133^{\circ}36'$ E. [redacted]), the entrance to which is at the head of Kamrau Bay, extends northward for about 40 miles. The greater part of the shore in the southern portion is steep-to, although high in only a few places; the western side of the northern portion is everywhere low, but the eastern side is fairly steep, rocky, and densely overgrown. There are several rather high mountains on the eastern side of the bay; Mount Genofu, the southernmost of these mountains, is 4,078 feet high. Argoeni Bay is much more thickly populated than other parts of the coast near here and the villages are larger and more prosperous. In the northern part the houses are nearly all built out into the bay on piles above the shore reefs and are connected with the shore by bridges of tree trunks. There are many crocodiles in the bay.

Argoeni Bay is difficult to navigate particularly the southern portion, unless it has been previously buoyed; the heavy swirls make it difficult to keep a vessel on her course, and the muddy water makes it impossible to detect any dangers. The entrance is about one-half of a mile wide and is obstructed by four very dangerous reefs, three of which are only a few yards in diameter and are very steep. These reefs uncover from 1-foot to about 10 feet. Beacons, with white cylindrical topmarks, mark the two northern reefs which obstruct the entrance of Argoeni Bay.

Northward of these four reefs the west side of the channel is clear up to about 1,400 yards northward of a small islet lying close under the western shore, opposite a gray patch in the rocks on the eastern shore; at this point there is a long, narrow reef with three drying rocks on its southern end, but the eastern side of the channel is now clear.

The channel is very narrow nearly midway between the two Ajar Poertar villages, located on the east side of the bay. A drying rock lies close southward. The straight stretch between Berdaha village and Tanjong Nagoera is clear except for a pinnacle rock, about 100 yards off the western shore, and $2\frac{1}{2}$ miles northward of Berdaha. Three islets, which lie close off Tanjong Nagoera, reduce the width of the navigable channel, considerably.

The channel, northward of Tanjong Nagoera, trends northerly. Several patches, of less than 2 fathoms lie on the east side. Five islets, two drying rocks, and a reef which dries, lie on the westside.

Northward of Orroem Island the channel shoals rapidly to a least depth of 9 feet, through a narrow passage leading north-eastward. Southward of Soesoenoë Island the channel, deep and wide, turns eastward. About 2 miles northward of the north end of Faternoës Island there are depths of less than 2 fathoms. The channel then parallels the northern spur of the Tongaran Range to the mouth of the river bearing the same name. Small craft only can navigate the bay northward of this position.

6-147 Directions.—Argoeni Bay is easily recognized by Genofa, which can be seen from all directions, and the entrance can be clearly seen. Dangers within the entrance are described in sec. 6-146.

A vessel should enter with the northwest end of Loem, an islet located close off the southern shore about $2\frac{1}{4}$ miles eastward of Sjimoesoe, in line with an islet bearing 062° . The islet is located about 1 mile east-northeastward of the south end of the same island. This course, which leads with a least depth of 26 feet, should be maintained until the west end of the island near Namasan village, located $1\frac{1}{4}$ miles southward of Sjimoesoe, is in line with the west end of the island northward of the village bearing 190° .

The west shore should be kept at a distance of not less than 350 yards. The east shore is less steep-to and can be picked up by the lead. It is inadvisable to enter Argoeni Bay on a full tide; the best

time is about 1 hour after low water, when the three most westerly reefs in the entrance are still visible and the ebb current is weak. Slack water, which lasts only a few minutes, occurs from $1\frac{1}{2}$ to 2 hours after high and low water.

When near the islet facing the gray patch one must cross over to the eastern shore, which can be closely approached northward of the patch. At low water the drying rocks on the southern end of the reef near the western shore can easily be seen. Because of the heavy rips and swirls it is impossible to navigate the portion between the two Ajar Poertar villages on a full tide; vessels must keep close to the eastern shore in order to pass eastward of the rock that dries at low water.

The straight portion between Berdaha and Nagoera villages presents no difficulties; a rock that dries at low water and a projecting reef with a least depth of $3\frac{1}{4}$ fathoms lie on the eastern side. A midchannel course should be steered to pass between the three islets off Tanjong Nagoera and the eastern shore; beyond that position the vessel should steer over toward Tanjong Nagoera and bring the east side of the southern of the three islets in range with that point. This course will lead westward of 2 rocks, which dry, located 1 mile north-northeastward of Tanjong Nagoera.

In the wide portion of the bay to the northward of Tanjong Nagoera the tidal currents suddenly slacken. A good lookout must be kept for the drying reefs that extend to the southward from Soesoenoë and to the northward from Faternus; the ebb current here sets toward these reefs.

6-148 Kaimana Bay is a wide bight formed between Tanjong Simora and the high tongue of land which terminates in Tanjong Bitsjaroe ($3^\circ 44' S.$, $133^\circ 48' E.$).

The low west shore of the bay, on which lies the small village of Simora, is fronted by a broad drying reef which is 1,600 yards wide abreast the mouth of Sungai Air Tiba. At about 1 mile above its mouth this river divides into two branches; the

right-hand branch is navigable for about 1 mile, and the other branch for 3 miles.

A reef extends off the shore immediately southward of Kaimana Village, on the eastern side of the bay. A red buoy marks the west side of the reef. A buoy is also moored off the edge of the reef on the west side of the bay.

Safe anchorage in about 5 fathoms can be obtained about 200 yards off the head of the pier at Kaimana. A light is shown on the pier from 1830 to 2330, and until sunrise on 24 hours prior request.

A 3-foot patch and a 3-fathom patch lie about $1\frac{1}{2}$ miles east-southeastward and $1\frac{1}{4}$ miles southeastward, respectively, of Tanjong Simora; $2\frac{1}{4}$ and $2\frac{3}{4}$ -fathom shoals lie about $2\frac{3}{4}$ miles eastward and $1\frac{3}{4}$ miles southward, respectively, of the same point. Foul ground lies within three-fourths of a mile southward and southwestward of Tanjong Bitsjaroe.

Tides.—In Kaimana Bay there is both a diurnal and a semidiurnal tide, but the latter predominates. The spring lows of the two tides can coincide and thus produce, in May or June and November or December, a maximum fall of 4.6 feet below the mean level. The maximum rise that can be expected is 2.6 feet above the mean level. The mean high-water interval at Kaimana is 1h. 42m. Mean high-water springs rise 8 feet, mean high-water neaps rise $6\frac{1}{2}$ feet, and the mean tide level is 5 feet.

A light is shown occasionally from the head of the pier fronting the village.

An aeronautical radiobeacon transmits from a position about $\frac{3}{4}$ mile southeastward of the village of Kaimana.

6-149 Kaimana Village, lying on the northeastern shore of Kaimana Bay, can be made out from some distance by the customhouse, which has an iron roof, the flagstaff on the residence of the Netherland Government representative, several houses with corrugated iron roofs northward of the latter, and the village mosque. In 1957 the village had a population of about 1,000 and included the place of residence of a rajah who rules over the adjacent territory. Fronting the customhouse is a pier with a length of 240 feet, a width of 13 feet, and a depth of 4 feet at its head.

Supplies.—Water is reported to be available and reasonable.

Communications.—Regular air service is maintained. The airfield is located $4\frac{1}{2}$ miles northwestward of the village.

Medical.—There is a modern hospital.

6-150 Bitsjaroe (Bitsjara) Bay, lying immediately eastward of Kaimana Bay, extends about 10 miles to the northward; its shores almost everywhere consist of high, rocky walls, but there is some low land in the northwestern part of the bay, near the mouths of Sungi Sisiandang. Farther inland there is a cleft, running in the direction of Kaimana, between Mount Lowai, 2,484 feet high, and the mountains eastward of Kaimana Bay.

In the middle of the bay are three reefs with depths of $\frac{3}{4}$ to 3 fathoms over them. There are several dangerous reefs in the southeastern part of the bay, near the northern entrance to Koningin Sophia Strait.

6-151 Namatotte Island, paralleling the coast south of Bitsjaroe Bay for a distance of 10 miles in a north and south direction, is formed by a narrow mountain range which descends precipitously into the sea except near the northern end, which terminates in a drying reef that extends 300 yards farther northward and eastward than charted. A small hill, 810 feet high, located in the southern part of this island, is a conspicuous landmark. The highest elevation of the island, 1,467 feet, is about $2\frac{1}{4}$ miles northward of this hill. Off Namatotte village, situated on a low part of the island to the southward of the flat hill mentioned above, good anchorage may be obtained during the southeast monsoon. To the southward of the village the island terminates in a single mountain. Sagin Island lies off the south point of Namatotte Island; the channel between Sagin Island and Namatotte contains several small islets and should not be used by vessels.

Java Bay, on the east side of Namatotte Island, is very shoal at its head; in it there is anchorage in 10 fathoms with just sufficient room for one vessel to swing. The small bay on the west side of the island immediately opposite Java Bay is closed by a reef.

6-152 Koningin Sophia Strait, separating Namatotte from the mainland shore, connects Bitsjaroe Bay, to the northward, with Triton Bay, to the southward. The coast on both sides is high and rocky, and at many places rises almost perpendicularly from the sea. The north part of the strait is obstructed by several reefs and should not be used. The drying coastal reef off the north point of Namototte is marked by discoloration.

Southward of Raaf Bay the strait is clear. Good holding ground is found everywhere in the strait. The current sets in the direction of the strait, but the numerous rocks in the northern part cause swirls.

6-153 Raaf Bay ($3^{\circ}45' S.$, $133^{\circ}54' E.$), situated on the eastern side of Koningin Sophia Strait, penetrates some distance inland in a southeasterly direction and affords safe anchorage under all conditions. The entrance is narrow, but, if a good lookout is kept for the reef on the north side, it is not difficult to enter; this reef dries 3 feet and is well-marked by discoloration. Up to about halfway across the bay the holding ground is good, but in the inner part of the bay are several reefs between which there is a narrow boat channel that leads to the mouth of the river at the head of the bay.

6-154 Triton Bay, located eastward of the southern end of Koningin Sophia Strait, is $6\frac{1}{2}$ miles wide at its entrance, between Tanjong Aiwa and the northwestern end of Aidoema Island, and 11 miles long northeastward and southwestward. It is completely surrounded by high rocky shores except in the northern corner of the bay, where the Tombona River flows out through a cleft between the Lamansiére Mountains and the high land eastward of them. Maoewara and Semisarom Islands lie in the northwestern part of the bay. The channel between these islands and the one between Maoewara and the mainland shore are not navigable by

large vessels; the latter channel can scarcely be used even by boats. The small bay northward of the Awarawis Islets is also navigable only by boats.

A number of islets and rocks lie inside as well as off the entrance of Triton Bay. Noesurumi Islet, the largest of the group situated in the middle of the bay, has a reef extending from its eastern side. A detached reef with a depth of 1 fathom lies about $\frac{3}{4}$ mile westward of the northern end of Noesurumi Islet. The other islets can all be approached closely. Ambasinsi, lying off the southern shore, has a village on its southeastern side, and is the only inhabited island in the bay.

A 3-fathom reef lies about $\frac{1}{2}$ mile southward of Laoezaro, an islet located about $2\frac{1}{2}$ miles westward of the westernmost point on Aidoema Island (sec. 6-155). A $3\frac{3}{4}$ -fathom reef lies about $1\frac{3}{4}$ miles northeastward of the latter point. No other detached dangers are known to exist within the bay.

The navigation of Triton Bay presents no difficulties. Inasmuch as the southwestern edge of the drying reef off the mouth of the Tombona River is very steep, and as the water is so muddy that the dangers are not marked by discoloration, vessels proceeding to the anchorage off Lobo village should steer close in to the western shore after rounding Tanjong Kumura.

6-155 Aidoema Island, on the east side of the entrance of Triton Bay, is $11\frac{1}{2}$ miles long, northwest and southeast, high and steep-to, especially so, on its southwest side where the 100-fathom curve lies less than $\frac{1}{2}$ mile offshore. There are two peaks on Aidoema, the highest is 1,622 feet but the charted summits are not easily recognized. Aidoema village is located on the northwest end of the island. A dangerous $1\frac{1}{2}$ -fathom reef lies close northwestward of the two islets located off the northwest side of the island.

Anchorage can be taken within the inlet located about $3\frac{3}{4}$ miles eastward of Saroe Noes (Sarue Nus) by vessels with local knowledge. Small vessels can anchor in the inlet located about $4\frac{1}{4}$ miles south-south-eastward of the latter point. A $1\frac{3}{4}$ -fathom reef which extends some distance offshore, restricts the swinging area.

6-156 Dramai Island, off the southeast end of Aidoema and in the southern entrance to Iris Strait, is hilly and partly cultivated. There is fairly good anchorage in depths of 13 fathoms about 1,600 yards eastward of the northwest point of the island, which is much lower than the other parts of the island. Southward of the anchorage there is a creek which probably runs through to the west coast.

6-157 Iris Strait, separating Aidoema from the mainland, has a general width of about 2 miles except in the northern entrance,

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where the navigable channel is reduced to one-half of a mile, and in the southern part, where it is split in two by Dramai Island. The strait is deep and clear and offers no difficulty except for a strong current, especially in the northern entrance, near Saroe Noes (Sarue Nus), where whirlpools may be encountered.

The eastern shore, like the western, is steep-to. The inlet to the northward of Dramai, named Mangkawu, affords good anchorage.

6-158 Kajoe Merah Bay.—Across the entrance to this bay lies Kajoe Merah Island ($4^{\circ}01'S.$, $134^{\circ}23'E.$), which is roughly triangular in shape and attains a height of 1,821 feet on its southern side; there is another conspicuous summit, 1,250 feet high, a little farther westward. The south and west sides of the island are steep and rocky, but elsewhere the land slopes up gradually. Salakula Island lies off the western end of Kajoe Merah, leaving a channel about 600 yards wide, deep and clear, between it and Tanjong Wandala, located on the mainland; the passage between Salakula and Kajoe Merah is not navigable. Off the eastern end of Kajoe Merah are three small islets; the channel on either side of this group is clear. Off the north point of Kajoe Merah are several islets, the largest of which are Nasir, Marewa, and Mondan; the passage between these islets and Kajoe Merah is fit only for boats.

The inlet on the west side of the bay between Tanjong Wandala and Tanjong Sawara Sekai is clear of dangers. Its sides are surrounded by high cliffs. The small bay, southward of Tanjong Wikromboes is almost closed by a 3-foot reef extending about $\frac{1}{2}$ mile south-southeastward and a 1-fathom reef which fronts its entrance. The Airawoi River, which flows out into a small cove with mangrove-covered shores at the head of Kajoe Merah Bay, is navigable by boats; fresh water is found 3 miles up this river. At low water, when the reefs can be seen, this cove is easily navigable.

The eastern shore of Kajoe Merah Bay, between the Airawoi River and Tanjong Feraï, is for the greater part low and covered with mangroves, and is backed by steeply rising mountains. Northward of Tanjong Feraï is an inlet, in the southeastern part of which are a number of dangers that mostly dry at low water and lie inside the 5-fathom curve. Between Tanjong Feraï and Tanjong Awura the coast is steep and rocky.

Dangers.—Two rocks of 9 and 29 feet lie about $2\frac{3}{4}$ and 2 miles, respectively, north-westward of Tanjong Feraï. The western extremity of the islet which lies $1\frac{1}{2}$ miles north-westward of Tanjong Awoera, in range with the eastern side of the northernmost of the islets farther to the northwest, leads westward of these dangers.

6-159 LAKAHIA AND ETNA BAYS.—Lakahia Bay is $8\frac{1}{2}$ miles wide at its entrance between Tanjong Awoera and Tanjong Bohia, and penetrates the land in a funnel shape for 11 miles to the northeastward, after which it bends around to the eastward and continues far inland; the latter portion, known as Etna Bay, is only about three-fourths of a mile wide. A drying bank which extends westward from Tanjong Bohia merges into a reef with depths of less than 3 fathoms that extends for about $2\frac{1}{4}$ miles southwestward. Shoal patches with depths of $13\frac{1}{2}$ to $16\frac{1}{2}$ feet lie about $2\frac{1}{2}$ miles southwestward, and a reef, awash, lies about $2\frac{1}{4}$ miles south of Tanjong Bohia. A group of coral patches with depths of $3\frac{1}{2}$ to 7 feet lie about $1\frac{1}{4}$ miles westward of Tanjong Bohia. Two small islets about 7 feet high lie near the end of the drying bank extending westward from Tanjong Bohia, and a reef, which dries 3 feet, lies about $\frac{3}{4}$ mile north of the point.

Lakahia ($4^{\circ}04'S.$, $134^{\circ}36'E.$), a low, wooded island that is surrounded by a reef, lies in the entrance to Lakahia Bay; the reef extends for 1 mile from the southwestern extremity of the island. The channel between Lakahia Island and Tanjong Bohia is very narrow at the

northern end, where it is limited by the mainland shore bank and a steep-to reef that extends from the northeastern extremity of Lakahia; this passage should not be used without local knowledge. The entrance between Lakahia and Tanjong Awoera is wide and deep.

Between the southeastern side of Lakahia Island and the shore eastward there are two areas swept to depths of 16 and 24 feet. Another area, about $2\frac{1}{2}$ miles westward of the west end of Lakahia, is swept to a depth of 39 feet.

The northwestern shore of Lakahia Bay is steep and, for the most part, high and rocky, but it is broken here and there by a sandy beach immediately behind which the land rises. The eastern side is tree-covered and low except near Tanjong Bohia, where a conspicuous hill of the same name rises to a height of 338 feet. Tanjong Tarella, $8\frac{1}{2}$ miles northward of Tanjong Bohia, is a low, sandy point that is covered with trees; three-fourths of a mile westward of the point is a long, narrow, drying bank. The eastern side of Lakahia Bay is, in a great measure, occupied with an extensive bank over which there are depths of less than 3 fathoms. Tarera Bay is shoal and unimportant.

Between the drying bank and the western shore there is an irregularly shaped area swept to a depth of 15 feet.

There are two passages to Etna Bay. Each is narrow and hazardous. The west passage, close along the west shore, passes between a 2-foot rock off Tanjong Etaboeri and Karang Japbari, which has a least depth of 1-fathom. The east passage lies between the drying bank westward of Tanjong Tarella and Karang Japbari. In 1958 the controlling depths were 18 and $19\frac{1}{2}$ feet, respectively, in the east and west channels. The approach to the passages has been swept to 15 feet leading on either side of a $6\frac{1}{2}$ -foot bank. Local knowledge and alert piloting are essential for a safe transit through this area. Numerous unmarked dangers within the area are best shown on the chart. A village stands on the north side of Tanjong Tarella.

A middle ground with a least depth of 6 feet near its north end lies about 1 mile eastward of Tanjong Etaburi.

6-160 Anchorage.—There is good anchorage anywhere in Lakahia Bay. During the east monsoon, since a heavy swell then runs to the north-northwestward around Lakahia Island, the best anchorage is off the mouth of the small Kambelangan River, westward of Tanjong Etaburi. In the west monsoon there is anchorage off the northwestern side of the bay, eastward of Tanjong Amanmawa.

Tides.—At Lakahia Island there is both a diurnal and a semidiurnal tide, but the latter predominates. The spring highs and the spring lows of the two tides do not coincide. The highest water level occurs in May and November. The maximum rise and fall that can be expected are, respectively, about 3.6 feet above and 3.6 feet below mean sea level.

6-161 Etna Bay, narrow and landlocked, is entered from Lakahia Bay between Tanjong Itewi ($3^{\circ}56' S.$, $134^{\circ}39' E.$ [REDACTED]) and Tanjong Bawia, two steep projections of the coast; the western of these, Tanjong Itewi, is steep-to, but on its eastern side a row of drying rocks extends nearly 200 yards from the shore between Tanjong Oeloepala and Tanjong Bawia. Immediately outside the outer rock the depth is 4 fathoms. A drying sandbank lies off Tanjong Oeloepala. The north side of the bay is mountainous; the highest point, Bamana Mountains, about 3 miles northeast of the entrance, has an elevation of 4,265 feet. The shore is not steep-to everywhere, but is broken by stretches of low, mangrove-covered land. The south side is similar to the north except that the mountains there are in detached groups; this more open coast has a perceptible effect on the local weather conditions. In the western part of the bay, north-

ward of the western entrance point, is a waterfall with a graduated drop of about 650 feet. At the head of the bight westward of the waterfall is a small stream, named Emborra, which affords fresh water.

Sungi Oremma, the principal river that flows into Etna Bay, empties on the south shore, southward of Tanjong Jaramabonga; it is navigable for a distance of about 3 miles. The banks are mostly of mud with an occasional small patch of firm ground. Sungi Uwawa flows out on the north shore opposite the Oremma, but it is of little importance and divides into several branches which soon end among the mountains. Right at the head of the bay there is a small stream which always provides fresh water.

The depths in the bay vary considerably, the narrowest parts being the deepest; southward of Mount Puran and northward of the Seriwi Range, where the bay is only one-half of a mile wide, the depths are, respectively, 26 and 16 fathoms. In the broader parts there are depths of 6 to 10 fathoms. The eastern part of the bay is shoal, but a channel with more than 5 fathoms extends to within $5\frac{1}{2}$ miles of the head, and 3 fathoms can be carried 3 miles farther.

A settlement stands on the north shore, about 1 mile north-northwestward of Tanjong Itewi. An oil storage tank farm is located on the northern side of Etna Bay abreast Tanjong Bawia.

There is a pier, 65 yards long, with a depth of 13 feet at its head.

6-162 Shoals.—A patch of 4 fathoms lies about 600 yards northeast of Tanjong Itewi on the west side of the entrance.

On the north side of the bay, just westward of a projecting point 3 miles eastward of the entrance, there is a shoal with a length of 1 mile and a least depth of 3 feet; the outer edge of this shoal is about 600 yards from the shore.

North of Tanjong Jaramabonga ($3^{\circ}56' S$, $134^{\circ}45' E$. [REDACTED]) are two narrow banks of mud and sand with least depths of 2 and $2\frac{1}{2}$ fathoms, respectively, and 1,600 yards east of the northern of these banks and 300 yards offshore there is a 3-fathom patch.

Northward of the Seriw Mountains in the middle of the narrow channel is a steep-to reef that partly dries; the deeper and preferable channel is southward of this reef.

About 6 miles eastward of Tanjong Jaramabonga the south shore turns sharply southward; westward of the point thus formed is a bank of less than 3 fathoms which extends 800 yards from the shore over a length of more than 1 mile.

6-163 Anchorage.—There is anchorage throughout the length of Etna Bay in a moderate depth of water. Current eddies and poor holding ground make it inadvisable to anchor in the narrow parts of the bay or in the bight north of Tanjong Itewi.

Weather.—Between November 1904 and February 1905 rain storms occurred almost daily in Etna Bay, either from off the mountains or from the westward. The weather was unusually fine in the forenoon, but after midday there was generally rain, particularly in the narrower parts of the bay, sometimes accompanied by heavy squalls from the mountains. When the northwest monsoon set in, in the second half of December, there was considerable swell from the southwest

outside the bay; this was felt as far as the entrance to Etna Bay.

6-164 Tides.—In Etna Bay there is both a diurnal and a semidiurnal tide, but the latter predominates. The spring highs and the spring lows of the two tides do not coincide. The highest water level occurs in April or May and October or November; the lowest in May and November. The maximum rise and fall that can be expected are, respectively, about 4.3 feet above and 4.3 feet below mean sea level.

Tidal currents.—The tidal currents in Etna Bay turn four times each day; the strength depends on the range, the phase of the tide, and the breadth and depths of the part of the bay. Generally the current at springs has a velocity of 3 to 4 knots in the narrow parts of the bay. The currents follow the direction of the channel. Whirlpools, necessitating careful steering, are formed at the drying reef in the narrow part of the bay and at various places where the turns are sharp; in the bight northward of Tanjong Itewi, particularly, the water has a continuous turning motion.

6-165 Directions.—When approaching Lakahia Bay from the southward, Mount Buru to the eastward is a good mark, inasmuch as it stands quite apart and close to the coast; upon closer approach Bohia Hill and Lakahia Island serve to point out the entrance to the bay. The southern portion of Lakahia Bay presents no difficulties. From the westward the 1,598-foot mountain on Tanjong Awura is a good mark. Vessels approaching from the eastward must give Tanjong Bohia and Lakahia Island a wide berth.

After passing between Tanjong Amanmawa and Lakahia Island bring Tanjong Tarella, which is made conspicuous by its trees, to bear 068° and cross the bank abreast Tanjong Etaburi on that course over a least depth of $3\frac{3}{4}$ fathoms. When in depths of

6 fathoms alter course to 040° until Tanjong Wariwi bears 285° , after which steer straight for the center of the entrance to Etna Bay. On the east side of the navigable channel near Tanjong Tarella there are two drying patches which at low water assist in giving the direction of the channel.

In the entrance to Etna Bay a drying sand-bank and shoal water between Tanjong Ulupala and Tanjong Bawia ($3^{\circ}56' S.$, $134^{\circ}40' E.$, *H. O. Chart 2982*) considerably reduce the width of the navigable channel. The deep western side near Tanjong Itewi should be held and the bay gradually steered into as Tanjong Saimba, the point on the north shore about $3\frac{1}{2}$ miles eastward of Tanjong Bawia, opens clear of Tanjong Bawia. When about 2 miles eastward of Tanjong Bawia keep on the south side of the channel to avoid the bank to the westward of Tanjong Saimba.

If the current is strong, give this point a good berth in order to avoid the eddies, and keep along its eastern side until the part of the bay eastward of Tanjong Jaramabonga comes open, and then cross over and keep along the north side of that point and on the south side of the channel until the partly drying reef in the narrowest part of the channel abreast the Seriwu Mountains has been passed; the channel northward of this reef is also clear. After passing the reef gradually steer over to the north shore until abreast the steep headland $2\frac{1}{2}$ miles eastward of the reef, when a course of 116° on a conspicuous spur of the mountains on the south shore leads farther into the bay. The channel here narrows considerably and is steepest on the north side; the best plan is to keep on soundings on the south side of the channel and act according to the results obtained.

6-166 Coast.—From Tanjong Bohia the coast trends east-southeastward for about 13 miles to Tanjong Nariki, which is a spur

of Mount Buru and may be recognized by some large yellow patches against the rocks. Several streams discharge on this part of the coast; one of them, named Omba, is approached through a channel in which there was in 1910 a low water depth of 4 feet and which leads along the east side of two sand-banks in the entrance. These banks dry at low water, and the outer one has a few bushes on its north side. Vessels enter on a course of 029° , which leads through the channel with the east entrance point a little on the port bow; when past the bar they keep along the left bank. The western channel has 1 foot in it at low water; at high water there are often breakers in this latter channel. The depths are subject to change. The banks are low and wooded in places. The mouth of a stream situated $2\frac{1}{2}$ miles northwestward of Tanjong Nariki may be recognized by a row of bare tree trunks. A sand-bank projects out from the eastern entrance point of this stream.

Mount Buru ($4^{\circ}13' S.$, $134^{\circ}56' E.$, *H. O. Chart 2999*).—Eastward of Tanjong Nariki the land rises for about $7\frac{1}{2}$ miles to Mount Buru, a ridge 14 miles long and 4,334 feet high, which slopes steeply on the east side. Between it and the Charles Louis Mountains to the eastward there is a valley with hilly ground.

6-167 Coast.—Between Tanjong Nariki and Tanjong Namaripi, about 29 miles east-southeastward, several rivers discharge. Buru River, the northwesternmost of these, empties at a position 9 miles southeast of Tanjong Nariki. The coast between this point and the mouth of Buru River is high and rocky, but beyond that it is lower and is closely backed by hills. Breakers have been reported at a position $1\frac{1}{2}$ miles west-southwestward of the mouth of the river, but at 3 miles south-southeastward of the entrance the depth is 8 fathoms.

A village is situated about 9 miles south-

eastward of the mouth of the Buru River, on the eastern entrance point of the Petawai River; the natives, who are timid, speak Ceramese and a little Malay.

Katera River, between the Petawai and Tanjong Namaripi, has a large village on the east side of the entrance.

Tanjong Namaripi is a steep foreland which appears as an island when seen from the eastward, and is visible for a distance of 30 miles.

6-168 Mountains.—From a few miles eastward of Mount Buru the Charles Louis Mountains, from 5,000 to 10,000 feet high, extend in an easterly direction and join the Snow (Sneeuw) Mountains; this latter chain attains a maximum elevation of 15,709 feet. It is probably connected with the Victor Emanuel Range to the eastward. The highest summits are covered with snow, and the range is visible from the southward at a distance of 75 miles in clear weather, but it is generally enveloped in clouds except in the early morning or at about sunset. The chain in general appears to be gently undulating. Below the high summits there are a number of broad table-shaped tops.

6-169 The coast between Tanjong Namaripi and Naurio Islet, about 100 miles to the east-southeastward, is low and densely wooded, presenting a monotonously uniform appearance, relieved only here and there by gaps at the mouths of the rivers. Along this coast there are no known off-lying dangers except near Naurio Islet.

The Umar River discharges 8 miles eastward of Tanjong Namaripi. About 22 miles beyond the mouth of this river is a wooded point that is conspicuous from both westward and eastward. Near the wooded point three small rivers discharge; the easternmost and westernmost have villages near them. At about 1½ miles southward of this point the depth is 6 fathoms.

A remarkably flat summit lies about 9 miles northwestward of the wooded point

and 5 miles from the coast; it is a good mark when bearing between 045° and 315°.

6-170 The Uta River (4°33' S., 135°59' E., *H. O. Chart 2999*) discharges about 45 miles eastward of Tanjong Namaripi. It has a width of 650 yards at the mouth and 220 to 450 yards for a considerable distance above the mouth. Light-draft vessels ascend the river for several miles. The current, especially in the upper part of the river, is rather strong.

6-171 Bokamau River entrance, which lies about 9 miles eastward of the Uta, may be easily recognized. The western entrance point projects sharply, and the eastern point appears as two islets. From the latter point a drying bank extends 2 miles in a southwest direction; breakers have been seen at a distance of 2½ miles from the shore. This river is not navigable.

Anchorage.—Between the Uta and Bokamau Rivers there is anchorage anywhere in depths of 6 to 8 fathoms; breakers were seen off the entrances to two rivers along this coast. Off the mouth of the Bokamau the depths decrease rapidly toward the shore.

6-172 The Mimika River (4°41' S., 136°28' E., *H. O. Chart 2999*), which empties at a position about 22 miles eastward of the Bokamau, can easily be recognized by an isolated group of trees near Kaukenau village just west of the mouth of the river. This river can be navigated only by very small steamers and by them only at high water. A narrow channel winding between large sandbanks leads to the entrance, which is 80 to 90 yards wide. The channel shifts and the depths appear to vary. Inasmuch as the depths decrease rapidly, caution is necessary when approaching the river.

The coast is low, swampy, and covered with mangroves. The banks at the entrance are bordered by a strip of sand partly covered with trees among which are some primitive dwellings. A few miles up the river

the water is fresh even at flood tide. At some distance up the river there is a large village. The natives, who are friendly, speak a language which is quite different from that of the natives of the Oetoemboewe Basin, about 110 miles to the southeastward, and is unintelligible to the people of Fak Fak and Etna Bay.

There is good anchorage in 6 fathoms, with the west entrance point of Mimika River bearing 014°.

6-173 Coast.—The Keakwa River empties into the sea about 5 miles eastward of the mouth of the Mimika. There are depths of 2 to 3 feet at low water in the channel leading to this river and 6 to 7 fathoms in the river itself. Banana, coconut, and sugar plantations have been found a few miles up the river.

Beacon.—A conspicuous, large white target is located about 3 miles eastward of Keakwa River. A beacon, topmarked by a white triangle, is located close southeastward of a reef, on the coast about $\frac{1}{2}$ mile southeast of the mouth of the Keakwa River.

Shoal.—Between the Mimika River and the Keakwa River, depths of 5 fathoms or less extend up to 2 miles offshore. A shoal, with a depth of 17 feet, lies about 2 miles southwestward of the mouth of the Keakwa River.

The Timora River, $3\frac{1}{2}$ miles eastward of the Keakwa, has two villages at its mouth; in the channel leading to the river there are depths of 2 to 3 feet.

The Atuka River, $2\frac{1}{2}$ miles eastward of the Timora, has an island in the entrance; in 1904 the western entrance point was marked by a white dead tree trunk that was visible from a considerable distance.

The Wania River, 5 miles farther eastward, is practically closed by a large drying bank. The island in the entrance is covered with high trees. The approach to Murauka village, at the east entrance, is made difficult by breakers. Shoal water extends $2\frac{1}{2}$ miles off the entrance.

The Aika River discharges through a wide mouth at a position about 5 miles north-westward of Naurio Islet.

The depths off this part of the coast decrease gradually from 30 fathoms at 10 miles to 5 fathoms at about $1\frac{1}{2}$ miles off-shore. About 5 miles south of the entrance to the Aika River, however, there is a $3\frac{3}{4}$ -fathom reef on which surf has been sighted when there was a slight swell. Vessels should not anchor in less than 7 or 8 fathoms if there is any sea or swell.

The flood current sets east-southeastward and the ebb west-northwestward along the coast, but the currents are irregular and are influenced by the discharge from the rivers.

6-174 Wajeteri and Naurio Islets ($4^{\circ}56'$ S., $136^{\circ}50'$ E.), are connected with the shore by banks and are made conspicuous by their high trees. A dry sandbank extending 1 mile seaward from Naurio forms the eastern side of the channel to the Wajeteri River, which discharges just westward of that islet. There are depths of 2 to 3 feet in the channel.

6-175 Anchorage can be obtained off Naurio in 5 fathoms, with the western extremity of Puriri Islet bearing 005° and the mouth of the Inabuka River bearing 084°. Since the depths shoal rapidly from 10 to 4 fathoms, it is advisable, when approaching the shore on a northerly course, to keep the lead going and to reduce speed.

Shoal water extends southwestward and southward from Wajeteri and Naurio Islets. At a position 5 miles southwestward of the islets there is a depth of 4 fathoms. Breakers were seen at about $1\frac{1}{4}$ miles northward of this 4-fathom spot. The edge of the bank passes 4 miles southward of the islets and trends in a southeasterly direction at a distance of 5 to 12 miles from the New Guinea shore. The edge of the bank off the islets is steep-to. The 10-fathom curve lies close outside the bank.

6-176 Coast.—The coast eastward of Naurio forms a shallow bay into which the Newerip River discharges. The approach to the river is barred by Puriri Islet and the banks lying east and west of it. A channel with a depth of 3 feet was found close along Naurio Islet. Northward of the islet there were depths of 2 to 3 fathoms, but on account of the numerous drying sandbanks there was no passage eastward of Puriri. In the middle of Puriri Islet is a lagoon-like basin which is entered on the west side of the islet.

Kupera Pukwa River, with an entrance 3 miles wide, discharges about 10 miles eastward of Naurio Islet. An extensive bank that dries at low water lies along a north-east-southwest line southwestward of the east entrance point of the river. Along the western side of the bank there are depths of 2 fathoms. Insofar as is known, there is no channel into the river. Anchorage can be taken in a position 8 miles southwestward of the eastern entrance point of the river. Heavy breakers are frequent along the coast between this river and Newerip.

6-177 Inabuka River ($4^{\circ}58'S.$, $137^{\circ}08'E.$), which empties into the sea about 17 miles eastward of Naurio Islet, has a least depth of 11 feet on the bar. The maximum strength of the current in the entrance channel is about $1\frac{1}{2}$ knots. There is a village on the west bank of the river. On each side of the entrance channel are steep-to banks that dry at low water.

6-178 Otakwa River discharges about 5 miles eastward of the Inabuka. The south-east side of the approach is bounded by banks, dry at low water. Off the entrance a shoal bank extends 6 miles southwestward, with 6 fathoms close outside it. On the bar, which consists of hard sand, there is a least depth of 8 feet. A conspicuous tree, visible from a considerable distance, stands on the west side of the entrance, where there are mangroves of a light green color. The east entrance point has high trees on it and appears steep on all sides. The river seems to be of no importance, and its navigation is rather difficult.

gation is rather difficult.

6-179 Coast.—Several rivers flow out between the Otakwa and the Kasteel Rivers; the principal are the Ipukwa, Ambukerah, Akimeugah, Great Muras, and the Torpedoboat Rivers, all of which are interconnected. The Ipukwa, Akimeugah, and Torpedoboat Rivers are navigable for only a short distance, after which they are lost in the marshes. The Ambukerah has a width of nearly 600 yards and a depth of 4 fathoms at its mouth. It has been ascended for a distance of about 20 miles, at which distance it had a width of about 50 yards with a depth of 11 feet. The Great Muras River, which is about one-half of a mile wide and 20 feet deep at its mouth, was explored for nearly 20 miles. At that position it was 100 yards wide and 12 feet deep. Off the mouth of the Torpedoboat River there is a drying bank on which the sea breaks at high water.

De Jongs Banks, lying within the 5-fathom curve about 20 miles south-southeastward of the mouth of the Otakwa River, are two shoals of hard sand over which there is a least depth of about 8 feet. The lead gives no warning of approach to these banks. In bad weather they are marked by heavy breakers.

6-180 Kasteel Island ($5^{\circ}15'S.$, $137^{\circ}39'E.$), lies near the shore abreast the entrance to the Kasteel River, about 30 miles east-southeastward of the Otakwa River entrance. The island is lower in the center than at the ends, and has the appearance of a castle with battlements. It is connected to the shore by a mud bank which dries at low water.

The Kasteel River discharges abreast Kasteel Island. A good channel with a least depth of 10 feet leads along the east side of Kasteel Island directly to the river entrance, which is 300 yards wide. At about 2 miles above the mouth the river divides into two broad arms of about equal width; the western of these connects with a branch of the Torpedoboat River and is navigable for a considerable distance; the banks are

low, swampy, and covered with mangroves and nipa palms. The eastern branch connects with the Blumen River.

On the west side of the mouth of the main river there are three very conspicuous trees which from a distance have the appearance of three fingers.

6-181 The Blumen River discharges about 7 miles southeastward of the Kasteel and is navigable for vessels of 12-foot draft up to latitude $4^{\circ}58'$ S., longitude $137^{\circ}58'$ E., about 30 miles above the mouth, where it is joined with Le Coq d'Armandville River by a side channel which is navigable by craft of 6-foot draft. A steamboat can go up as far as latitude $4^{\circ}44'$ S., about 45 miles above the mouth of the river.

The least depth on the bank off the mouth of Le Coq d'Armandville River is 8 feet.

Laag Island, lying 5 miles south-southwestward of the entrance to the Blumen River, is about one-half of a mile long, north and south, and one-fourth of a mile wide; it is low and covered with vegetation. At 7 miles west-southwest of the island there is a depth of 6 fathoms, with less depths between that position and the island. A small islet lies about 4 miles eastward of Laag Island and about 1 mile from the coast.

6-182 Hellwig River.—The entrance to this river is nearly one-half of a mile wide and is reached by means of a 16-foot channel. It is navigable by a vessel of 12-foot draft for a distance of 30 miles, where the width is about 80 yards. At that position the river divides into two branches, one trending northwest and the other north-northeast. The river basin is well populated. At the entrances to the side branches there are four very large villages, the inhabitants of which are reported to be friendly. The mud banks along the river as far up as the place where it divides are covered with nipa forest, but farther up the banks are fairly high and are covered with rattan cane.

Providential Bank, over which there is a least depth of $2\frac{1}{2}$ fathoms, mud, lies off Flamingo Bay. A detached $2\frac{3}{4}$ -fathom shoal lies outside the 5-fathom curve about 7 miles southward of Providential Bank. A lighted buoy is moored on the southwest side of Providential Bank.

Flamingo Bay.—The Northwest, Lorentz, and Oetoemboewe Rivers empty into this bay; entering vessels should steer a course of 031° on the east bank of the Lorentz River. This course leads close eastward of the $2\frac{3}{4}$ -fathom shoal mentioned above. Under no circumstances should a vessel get into depths of less than $6\frac{1}{2}$ -fathoms until on this course.

Two white triangular beacons, about 100 yards apart, in range 322° are located on the north side of the mouth of the Northwest River; two similar beacons in range 286° are located on the west bank of this river, close within the river mouth.

A white rectangular beacon is located on the east bank of the Lorentz River opposite of the mouth of the Northwest River.

A white rectangular beacon stands on the northern entrance point of the Oetoemboewe River.

6-183 Northwest River is about 1,400 yards wide at the entrance, but at a short distance above the mouth it narrows to 80 yards. In 1908 a vessel of 12-foot draft and 164-foot length proceeded up the river for 8 hours on a rising tide.

Approaching the Northwest River, vessels should steer for the white rectangular beacon on the east bank of the Lorentz River. When this beacon is approached to within a distance of about 150 yards vessels should enter the Northwest River with the beacons mentioned above in range 322° and 286° . Thence, vessels can follow the course of the river.

In its upper part the river divides at three places into two arms which rejoin the river farther up. When the river is at its normal level, the most favorable time being from the middle of October to the middle of April, a steamboat can reach the third point of division in about two days, but when the water is low a steamboat could ascend only to the first point of division of the river. The Northwest River is connected with the Hellwig by a navigable branch. There are several large villages on the river; the natives are friendly.

6-184 The Lorentz River ($5^{\circ}25'$ S., $138^{\circ}05'$ E.), is navigable by steamers with a length of not more than 162 feet and a draft of

not more than 12 feet as far as just below the Dumas River, a tributary which joins the main river in about latitude 5° south. A branch, usable by steamboats, connects the lower part of the Lorentz River with the Oetoemboewe River. The banks of the lower part of the Lorentz are low and muddy, becoming higher farther up; they are densely wooded, mostly with mangroves in the lower part and heavy timber in the upper region. Along the river are many sago but no coconut trees. A great number of villages are located on the river banks, generally at the entrance to the side branches; the natives are friendly.

The Oetoemboewe River has been ascended to a position 50 miles above its mouth by a vessel of the dimensions given above in the description of the Lorentz River, and by a steamboat for 20 miles farther. Between the entrances of the Lorentz and the Oetoemboewe Rivers there is a shoal which extends 3 miles southwestward. A red and white banded can buoy with a topmark of two red spheres is moored at the junction of the Lorenta and Oetoemboewe Rivers.

6-185 The Eilanden River discharges through two mouths that lie about 8 miles apart; the northern mouth is situated about 12 miles southward of the Oetoemboewe River. In the northern arm, which is connected with the Oetoemboewe River, there are several islands and at least two places where the greatest depth is only 5 feet; hence the southern arm is the one that is generally used. The Eilanden River is deep and, at a favorable stage of the tide, can be navigated by vessels of 12-foot draft as far as latitude 5°21' south, longitude 139°20' east.

One of its various tributaries, the Dojiaissi, which discharges into the southern mouth, is about 275 yards wide at its mouth, but soon narrows to 165 yards. It was explored by a steamboat as far as latitude 6°00' south, longitude 138°44' east, where its width was only 16 yards. The depths everywhere seemed to be not less than 2¾ fathoms at low water springs. The ebb and flood currents are felt over the whole course of the river. The water for the most part is fresh, but of a brownish color. The large village of Biroefoe is situated near the junction of

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the Dojiaissi and the Eilanden.

The Vriendschaps River, which joins the Eilanden in latitude 5°28' south, longitude 138°53' east, can be navigated for about six hours' steaming by a vessel of 12-foot draft, until it divides into two branches; the eastern branch was explored by a vessel of 6-foot draft for a considerable distance.

The Wildeman River, which enters the left bank of the Eilanden River, was explored by a Netherland Government vessel for about 15 miles above its junction with the Eilanden, and by a steam launch as far up as latitude 5°23' south, longitude 139°32' east. The bends are not sharp, but the banks are low and boggy. At about 30 miles above its mouth the river divides into two branches.

6-186 Directions.—To enter the southern mouth of the Eilanden River steer a course of 093° on the southern entrance point, where there is a group of trees that rise above the other timber. This course leads just northward of a sandbank which dries at low water and extends as far as Triton Bank. The group of trees shows up fairly well when the approaching vessel gets into soundings of 3 fathoms; before this mark comes in sight, however, the conspicuous and steeply rising southern entrance point of the northern mouth serves as a good mark. There is a least depth of 2½ fathoms, soft mud, in the navigable channel to the mouth. The left bank should be favored, even at the bends, as far up as the junction with the second branch, the Kampoeng River.

Near the river mouths the flood current sets to the northward and the ebb to the southward.

6-187 Triton Bank (5°58' S., 138°04' E.), on which there is a least depth of 5 or 6 feet, hard sand, lies about 10 miles southwestward of the south entrance point of the southern arm of the Eilanden River; the edge of the bank extends 2 miles farther seaward. There is a good channel between it and the shore.

Coast.—From the Eilanden River the coast—low, wooded, and swampy—trends south-southeastward for about 30 miles and then southeastward. Along this coast are

a number of creeks and rivers, of which the most important are the Kronkel (Savoena) and the Cook Rivers. There is a depth of 8 feet in the channel leading to the Kronkel River; Birab village is situated near the mouth of this river.

The Cook River flows out into a bay on the southern side of which there is a large village. There is a depth of 4 feet in the channel to this river.

6-188' Odammoen River, about 60 miles southward of the Eilanden River, discharges by three mouths, named from the northward, Maboer, Majoe, and Viarre.

The Viarre, the southernmost entrance, is accessible to vessels of 12-foot draft; in the channel to this river are 13 feet, but inside the mouth the depths decrease to a minimum of about 10 feet at its junction with the Majoe. Inasmuch as vessels steer in on a course direct for the northern entrance point, this mouth is easy to enter.

The depth in the approach to the two northern channels is 2 fathoms, but at the inner end of the Majoe the chart shows a depth of 1 fathom.

At about 40 miles above De Jongs Point the Odammoen divides into two branches, the Mappi and the Kawarge; the latter connects with the Digoel River. The Mappi has been ascended as far as latitude $6^{\circ}16'$ south, longitude $139^{\circ}51'$ east, by a vessel drawing $11\frac{3}{4}$ feet; small craft can go up somewhat farther. There is very little current in the river. Large and small villages along the river point to the presence of a numerous population. In some places friendly relations were established with the natives by the exploring party.

Shoal.—A shoal over which there is a least depth of 8 feet lies off the mouth of the Viarre, at a distance of 8 miles north-northwestward of De Jongs Point.

Buoy.—A lighted buoy is moored about $13\frac{1}{2}$ miles southward of De Jongs Point, within the 5-fathom curve.

6-189 DIGOEL RIVER ($7^{\circ}10'$ S., $138^{\circ}42'$

E., *H. O. Chart 2999*), the most important river on the west coast of New Guinea, probably has its source in the mountains near Juliana Top.

The river is about 6 miles wide abreast Modderhoek, situated on the south side of the entrance, but gradually becomes narrower. Several banks and dangers that dry at low water lie on the north side of the channel. Drying shoal flats extend about 5 miles westward from Modderhoek. The main channel lies along Modderhoek, where the bank is not joined to the south shore; over the bar, west-northwestward of Modderhoek, there is a depth of only $6\frac{1}{2}$ feet, but the rise of the tide is great enough to make the channel readily navigable. Mariners are cautioned that depths in the approach to the Digoel are reported to be extensively different from those shown on the charts. A $1\frac{1}{2}$ -foot patch is located about 9 miles southwestward of Modderhoek. The land on either side of the lower Digoel is low and swampy, but farther up the river it gradually becomes slightly hilly with elevations on the east side, near the Oewimmerah, of 30 to 35 feet; the land along the west bank is lower. The Digoel is navigable by vessels with a length of 164 feet and a draft of 12 feet.

The Oewamba can be ascended for a distance of 330 miles from its mouth, or to $5^{\circ}20'$ S., $140^{\circ}27'$ E., by vessels not more than 82 feet long nor drawing more than $6\frac{1}{2}$ feet.

The Kawarga, connecting the lower Digoel with the Odammoen, has depths of 3 to 4 fathoms; it should be attempted, however, only at high water.

6-190 The Oewimmerah River, which joins the Digoel in $6^{\circ}32'$ S., $140^{\circ}20'$ E., has been navigated by a vessel 164 feet long and drawing $11\frac{3}{4}$ feet, but the numerous sharp bends in it makes navigation difficult. Its width decreases from 110 yards at the junction to 70 yards at a day's steaming above the entrance to the Inggivahke; the depth there is between 4 and 5 fathoms. The Oewimmerah was ascended as far as $5^{\circ}29'$ S., the last 40 miles being by canoe; it then had the character of a mountain stream. In

the lower part of the river the banks are wooded and alternately high and low; farther up they become hilly and, in some places, steep. The natives are friendly.

The Inggivahke was also ascended for some distance; it has depths of 5 fathoms at the entrance and 4 fathoms at a distance of two days' steaming from its mouth, but it is very narrow.

The Ederah flows southward and joins the right bank of the Digoel in $7^{\circ}08' \text{ S.}$, $139^{\circ}48' \text{ E.}$; it is between 55 and 65 yards wide at the entrance, where there are depths of 5 to 6 fathoms, and 25 yards wide at a position 30 miles above the entrance.

Tides.—At the mouth of the Digoel River there is both a diurnal and a semidiurnal tide. Since the spring lows of the two tides can coincide, the lowest water level that can be expected, occurring in July and November, is 13 feet below mean sea level. The maximum rise that can be expected is 7 feet above mean sea level.

Currents.—The flood current is strongest along the north bank of the river, and the ebb is strongest near the south bank. The maximum strength of the ebb current is 5 to 6 knots. On the second day after full moon, at about 3 hours after low water, however, the flood current has been observed to rush in with a velocity of $7\frac{1}{2}$ knots, and for four days after full moon this current has a velocity of 5 to 6 knots; at other times its maximum strength is about 3 knots. The currents in the river change about $1\frac{1}{2}$ hours after the tides.

Bores—caution.—A tidal wave or "bore", known locally as *Kapala Aroes*, is experienced in the Odammoen and Digoel Rivers. It occurs from 2 days before to 2 days after full or new moon. It is in the form of a wave about 6 to 13 feet high which moves upriver with great speed. In the Digoel River the wave, as such, is experienced as far as Bade some 28 miles above the Kawarga River. It favors the south bank of the river and penetrates into the creeks of the adjacent islands. Farther up the river above Bade, it is noticed as a light

swell. The effect of the wave can be noticed on the Mappi River to the junction with the Obaa River. Moreover, due to the interconnection of the Odammoen and Digoel Rivers through the Kawarga River, the wave from the Odammoen River travels through the Kawarga River to the Digoel River, and vice-versa, causing the two waves to meet in the Kawarga River. It is reported that several waves in succession can be experienced in the Digoel River. Vessels which traverse the Kawarga River should wait downriver until the waves have passed, before attempting this shallow waterway.

Small vessels in the Digoel River, when the bores are expected, usually anchor in a branch of the river until the waves have passed. Large vessels anchor with both anchors, and steam ahead while the waves are passing.

6-191 Directions.—To enter Digoel River bring De Jongs Point to bear 011° when it is 8 miles off. Then steer a course of 125° until the clump of trees near Gemeene Hoek bears 083° and Modderhoek bears 172° , and then change course to 096° , steering for Zondags Hoek until the clump of trees bears 040° . At that time change course to 080° and hold that course until a beacon, located about 4,400 yards eastward of the clump of trees, bears 046° . Steer for this beacon and proceed in, following the channel.

Vessels coming from the northward should be absolutely certain of their position before heading in for the Digoel River, otherwise they may easily mistake one of the mouths of the Odammoen River for that of the Digoel.

6-192 Tanah Merah, located on the Oewamba River about 50 miles above its junction with the Digoel, is a Government settlement. The village has a radio station and is regularly served by vessels of the K. P. M.

6-193 Kolff Bank ($7^{\circ}00' \text{ S.}$, $136^{\circ}50' \text{ E.}$, *H. O. Chart 2999*), located about 95 miles north-northwestward of Cape Valsch, the western extremity of Frederik Hendrik Island, is a relatively small bank on which there is a least charted depth of 8 fathoms,

with 20 fathoms, mud, around it. In 1956, an 11-fathom bank was reported bearing west-northwestward of Kollf Bank, at a distance of about 60 miles.

Le Cher Bank, upon which depths of 13 to 14 fathoms were found, is steep-to, 6 miles in length in a west-northwest and east-southeast direction, and surrounded by depths of 36 fathoms.

Shoals.—A shoal area enclosed by a danger line on the chart is located westward of Le Cher Bank. Several shoals over which there are depths of 5 to 10 fathoms lie within a distance of 7 miles of the danger line en-

closing this area.

A shoal area lies about 110 miles westward of Le Cher Bank. The area has not been examined.

6-194 FREDERIK HENDRIK ISLAND (*H. O. Chart 2999*), the southwesternmost part of New Guinea, is separated from the mainland by Prinses Marianne Strait. The island is about 100 miles long, northeast and southwest, and 50 miles wide at the eastern part, but it tapers to a narrow point at Cape Valsch, its southwestern extremity. The land is everywhere low, covered with a dense

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forest, and so marshy as to be almost inaccessible. The northwest coast is fronted by a mud bank that extends out 7 to 12 miles and has 3 fathoms on its outer edge, increasing very gradually to seaward. About 50 miles northeast of Cape Valsch the bank decreases in width, and southward of Cape Valsch the 3-fathom curve is about 9 miles from the shore; the seaward edge of the shore bank is much steeper there than on the northwest side of the island.

6-195 Cape Valsch ($8^{\circ}21'S.$, $137^{\circ}35'E.$), the southwestern extremity of Frederik Hendrik Island, is dangerous to approach from the westward inasmuch as a bank with depths of less than 10 fathoms extends about 65 miles offshore and it is possible to run aground before sighting the land. A $6\frac{1}{4}$ -fathom patch lies on the bank about 40 miles westward of the cape, and the 6-fathom curve runs about 24 miles westward of the cape. Southward of the cape the depths decrease rapidly from 10 to 5 fathoms. There is generally a heavy sea off it in the east monsoon, and sometimes also in the west monsoon.

The flood current has been observed to set toward Cape Valsch with a speed of $1\frac{1}{2}$ knots and there divide and continue northeastward along the northwest coast and eastward along the south coast of the island. The ebb current sets in the opposite directions with a maximum rate of 1 knot.

6-196 Prinses Marianne Strait.—The northern entrance to Prinses Marianne Strait is 10 miles wide, with a depth of 6 to 10 fathoms, but the width as well as the depth gradually decreases to the southward. The southern part of the strait is narrow and very shallow and is liable to constant change; the southern entrance should be attempted only with rising water. The strait affords a safe passage for large sailing proas, which thereby avoid the heavy swell off Cape Valsch, but steamers very seldom use the strait. The bottom varies between sand, mud, and clay; the banks in general are but little

above high-water level, and the land is flat, wooded, and swampy. Here and there the immense grass plain of the interior approaches the shore. Numerous creeks discharge on both side of the strait. The depths in the southern entrance to the strait are not more than 1 fathom, soft mud, but when the drying bank that extends out from the west side of Bumbel Island is covered, just inside the southern end of the strait, there is a depth of about 2 fathoms on the bar.

Caution.—The southern entrance channels are constantly changing and the charts cannot be depended upon. It was reported that in 1953 the channel eastward of Groene Hoek was dry; the main channel then was closer in to Tanjong Kombies.

Extensive changes in depths in the north entrance of the strait were reported in 1955. A detached 6-foot patch lies about 6 miles south-southwestward of Modderhoek, and a 2-foot patch lies about 9 miles southwestward of the same point.

The Moebke River, which discharges on the east side of the northern part of the strait, has a width of about one-fourth of a mile and a depth of 5 fathoms at the mouth, but at 12 miles above its mouth its width is only about 20 yards and its depth 3 feet.

Bensbach (Boeja) Creek, which runs along the southeast coast of Frederik Hendrik Island, is the eastern branch of the Prinses Marianne Strait. It is not known whether there is a channel through the shore bank off the southern entrance to this creek.

6-197 Kaap Kool, situated at the southern entrance to Prinses Marianne Strait, is the monotonously wooded southeastern extremity of the swampy Komoran Island. It may be recognized by two coconut palms on its south side. These trees, however, are not conspicuously higher than the others around them and cannot, therefore, be made out from a very great distance. It is reported that there is a patch of vegetation on the broad drying bank eastward of Kaap Kool.

A beacon consisting of a white rectangular board stands about $1\frac{1}{2}$ miles south-southwest of Tanjong Kombies on the west shore of the southern entrance of Prinses Marianne Strait. Another beacon consisting of a white triangular board, point down, stands on the southern entrance point of the Kaoet River, about 5 miles northeastward of Tanjong Kombies.

Tidal currents.—In Prinses Marianne Strait between Boembel Island (Bumbe Islet), in the southeast entrance, and Boe Island (Bu Islet), some 25 miles northward, the tidal currents are strong. The north-going stream is the stronger and may attain a rate up to $4\frac{1}{4}$ knots. The south-going current may attain a rate up to $2\frac{1}{2}$ knots. There is also considerable diurnal inequality in the rates of the currents. The tidal currents, over the bar in the south entrance, have similar rates.

6-198 Directions.—The northern part of the strait is easily navigated, and appears to be subject to little alteration. Steer a midchannel course until off the bight in approximately latitude $7^{\circ}52'$ S. As soon as the northern shore is open, steer along it, keeping about 200 to 300 yards offshore. After passing Boe Island do not steer farther to port until the stretch of the opposite shore is well open. Thence follow midchannel courses to abreast the entrance to Bensbach Creek.

After passing the entrance to Bensbach Creek follow the Komoran Island shore for about 2 miles, keeping about 550 yards offshore and then cross over to the opposite shore of the strait and follow it, keeping about 300 yards offshore, until the southeastern point of Bumbel Island bears 232° .

From this position it is advisable to seek local assistance for navigating the strait due to changing conditions in the channels.

Good landmarks for vessels entering the southern end of Prinses Marianne Strait are Kaap Kool and Tanjong Kombies.

A beacon with a white triangular wooden

topmark, point down, stands on the south entrance point of the Kaoet River, about 5 miles northeastward of Tanjong Kombies.

During the southeast monsoon season it is inadvisable to navigate the strait from south to north because of the heavy scend caused by the southeasterly swell.

6-199 THE SOUTH COAST OF NEW GUINEA between Kaap Kool and the mouth of the Bensbach River, trending eastward for about 65 miles and then southeastward, forms a wide and open bight. The shores of this bight are fronted by a wide mud bank. The coast between Kaap Kool and Tanjong Kaja Kaja is low and covered with mangroves, but between Tanjong Kaja Kaja and the mouth of the Merauke River a ridge of low sand dunes on which coconut trees grow abundantly rises behind a broad beach; back of the ridge are low, fertile valleys which are submerged during the rainy season and are separated from one another by low, sandy ridges. There are numerous villages along the coast. The most important rivers that empty into the sea along this stretch of coast are the Bulaka, Bian, Kumbe, and Merauke. What landmarks there are along this coast are useful only for inshore navigation.

6-200 The Bulaka River ($8^{\circ}08'$ S., $139^{\circ}14'$ E.) discharges into the sea about 22 miles northeastward of the southern entrance to Prinses Marianne Strait. Both of its entrance points are fronted by mud flats to a distance of one-half of a mile. Although there are depths of 4 to 6 fathoms in the mouth of the river and 3 to 4 fathoms for 8 miles or more up river, the approach is over shallow flats of 1 to 2 fathoms which extend about 4 miles off. The river is navigable by a vessel with a length of 160 feet and a draft of 11 feet as far as Apong village, about 20 miles above the mouth.

In 1959 the least depth in the approach to the entrance was 6 feet, with $4\frac{1}{2}$ feet over the bar, and 6 fathoms within the river.

Shoals.—A drying bank lies 2 miles southwest of the entrance, and a small 2-foot coral reef with 2 fathoms around lies about $3\frac{1}{2}$ miles southward of the east entrance point.

Tanjong Kaja Kaja, about 25 miles eastward of the southern entrance to Prinses Marianne Strait, is at the western end of the more densely wooded shore; it appears from the eastward as a sharply defined point. About $11\frac{1}{2}$ miles westward of the point is a small detached wood, on each side of which there is low brushwood. The coast bank, which extends from $11\frac{1}{2}$ to 5 miles from the shore, dries in some places for a distance of $11\frac{1}{2}$ miles offshore.

6-201 Habeeke (Habe) Island, about 6 miles southeastward of Tanjong Kaja Kaja, is about 10 feet high and 500 yards across; it is covered with high trees which can be seen for a distance of 15 miles. A ledge of sand and stones with depths of 1 to $2\frac{1}{2}$ fathoms over it projects southward $2\frac{1}{4}$ miles from the island. Karang Sametinke, a drying reef, lies 1 mile within the south edge of this bank.

A light is shown from Habeeke Island.

A $4\frac{1}{2}$ -fathom and a $4\frac{3}{4}$ -fathom shoal lie about $25\frac{1}{2}$ miles, 164° and 142° , respectively, of Habeeke Islet.

On the detached shallow flat that extends far seaward from the eastern side of the island are many boulders. Along the north side of the island is a blind channel with a depth of 16 to 20 feet; it is approached from westward over a 3-fathom bar; a $2\frac{3}{4}$ -fathom patch lies $3\frac{3}{4}$ miles west-southwestward of the island. In this channel, which provides the only access to the island, the water is always smooth; even this channel, however, must be marked before it can be used with safety. On the north side of the channel the reef rises steeply and is more or less dry thence to the mainland. A $2\frac{1}{2}$ -fathom patch lies 4 miles south-southwestward of the island, and a 3-fathom patch a similar distance southeastward. A shoal with a least depth of 4 fathoms lies about 16 miles southwestward of the island. Other dangers may exist.

Anchorage.—There is good anchorage in about $3\frac{1}{4}$ fathoms, mud, about 2 miles west-southwest of Habeeke Island. To reach the anchorage the island should be steered for, bearing 054° , until Tanjong Kaja Kaja bears 315° , then steer north-northeast and anchor with the northwest extremity of Habeeke Island bearing 070° .

6-202 The coast from Tanjong Kaja Kaja to a few miles southeastward of Bian River is low and sandy and thickly overgrown with tall trees; the only perceptible break in this coast is at the mouth of the above-mentioned river. Many coconut trees grow near the villages. Along the coast are small woods and clumps of tall trees, some of which can be seen for a distance of 13 miles. In Okaba village, situated 24 miles eastward of Tanjong Kaja Kaja, is the residence of a government representative.

6-203 The Bian River ($8^\circ 08' S.$, $139^\circ 57' E.$) is 1 mile wide at the mouth; it maintains much the same width for about 5 miles from the sea. A vessel 164 feet long and drawing $10\frac{1}{2}$ feet has ascended the river as far as Kabtél village, about 30 miles above the mouth. Beyond the village, however, the river is so narrow that a vessel of that length would be unable to turn around.

The depths in the entrance vary from 6 to 8 feet; on the south side, within the entrance, is a depth of 2 fathoms, and 3 miles above that position the depth is about $2\frac{1}{2}$ fathoms. A large volume of muddy water is brought down by the stream and is noticeable as far out as 10 miles. Patches of $3\frac{1}{4}$ to 5 fathoms lie outside the 5-fathom curve. At high tide the mangrove-covered banks of the river are flooded for a considerable distance.

In the southwestern approach to Bian River two shallow spits extend southwestward from the coastal bank. The southeasternmost has a depth of $1\frac{1}{2}$ fathoms in a position about 13 miles south-southwestward of Tanjong Mawal, the south entrance point of the river. Two detached drying banks lie about 4 miles southwestward of the same point.

Tidal currents.—There is practically no period of slack water in the river; in fact, while the ebb current is still running in the outer bend the flood current may be flowing at a considerable rate into the inner bend. There seems to be a bore here, for the water has been observed to rise 8 feet in 10 minutes, rushing in with a hissing sound.

Directions.—In entering the river bring the east entrance point to bear 054° and steer in on that course.

The coast between Bian River and Kumbe River is fronted by a coastal bank with depths of less than 3 fathoms, extending about 11 miles offshore. Southwestward of the entrance of the Kumbe River, the coastal bank, with depths of less than 10 fathoms, extends about 50 miles offshore; on this bank there are several detached shoals with depths of 5 to 6 fathoms. A shoal with a depth of 2½ fathoms, mud, lies about 14½ miles southwestward of the south entrance point of Kumbe River.

6-204 Kumbe River.—The mouth of this river is about 23 miles southeastward of that of the Bian River. A 2½-fathom shoal lies about 14½ miles southwestward of the south entrance point of the river. A 1¾-fathom patch lies about 3½ miles north-northeastward of this shoal. A 13-foot shoal lies about 6½ miles southwestward of the above point. A 14-foot shoal lies about 10½ miles southwest of the same point. Because of the incurving of the coast and the lack of recognizable points, the entrance is hard to make out. Shoal water extends about 2¼ miles off both entrance points. The river is approached through a very shallow channel, which is about 50 yards wide and runs in a northeasterly direction. Two beacons in range 055° lead through the channel to the entrance of the river. The outer beacon has a triangular topmark point up and the rear beacon a similar topmark point down. The entrance points have broad sand beaches with coconut trees behind them. A village stands on the north entrance point. A red-roofed house on the north bank of the river serves as a good landmarks.

A pier with two dolphins is located about

200 yards west of the rear range beacon.

The river, which has many sharp curves, is navigable by boats for a distance of 165 miles. In the curves immediately within the mouth the depths are from 2½ to 3 fathoms; the general midchannel depths are from 4 to 5 fathoms. The shores are low and wooded, at first with mangroves and higher up with heavier timber.

Tidal currents.—During November and December the tidal currents were found to set in the direction of the coast, averaging about 7 hours to the northwestward and 5 hours to the southeastward. The velocity of these currents varied from 1 to 2½ knots, which was attained at about the time of high water by the northwesterly current and near the time of low water by the southeasterly current.

6-205 THE MERAUKE RIVER (8°29' S., 140°21' E.), which discharges at a position about 10 miles southeastward of the mouth of the Kumbe River, is deep and tortuous; it has been ascended for a distance of 60 miles by a vessel about 200 feet long and drawing 10½ feet, and 90 miles farther by boats. The river is about 600 yards wide abreast the town.

A wide drying bank extends out from the coast on either side of the entrance, and the 3-fathom curve lies about 6½ miles offshore abreast the entrance. Breakers have been reported in a position about 8 miles southwestward of Tandjoeng Haram, the southeastern entrance point of the river. Depths of from 1¾ to 2½ fathoms are charted in this vicinity. A channel with a least depth of about 3 feet across the bar leads northeastward through the above drying bank. The channel is marked by buoys.

The entrance to the river is difficult to distinguish, as the coastline is flat. A belt of trees on the southern side of the river mouth, however, offers some slight variation from the general featureless surroundings, since it presents a slightly domed appearance. Three rows of fishing stakes approximately 700 yards apart, extending about 250 yards

from the shore northward of the trees, also serve as an aid to recognition.

Dangers.—Several shoals with depths of less than 3 fathoms lie between the 8 and 5 fathom curves about 15 miles westward of Tandjoeng Haram.

Four shoals with depths of from $2\frac{1}{4}$ to 3 fathoms lie between 28 and 33 miles south-southwestward of Tandjoeng Haram.

Shoals with depths of less than 5 fathoms extend about 42 miles offshore from a position on the coast about 29 miles southeastward of Tandjoeng Haram.

Two shoals, with depths of 5 and $5\frac{1}{2}$ fathoms lie, respectively, 40 miles south-southwestward and 31 miles southwestward of Tandjoeng Haram.

Navigation aids.—Tandjoeng Mimiabe Light is shown from a position on the coast about $1\frac{1}{4}$ miles southward of Tandjoeng Haram; this light is shown only on request. The structure is extremely difficult to see, and a flag is sometimes flown from it to assist identification.

A radio mast, 171 feet high, painted in red and white horizontal bands, is located 600 yards southeastward of the light.

A light is occasionally shown from the head of a small jetty on the south side of the river at Merauke.

Lighted range beacons, shown only on request, stand on the northern side of the river mouth. These beacons in range 035° lead in a northeasterly direction through the drying bank to the river mouth.

An aeronautical radiobeacon, operating also on requests by ships, is located about $1\frac{1}{4}$ miles east-southeastward of Tandjoeng Haram.

A red can buoy, equipped with a reflector, is moored about 3 miles westward of Tandjoeng Mimiabe light structure.

Wreck.—A sunken wreck, dangerous to navigation, with about $3\frac{1}{2}$ feet of water over it, lies $11\frac{1}{4}$ miles, 262° from Tandjoeng

Mimiabe light.

Anchorage can be taken in a depth of $3\frac{3}{4}$ fathoms in the middle of the river abreast the town.

Tides.—At Merauke there is both a diurnal and a semidiurnal tide, but the latter predominates. Mean high-water springs rise 16.2 feet, mean high-water neaps 12.4 feet, and the mean sea level is 9.8 feet.

Tidal currents.—In the mouth of the Merauke River the ebb current, attaining a maximum velocity of 2 knots, lasts about 7 hours; the flood current runs for about 5 hours with a maximum velocity of 1 knot. It is reported that the flood tide comes in three bores which make pilotage extremely difficult. Abreast the town the current has been known to attain a strength of 5 knots. Tidal currents are perceptible in the river for a distance of at least 60 miles above its mouth.

6-206 Directions.—Constant soundings should be obtained on approaching the coast, and on no account should the 5-fathom curve be crossed until the ship's position is definitely ascertained. Steer due north until Tandjoeng Mimiabe light structure bears 066° , thence alter course to this bearing and steer in toward the light structure. No further directions are given because of the changing conditions of the bar and relocation of buoys. Strangers should employ a pilot.

Pilot.—A pilot is available at Merauke. Pilotage is compulsory for large vessels and is performed by the harbor master. Request for his services should be made in advance by radio. Vessels not having local knowledge are strongly advised to obtain the services of a pilot due to the changing condition of the bar and to the absence of prominent land features.

Caution.—As the position of the shoals may vary, care should be taken to adhere closely to the marked channel.

6-207 MERAUKE ($8^{\circ}29'S.$, $140^{\circ}23'E.$), the capital of South New Guinea, is situated on a plain in the midst of the jungle on the south bank near the mouth of the Merauke River. The low land on which the town stands is protected by dikes. From a distance the town, which covers a considerable area, looks like a mass of galvanized roofs. The encampment of the local military police stands on a sandy ridge. There are several Chinese, Arab, and Cingalese trading establishments and a few European stores in the town. It is a free port.

Wharves.—A jetty at Merauke is about 130 feet long and has a depth alongside of 4 feet. This jetty was in poor condition in 1960.

An L-shaped pier located close northward of Merauke is about 134 feet long at its head; there was a depth of about 18 feet alongside the head in 1960.

A jetty with a depth of 8 feet at its head is located about 300 yards downstream from the main wharf. There is a combination pilot and mooring boat. A $4\frac{1}{2}$ -ton and a 5-ton mobile crane are available.

At Merauke there are two wharves that can accommodate small craft. Copra is the chief export.

Supplies.—There are no provisions available for shipping, and water is limited. A limited supply of oil in drums is available.

Communication.—There are two radio stations in the town. Local telephone service is maintained. An airfield is located about 3 miles southeastward of the town.

Repairs.—Minor repairs can be made.

Medical.—There is a 125-bed hospital at the settlement.

6-208 Coast.—Between the mouth of the Merauke River and the rounded point that lies 19 miles to the south-southeastward the slightly receding coast is fringed by a sandy beach which dries in places to a distance of nearly 2 miles offshore. Several native vil-

lages with coconut trees around them are built near the shore along this coast. The Bensbach River empties into the sea at the boundary between the Netherland and British territory, about 35 miles east-southeastward of the rounded point referred to above. The sandy beach continues along this part of the coast and is backed by cultivated low land.

A shallow bank extends about $4\frac{1}{2}$ to $8\frac{1}{2}$ miles offshore along the coast between the mouths of the Merauke and Bensbach Rivers. A rock with a depth of less than 6 feet and a sandbank which dries 3 feet lie about 8 miles westward and 4 miles west-southwestward, respectively, of the rounded point. Another sunken rock lies northwestward of the point $1\frac{1}{2}$ miles offshore. Outside this bank there are depths of more than 3 fathoms. Inasmuch as the coast is low and shoal depths extend so far offshore, it is difficult to get close enough inshore to make out the coast or the mouths of the rivers along it.

6-209 Current.—Semidiurnal tidal currents are felt along this coast, even by vessels out of sight of the land. A strong current runs up and down the coast following the tides, the flood setting southeastward and the ebb northwestward. The ebb current is the stronger, and has a longer duration. The velocity of the current is about 2 knots.

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CHAPTER 7

SOUTHERN COAST OF NEW GUINEA—BENSBACK RIVER TO SOUTH CAPE

7-1 TERRITORY OF PAPUA—SOUTHERN COAST—General remarks.—The western limit of the Territory of Papua and the boundary between it and Netherland New Guinea is the mouth of the Bensbach River, in longitude $141^{\circ}02'$ east. Thence eastward to longitude $145^{\circ}30'$ east, a distance of 300 miles, the coast, which is low and composed principally of mangrove swamps, is fronted by shoals and reefs that extend some 30 miles from the land. Navigable channels probably exist within this distance, but until it is surveyed the locality should be avoided by strangers. For information regarding the outlying dangers the mariner is referred to the charts.

Numerous and but little-known rivers that form an immense delta with many creeks and mouths traverse the great plain within the limits of this stretch of coast. No entrance except for light-draft vessels has yet been found to any of these rivers, although the Fly and Aird, the principal rivers, apparently have deep, navigable channels inside the bars, and it is possible that there is a good entrance to the former river.

Eastward of $145^{\circ}30'$ E., the coast becomes gradually higher, and the water is, for the most part, clear of dangers as far as the vicinity of Cape Suckling, a distance of 90 miles, where coral reefs commence. From this point to the eastern extremity of the Louisiade Archipelago the coast is fringed by coral reefs that form barriers within which there are good anchorages, but in their present imperfectly surveyed condition they constitute only an impediment to free navigation.

Port Moresby, the headquarters of the government of the Territory of Papua, lies about midway of this coast.

7-2 The Bensbach River ($9^{\circ}07'S.$, $141^{\circ}02'E.$) is navigable by boats or very light-draft steam vessels for 100 miles or more; it is 100 yards wide at the mouth, but nar-

rows to 30 yards at 1 hour's journey above its mouth. The river has sharp bends and is obstructed by numerous snags.

An extensive spit with depths of less than 3 fathoms extends southward and south-southwestward for about 25 miles from the river mouth; on this spit is a drying reef and several sandbanks which dry up to 4 feet.

7-3 Heath Bay.—From the Bensbach River the coast trends eastward for about 15 miles to a low point marked by a coconut clump, whence it trends east-southeastward for another 15 miles to Tarudaru (Parliament) Point. The open bight thus formed is named Heath Bay. The water apparently is shallow for a distance of 5 miles or more offshore. A grove of tall mangrove trees stand on Tarudaru Point.

Morehead (Tatogabe) (Kudi Kussa) River, which discharges at the head of Heath Bay, has been ascended for 120 miles. A white beacon with a diamond topmark and with a tide gage stands in Heath Bay about 3 miles south-southwestward of the entrance of the river. A white beacon stands on the shore about 2 miles southwestward of the same entrance. It is considered possible for a small vessel to ascend the river. The mouth of the river is 150 to 200 yards wide, with a depth of 4 to 5 fathoms, but until the approach has been examined it would probably be unsafe for a vessel drawing more than 6 feet to attempt to enter. For about 30 miles from its mouth the banks of the river are low and lined with mangroves; beyond this there is higher land.

7-4 The coast from Heath Bay eastward to the Talbot Group is shoal up to 4 miles offshore. Beyond the shoal area are found numerous reefs which in an area between Bensbach River and Wassi Kussa extend up to 23 miles southward of the shoreline.

Thomson Bay, about 25 miles eastward of Morehead River and between Walarter and Maguara Points, is fringed by a sandy beach

on which there are coconut trees and behind which there is a dense forest. The coast to the eastward is lined with mangroves. Walarter Point may easily be distinguished by its red banks and coconut trees; light-draft vessels can approach this point and boats can land on it.

7-5 Deliverance Island ($9^{\circ}31'S.$, $141^{\circ}35'E.$), situated about 19 miles southward of Walarter Point, stands 1 to 3 feet above high water, spring tides, and is covered with trees, the tallest of which are about 102 feet high. The island is surrounded by extensive reefs. There is anchorage southward of the reefs, in a position about 4 miles eastward of the island. Numerous turtles are found on the island.

Kerr Islet, a sandbank on a reef lying $3\frac{1}{2}$ miles southward of Deliverance Island, is covered with vegetation. There is a conspicuous tree on the islet. A 2-fathom shoal lies about 3 miles east-southeastward of Kerr Island.

Channel.—Shoals extend in an almost unbroken line from a position 5 miles northwestward of Deliverance Island to the western end of Boigu Island, but there appears to be a channel between them and the shoal water which fringes the shore of New Guinea.

7-6 Talbot Group consists of one large island and six smaller ones. Boigu, the largest island of the group, together with two small islands close off its northern side, lies about 5 miles southward of the entrance to Mai Kussa; the Kawa Islands, constituting the balance of the Talbot group, lie close off the entrance to Wassi Kussa.

Boigu Island has a length of $9\frac{1}{4}$ miles east and west and a maximum width of 5 miles. The island, which is low and swampy, has a large patch of cultivated land near a village on its northern side. Two fishing stations are situated on the southern side of the island. A bank of mud and rock that dries extensively and that has not been examined extends 5 miles offshore from the southwestern end of the island and 2 miles offshore elsewhere. Westward of the island there is foul ground up to 3 miles offshore of the mainland.

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A rock, with less than 6 feet of water over it, was reported (1963) to lie about 3 miles east-northeast of the east extremity of Boigu Island.

There is a channel between the Talbot Group and the shore but it should be used only with local knowledge. A drying reef 3 miles northwestward of the northern point of Boigu Island, a drying reef about 4 miles westward of the western point, and a reef drying about 9 feet that is about 5 miles west-southwestward of the western point are each marked by beacons.

7-7 Wassi Kussa (Chester River) and Mai Kussa (Baxter River) are two arms of the sea surrounding Strachan Island. They unite about 20 and 25 miles, respectively, above their mouths; over those distances there are depths of 5 to 10 fathoms in the rivers. Above the junction of these arms the stream is known as the Bé Kussa. The approaches have not been surveyed. The shores are generally mangrove swamps. Strachan Island is also low and wet, and, where the soil is not too poor to grow timber, is covered with mangrove and eucalyptus trees.

7-8 The coast from the entrance to Mai Kussa trends east-southeastward for 24 miles to the point abreast the western end of Saibai Island; it is a low mangrove shore with a low wooded country behind it. For a greater part of the distance the coast is fronted by a bank which dries off for a distance of $\frac{1}{4}$ to $1\frac{1}{2}$ miles.

Bugi village, where there is a government station, lies on the mainland abreast Boigu Island about $1\frac{1}{2}$ miles eastward of the entrance to Mai Kussa.

Kussa Island lies close offshore about 4 miles southeastward of the entrance to Mai Kussa.

Reef.—A reef awash and a sunken patch lie about 16 miles east-southeastward of the entrance of Mai Kussa, about $2\frac{1}{4}$ miles offshore.

7-9 Dauan Island ($9^{\circ}25'S.$, $142^{\circ}32'E.$), lying about 16 miles southeastward of Boigu, is roughly triangular in shape, each side being about $1\frac{1}{2}$ miles in length. Mount Cornwallis, the summit of the island, is 795 feet high. A native village and

mission station are situated on the northern side of the island.

Tides.—It is high water full and change at Dauan Island at about 11h. 30m.; springs rise 12 feet.

Two reefs with less than 6 feet of water over them, were reported (1963) to lie about 7 and 8 miles south-southeastward, respectively, of the south extremity of Dauan Island.

Saibai Island, the western extremity of which is $2\frac{1}{2}$ miles eastward of Dauan Island, has a length of 12 miles, east and west, and a maximum width of $3\frac{1}{4}$ miles. The island is a closed native reserve prohibited to white men by order of the Government of Queensland. The natives are skilled fishermen and possess a modern fishing fleet.

Saibai is mostly low and swampy, but a considerable portion of the northwestern side of the island is under cultivation. The bank of mud, coral, and stones encircling the island dries off 1 mile at the western and $2\frac{1}{2}$ miles at the eastern end of the island.

Saibai village, at which there is a mission station and a church, is on the northwest side of the island; on the southwestern side there is a fishing village named Churum.

Kauamag Island, lying close off the northern shore of Saibai Island, is little more than a mangrove swamp; there are many flying foxes on the island. The narrow channel between these two islands is nearly blocked off at its eastern end by a bank over which there is a depth of $1\frac{1}{2}$ fathoms; elsewhere in the channel there are greater depths. The small islet close west of Kauamag Island is marked by a white beacon off its northwest extremity.

7-10 Channel.—Between Saibai Island and the mainland there is a channel 2 to 4 miles in width; it has depths of 20 fathoms in places, but $1\frac{1}{2}$ miles northward of the center of Kauamag Island there is a $3\frac{1}{2}$ -fathom patch. The western end of the channel is barred by a shoal ridge with about 2 fathoms at low water in the deepest part. The eastern end of the channel is restricted by shoals to a width of 1 mile, and the approach to that entrance is obstructed by

dangerous shoals and reefs. Several reefs at its western end are marked by beacons.

A white beacon stands close off the mainland about 4 miles northeast of Saibai village.

Vessels of about 12-foot draft may use this channel and proceed as far eastward as Binaturi River, but local knowledge is necessary. The water is much discolored.

The entire space between Saibai Island and Warrior Reefs, and for 20 miles southward, is unexamined.

Discolored water was reported (1962) in $9^{\circ}28'12''$ S., $142^{\circ}54'00''$ E.

Reefs.—A drying reef, $1\frac{1}{2}$ miles long and 600 yards wide, lies 1 mile northwest of the 50-foot hill on the west end of Saibai Island. There is a narrow passage with a depth of 3 fathoms between the reef and Saibai Island. Two small black buoys mark the center of the passage.

On the north side of the channel, at $1\frac{1}{4}$ miles offshore, is a similar reef with a sand cay. The eastern end of the reef lies $2\frac{1}{8}$ miles north-northwestward of the 50-foot hill on Saibai.

7-11 Pahoturi (Kaua) River is entered about 6 miles north-northwestward of the eastern extremity of Saibai Island. The approach to this river is obstructed by reefs and shoals, but there is deep water in the river for many miles above its mouth.

A group of islands divides the mouth of the river. On Paho Island ($9^{\circ}17'$ S., $142^{\circ}45'$ E.), lying close to the eastern entrance point of the river, there is a pearl fishing station. On the western entrance point of the river there is a government station and a jetty for small vessels.

Marakara and Sapukaua (Sogeri) are two mangrove islets that lie about 1 mile offshore on the eastern and western side, respectively, of the entrance of the Pahoturi River. Foul ground with many sunken rocks extends southward from Marakara Island. A rock awash lies about 3 miles east-southeastward of the same island.

Landmark.—Mabudauan Hill, on the western side of the entrance to the Pahoturi River, is 192 feet high and thickly wooded.

It is the only elevation on the coast between the Fly and Bensbach Rivers.

Binaturi (Katau) River, which discharges about 15 miles northeastward of the mouth of the Pahoturi River, with the shore between fronted to a distance of nearly 4 miles by a shallow bank, is merely a creek 70 to 80 yards wide, narrowing at a short distance above its mouth to 20 or 30 yards. It can be ascended by boats for about 8 miles. The banks are of mud, covered with scrub and groves of coconut palms. The mouth is divided by the densely wooded Dubuaru Island. The water in the river is fresh at half ebb. At the entrance are large villages and a mission station.

Tide.—At the mouth of the Binaturi River springs rise $11\frac{2}{3}$ feet.

Oriomo (Tait) River is navigable for vessels of 10- to 12-foot draft for about 40 miles and is approached from Daru Roads; there is apparently no passage westward of, or within, Bristow and Daru Islands except for boats.

A white beacon stands on the east entrance point of the Oriomo River, and another on a point about 4 miles west-southwestward.

7-12 Bristow (Bobo) Island ($9^{\circ}08'S.$, $143^{\circ}14'E.$) is low, uninhabited, and covered with mangroves; it is situated about 13 miles eastward of the mouth of the Binaturi River and 5 miles offshore, and is connected by a shallow bank with Daru Island which lies between it and the mouth of the Oriomo River. Coral ledges front the eastern and southern sides of Bristow Island.

Daru Island is about 3 miles long and, on its northern side, 90 feet high. The coast westward of these islands is very unhealthy at times.

Daru Roads, with depths of 3 to 5 fathoms, lie northeastward of Daru and Bristow Islands. The approach is from the south-eastward, where there are irregular depths of 6 to 20 fathoms. On the northeastern side of the channel is the shallow flat that extends from Parama Island. A narrow channel with a least depth of 13 feet leads

through Daru Roads to the entrance of the Oriomo River.

Two black beacons with square topmarks stand close off the northeast and northwest extremities, respectively, of Daru Island.

7-13 Daru, located on the elevation on the northern side of Daru Island, is a government station with a magistrate's dwelling and other buildings. An 850-foot rubble and earth jetty, 9 to 11 feet wide, extends from the settlement and is connected to a 450-foot long timber pier, 8 feet wide, with a 55 by 20 foot T-head. There is a least depth of 6 feet alongside the T-head. Thirty inch gauge railway tracks are located on the jetty and pier.

It was reported (1962) that the pier is in poor condition and is to be replaced and the depth alongside the T-head increased to 8 feet.

Daru is a port of entry in Papua for vessels arriving from Thursday Island. The head station for the Fly River Mission is at this place. Daru has little trade, but it is of some importance in connection with the supplying of native labor for the pearling industry of Thursday Island and for work in Papua. A small steamer provides monthly communication with Port Moresby and Samarai, and there is irregular communication with Thursday Island by means of vessels.

7-14 Missionary Passage, lying between Bristow Island and Warrior Reefs (see H. O. Pub. No. 75, East Coast of Australia), has a least charted depth of $4\frac{1}{2}$ fathoms in the fairway. The northern side of the passage is formed by the coral reefs which extend about 13 miles southwestward from Bristow Island and terminate in Gimini Reef. Heavy rollers which set in during the greater part of the year make the passage dangerous to approach. In the passage there are strong tidal currents, which attain, during springs, a velocity of 5 knots.

A rock, with a depth of less than 6 feet, lies about 10 miles west-southwestward of Bristow Island.

7-15 Parama (Bampton) Island is situated about 10 miles northeastward of Bristow Island. The passage between Parama and the mainland has a width of about $\frac{1}{4}$ mile and depths of 1 to 3 fathoms. This island, which lies on the southern side of the southern entrance to Fly River, is low and thickly wooded, with trees attaining an elevation of 200 feet. The natives on this island are peaceable.

A bank of rocks and sand extends nearly 4 miles in a south-southeasterly direction from the southwest side of Parama Island; this bank has been reported to stretch $1\frac{1}{2}$ miles farther

(3535) **NEW GUINEA—Papua—Bristow Island—Light established.**—A light showing *Fl. 4 sec. 20 ft. 10 M.* has been established in (approx.) $9^{\circ}06'55''$ S., $143^{\circ}15'45''$ E.

(N.M. ~~22/00.~~)

(N.M. 16(162), Sydney, 1966.)

H.O. Charts **3466, 2944, 2940.**

H.O. Pub. 112, No. **30875.**

H.O. Pub. 73, 1952, page **238.**

in that direction. The sea breaks heavily on the bank during the southeast monsoon.

A reef with a probable depth of less than 6 feet lies about $7\frac{1}{2}$ miles southward of Bampton Point, the southeast extremity of Parama Island.

Missions.—There are mission stations at Geavi, situated on the mainland about 2 miles northwestward of the northern end of Parama Island, and at Ubiri, $7\frac{1}{2}$ miles farther northward.

7-16 Ellen Gowan Rock ($9^{\circ}00'S.$, $143^{\circ}31'E.$), a dangerous $1\frac{1}{4}$ -fathom coral reef, lies 4 miles east-southeastward of the northern extremity of Parama Island. There are many shallow patches within the 6-fathom curve eastward of Ellen Gowan Rock.

7-17 Bramble Cay (Massaramcoer) ($9^{\circ}09'S.$, $143^{\circ}53'E.$), a small islet located $28\frac{1}{2}$ miles east-southeastward of Bampton Point, is about 10 feet high and covered with low vegetation which, however, lying in a hollow, is not visible from seaward. It is surrounded by a drying reef close around which are depths of $2\frac{1}{2}$ to $4\frac{1}{2}$ fathoms.

Bramble Cay Light is shown from a steel framework tower, painted red, standing on the reef about one-fourth of a mile north-northwestward of Bramble Cay.

Black Rocks, the highest of which uncovers 4 feet at high water, lie on a reef 3 miles southwestward of Bramble Cay. The passage between the rocks and the cay is clear.

Nautilus Reef was reported to lie 2 miles east-northeastward of Bramble Cay, but its existence is doubtful. This reef was not seen in 1941.

Note.—Vessels intending to proceed westward through Great Northeast Channel may, with arrangement with "Torres, Sydney", pick up pilots off Bramble Cay. (See H.O. Pub..No. 75. East Coast of Australia.)

7-18 THE GULF OF PAPUA is about 190 miles wide between Parama Island and Cape Suckling and extends northward

about 80 miles from the line connecting these places. Its shores are low, and, with the exception of Aird Hill, located about 108 miles north-northeastward of Parama Island, and the Albert Mountains, located nearly 90 miles farther to the eastward, the western and northern shores present no objects of sufficient elevation to serve as marks for making the land from the southward; the lead will, therefore, afford the best indication of approaching the land, especially to the westward, where sand and mud flats extend far out from the shore. The bars in the gulf are of soft sand and the bottom outside them is sandy. Logs and other floating timber may be encountered between Bramble Cay and the mouth of the Fly River and thence across the gulf. Discolored water extends offshore as much as 30 miles.

At most places in the gulf the shore is slightly higher than the low, swampy country that extends 10 to 20 miles back of it. This swampy land, covered with mangroves, nipa palm, and sago, is being gradually raised by the force of crabs which raise hollow towers, 12 inches in diameter and about 30 inches high, on which to sit; the excavations made to obtain material to form these towers are filled by deposit from the rivers.

From Parama Island to the Aird River, 95 miles northeastward of the island, not a single eminence nor scarcely a tree more elevated than its neighbors can be seen above the level outline of this apparently swampy country. It is wooded to the water's edge, the height of the trees in many parts ranging from 100 to 150 feet.

Along this portion of the coast there are mud flats and banks of hard, fine, black sand, formed by sediment deposited by the Fly River. The outer 3-fathom edges of these banks extend 3 to 20 miles from the shore, projecting farthest from the land at about midway between Parama Island and Cape

Blackwood, which lies 96 miles to the north-eastward.

Anchorage outside the bars is not good during southeast weather, and there are always rollers in shallow water. During the northwest monsoon good anchorage may be found if a vessel can feel its way in with the lead.

7-19 Directions.—In approaching the head of the Gulf of Papua from the southward it is advisable to make the neighborhood of Maclatchie Point, on the eastern side.

In clear weather, when within a distance of 25 or 30 miles of the land, one will see the interior mountains, about 6,000 feet high and having three peaks in the western part; the two eastern peaks, situated about 35 miles northeastward of Aird Hill, are very rugged. On nearing the land it is easily known if the vessel is eastward or westward of Maclatchie Point as, to the westward of Flat-top and Woody Hills, situated north-northwestward of that point, there is no high land, and the land near the coast is low and flat. Toward the head of the gulf, off the Fly and Aird Rivers, the land is so low that it can not be seen from the deck of a vessel 6 or 7 miles offshore. Discolored water and the first hard cast of the lead, after bringing up mud, may be considered a certain indication of the approach to shallow water.

Caution.—During the height of the southeast monsoon this is a dangerous lee shore, with a heavy surf breaking upon it. The sea breaks in a depth of 4 fathoms.

Tides.—It is high water, full and change, on the flats fronting the western shore of the Gulf of Papua at 10h. 30m.; springs rise 14 feet, neaps 10 feet.

Tidal currents.—Near the head of the gulf the flood sets northwestward toward the rivers at a rate of 2 knots at springs, and the ebb in the opposite direction at a rate of $2\frac{1}{2}$ knots.

7-20 FLY RIVER.—The estuary of the Fly River is 33 miles wide in its entrance, but is only 7 miles wide abreast the northwest end of Kiwai Island ($8^{\circ}26' S.$, $143^{\circ}10' E.$), which may be considered as being at the mouth of the river; above this island the river gradually contracts to a width of 1 mile or less.

The estuary is studded with low and swampy islands that are covered with mangroves and nipa palms; there are villages and cultivated areas on these islands. The land on both sides of the estuary is of the same character.

As a means of entrance to the interior, the Fly River, which is perhaps the largest river in New Guinea, is of great importance. It flows through interminable forests which, for the greater part of the year, are under water, and through vast grassy plains, which are probably inundated during the rainy season.

7-21 Depths in the entrance.—There are depths of 4 to 5 fathoms in the mouth of the Fly River, but extensive flats in the approach to the estuary prevent it from being available for vessels of much draft until it has been surveyed and a proper channel found. The shallow patches will best be understood by reference to the chart, but their charted positions are exceedingly doubtful.

It is considered that vessels with a draft of not more than 14 feet could enter by having a boat ahead taking careful soundings.

The channels on either side of Kiwai Island are known as North and South Entrances, and that close along the western shore as Neva Pass. The channel northward of Wabuda, though wide, is apparently shallow, as its approach is marked by heavy rollers.

Caution.—The tidal currents in the approaches to Fly River are very strong and irregular, especially during the season of the

northwest monsoon and at the change of the seasons.

7-22 Ascent of the river.—The *Ellengowan*, a mission steamer of 6-foot draft, in December 1875 ascended the river for a distance of about 150 miles. In January 1890 a steam launch of 3½-foot draft proceeded about 500 miles up the river, to latitude 5°58' south, where the rapids prevented further progress. The *Neva*, a steam launch, also ascended the river for about the same distance in May 1876.

The following remarks were taken from a report of the *Ellengowan*:

For nearly the first 100 miles the river is shallow, with several sandbanks upon which the *Ellengowan* grounded many times. At about this distance from the sea there is a group of small islands through which it is was difficult to find a passage; beyond this the river narrows and the stream becomes more rapid and much deeper.

The first tributary of the Fly River above its mouth is the Strickland, above Ellengowan Island, in about 7°30' S., 141°30' E. The second is the Alice, at D'Albertis Junction, in 6°15' S., 141°00' E. The next great division is into two rivers of nearly equal size, the Fly and the Palmer, at about 30 miles north-eastward of D'Albertis Junction. In the third and fourth hundred miles a great deal of the country is too wet to grow timber, and the population is not fixed, probably because the land is too low for permanent occupation. This is probably what has given the nomadic habits to the tribes of the district.

Wild bananas and breadfruit trees are common; sago trees are not frequent. The first real grass was seen about 370 miles above the mouth of the river, and the last coconut tree at about 410 miles. The first low hills, beginning some 20 or 30 miles above D'Albertis Junction, are of sandstone, wooded, and a few hundred feet high; they continue up to the mountain range of the interior.

For some distance below D'Albertis Junction parts of the country are fit for permanent habitation, but the population still remains scanty.

From the farthest point reached no hills over 300 or 400 feet high could be seen, but lower down the river, from a hill 250 feet high, some high mountains were visible at a distance estimated to be 50 to 60 miles. Along the banks of the river there were indications of careful cultivation; the gardens were

well planted and irrigated by dikes cut at regular intervals.

At the farthest point the river was 25 to 30 yards wide and very shallow, preventing the launch, which drew only 3½ to 4 feet, from getting any farther. From the rapidity with which the water rose and fell, according as the weather was rainy or dry, the source of the river could not have been far distant.

At 500 miles from the mouth the surrounding country is said to be hilly and picturesque and the climate exhilarating.

Tides.—Close seaward of South Entrance is high water full and change at about 9h. 15m.; springs rise 12 feet.

The tidal influence extends 150 miles up the river. In the early part of January 1890 the river was low but rising; by the 24th of that month it had risen 15 to 20 feet.

Bore.—A bore dangerous to boats runs up the Fly River at spring tides; at that time, therefore, vessels should proceed along the side carrying the deeper water.

Climate.—The climate in the vicinity of Fly River is good. Thunderstorms occurred daily during January 1890, and the temperature stood at 85° to 90° F. in the daytime and 72° to 76° at night.

7-23 The islands in the estuary of the Fly River are flat and, being covered with a thick stratum of alluvial soil, are very fertile. The largest of these islands are Kiwai, Mibu, Purutu, Aibino, and Wabuda.

Kiwai Island (8°37' S., 143°29' E., *H. O. Chart 2944*), separating North and South Entrances of Fly River, has a length of about 30 miles and an average width of 2½ miles; it is the largest island in the estuary of this river. The island is well wooded and no part of it is more than a few feet above high water; the inhabitants of the island grow a great variety of native vegetables. The chief village, named Kiwai (Iasa), situated on the southern side of the island, is composed of two large villages separated by a creek. There is a mission station at this village.

About 15 miles to the northwestward, on the same side of the island, is Sumai (Imari) village, about midway of the northern side of the island is Doropodai village, and toward the eastern end are Dubera Duba, Wiorubi, Agabara, Ipisia, and Samari villages.

Wabuda Island, on the north side of the estuary, and Domori, in the mouth of the river above Kiwai, are apparently the only other inhabited islands.

7-24 The inhabitants of the Fly River delta support themselves by means of agriculture and hunting and live in large communities; some of their houses are over 200 yards in length. Cannibalism is extinct in the district known to the government, both on the Fly River and to the westward of it. Coconut trees, breadfruit, plantain, sago, palm, and sugar cane grow in great abundance in the vicinity of the delta.

7-25 The Bamu River ($8^{\circ}09' S.$, $148^{\circ}42' E.$, *H. O. Chart 2944*) is separated from the northern mouth of the Fly River by a long, low peninsula, which along the shores is covered with mangroves and nipa palms and inland by dense forests with cultivated patches in places.

7-26 Channels—Islands.—The estuary of the Bamu, about 10 miles wide, is encumbered with large islands that are low, swampy, and covered with mangroves and nipa palms. These islands divide the estuary into four channels in which there are charted depths of $1\frac{1}{2}$ to 5 fathoms, but the approach to all four is over a shallow flat that extends some 20 miles seaward of the islands and is reported to break in places; consequently, until the river is surveyed, it can be entered only by small craft with local knowledge. Vessels that can cross the bar apparently can ascend the river for many miles.

The northernmost channel, on the bar of which there is a least low water depth of 5 feet, is named Bebea; the next southward is the Bina; the third is named the Duro in its

outer part and the Dibiri River at a short distance inside the entrance; the southernmost, leading along the south shore of the estuary, is unnamed. The Bebea and Bina Rivers unite at a point westward of the northernmost island, and the Duro and the southernmost channel join just the southern entrance; the two streams thus formed unite at the northwestern point of Aramia, the westernmost island. From this point of junction the river extends for a very considerable distance inland.

Naviu and Aramia are the two largest islands in the estuary; the latter has a village on its northeastern side.

Dibiri, the southernmost island in the estuary, has Dibiri and Maipani village on it. There is also a village named Dibiri (Segara) on the mainland, $6\frac{1}{2}$ miles westward of the western end of Dibiri Island.

Bebea village is on the northern bank of the Bebea River, where the river bank, about 20 feet high, is said to be higher than elsewhere.

The current in the river is reported to have a maximum rate of 4 knots, but that is probably when the river is in flood.

Tides.—It is high water full and change at 10h. 30m. off the entrance to the river; springs rise 14 feet, neaps 10 feet.

A bore, said to attain a height of 11 feet at times, ascends the Bamu with the incoming tide.

7-27 Gama River ($8^{\circ}04' S.$, $143^{\circ}52' E.$, *H. O. Chart 2944*) empties into the sea at a position about 10 miles eastward of the Bebea mouth of the Bamu River; the submerged and uninhabitable coast between the mouths of these rivers is covered with mangroves. The Gama is nearly 1 mile wide at its entrance, with a depth of 2 fathoms at low water in its lower reach, but is fronted to a distance of $2\frac{1}{2}$ miles by extensive sand and mud flats over which there are depths of 3 to 6 feet at low water; there is a depth of

about 5 feet on the bar. At 35 miles above its mouth the river is but 80 yards wide; at that position the tidal currents attain a rate of 3 to 4 knots. Damebari and Daburarubi villages are situated 10 to 12 miles above the mouth of the river.

7-28 Coast.—Eastward of the mouth of the Gama River is Bell Point and a village. Beyond this point the coast, which is covered with sago and coconut palms and along which there are several scattered villages, turns sharply to the northward, forming the estuary of the Turama River.

7-29 Turama River.—The estuary of this river is about 20 miles wide. Morigio and Neabo, two large, low, and thickly wooded islands, divide the estuary into three channels. There are three villages on Morigio Island.

The southwestern branch of the river, known as the Binadamu, has a depth of about 1 fathom at low water; the middle channel, named the Giwoi, has depths of $1\frac{1}{2}$ to 2 fathoms, with a shallow bank in the fairway at its upper end. The Turama, the northeasternmost and broadest channel, is about 2 miles wide; the depth is not stated, but the least depth found in steaming across the entrance from Morigio Island to Goaribari Island was $2\frac{1}{2}$ fathoms. All of these channels are probably fronted by shallow water and therefore, until surveyed, can be entered only by those who are locally acquainted.

The river was ascended in 1892 for a distance of 80 miles, where it was about 60 yards wide and had depths of 2 to 3 fathoms; the river banks at that position were 3 to 6 feet high. At about 5 miles eastward of the farthest position reached is the Darai Range, consisting of hills 400 to 600 feet high. Numerous villages were passed on the way up.

Tidal currents—Bore.—Strong tidal currents were experienced as far up the river as the vessel went. At the first of each flood a bore, which is dangerous to boats, enters the

river by the eastern mouth and continues up the river for a distance of about 40 miles.

7-30 Goaribari Island ($7^{\circ}47' S.$, $144^{\circ}14' E.$), about 5 miles in diameter, lies in the approach to the Omati River. On either side of this island is a channel in which there are depths of about 2 fathoms, but there is less water in the approach. The channel that leads northward of the island is known as Aumo Passage. There are four villages on the island; the two on the northern side are named Anawaida (Dopima) and Oteai Turotere (Kerewa). The island is covered with tall mangroves and is barely above the high water level.

Southward of Risk Point, the eastern extremity of Goaribari Island, is a sandbank, nearly dry at low water, which extends nearly 3 miles off the southeastern side of the island. There is a boat passage close to the shore. An extensive bank projects about 1 mile northeastward from Risk Point. There is a channel between it and the bank just mentioned.

Off-lying bank.—A bank with a least depth of $2\frac{1}{2}$ fathoms over it lies 13 miles southward of Goaribari Island.

7-31 The Omati River, which empties into the sea northward of Goaribari Island, is about $1\frac{1}{2}$ miles wide in its entrance. The river has depths of $\frac{1}{2}$ to 2 fathoms; its banks, only a little above high water, are covered with mangroves and other trees. The villages of Daimo (Muragoa) and Baia-a (Pai-ia-a) are situated on the western shore near the entrance. At about 20 miles above its mouth the river is 150 yards wide and $2\frac{1}{2}$ fathoms deep. From 30 to 40 miles up the river it is reduced in width to about 30 yards and passes between limestone hills, about 400 feet high, that are covered with palms and pines. Several villages are located on the banks. The land on the delta of this river is

barely above high water and is, therefore, almost uninhabitable. The houses are built on piles.

7-32 DELTA OF AIRD RIVER—Cape Blackwood ($7^{\circ}49'S.$, $133^{\circ}30'E.$).—The several mouths of the Aird River lie on either side of Ibibubari Island; Cape Blackwood, the southeastern extremity of this island, is situated about $12\frac{1}{2}$ miles eastward of the eastern extremity of Goaribari Island. A light is shown from Cape Blackwood. Ibibubari Island is about 12 miles in length, 2 to 3 miles wide, and but a few feet above high water. It is covered with tall mangroves and other trees. There is a small village on the western side, but the island may be considered uninhabitable.

Between Goaribari and Ibibubari Islands are the Wairoro (Newberry), the Aird (Airo), and the Nakari mouths, while to the eastward are the wide mouths known as Bevan Sound and Paia Inlet. There appear to be average depths of about 2 fathoms, with shoals in places, in all these rivers, which are simply water channels through mangroves, with but little dry land anywhere. The three rivers are joined at about 30 miles above their mouths; beyond that point of junction the river is known as the Kikori.

The depths apparently shoal gradually from southward toward Cape Blackwood, but shoals, over which there are depths of less than 3 fathoms, extend southeastward from the cape for a distance of 10 miles.

7-33 The Aird River.—In March 1887 the steamer *Victory* entered the river by the Nakari mouth and, passing at the foot of Aird Hill, proceeded on to Tumu village, where the tidal effect ceased. Above that village the river widens and is joined by a tributary coming from the northwestward. From here the river was followed in a general north-northeasterly direction, winding around thickly wooded limestone hills that

varied in height from 300 to 2,000 feet for a further distance of about 25 miles, when the steamer's progress was stopped by rocky bars. For some 13 miles farther the river was explored by a boat; the estimated position of the highest point reached was $6^{\circ}39'S.$, $144^{\circ}11'E.$, or about 87 miles from Cape Blackwood. By a subsequent expedition, near the end of the same year, the river was further examined in a steam launch; the upper waters were found to be obstructed by rapids.

Returning, the *Victory* passed out to sea by Bevan Sound, eastward of Cape Blackwood, finding good depths as far as Deception Bay.

During these expeditions the population appeared to be confined principally to the islands of the delta and their general vicinity, although a few were encountered at some distance up the Aird. The latter appeared to be friendly. Their gardens were well cultivated and contained sugar cane, bananas, and tobacco; the houses of these people were large and fairly well built. The coast natives are of superior muscular development and of a lighter color than those encountered up the river; they appeared, in 1887, to be hostile.

Climate.—There was little or no sickness in the party that visited these rivers in March. The weather was generally fair during the day, but there were, altogether, only two or three dry nights. The winds were westerly and northerly and the temperature in the shade during the day was 83° to $85^{\circ}F.$

Aird Hill, situated up the Auro River about $23\frac{1}{2}$ miles above Cape Blackwood, is a steep limestone hill, about 900 feet high, that is difficult to reach because of the swamps that practically surround it. There is fresh water in the creek close to Aird Hill. A mission station is situated on the hill.

7-34 Bevan Sound ($7^{\circ}45'S.$, $144^{\circ}30'E.$), the most direct route to Aird Hill, is practicable for vessels of 15-foot draft. There are, however, numerous sandbanks in the sound.

Villages.—A few miles above the junction of the mouths of the Aird River is Tumu village, around which there are limestone hills that attain a height of about 300 feet. On Babaibari Island, separating the Aird and Nakari mouths, are two villages.

At Kikori, about 18 miles up the river, there is a government station. It is reached by means of the Waikoro River, in which there is sufficient depth for vessels of 6-foot draft.

7-35 Deception Bay, lying between Bald Head, on the east, and Ibibubari Island and Saumao Peninsula, which constitutes the eastern side of Bevan Sound, on the west, is about 15 miles wide and is fronted to a distance of about 10 miles in places by flats with depths of less than 3 fathoms. Little is known about the western part of this bay, which derived its name from the fact that it at first appears as a deep entrance to some navigable river. Numerous streams discharge into this bay. The estuaries of the most important of these streams are Paia Inlet, Era Bay, and Port Romilly. The islands separating the several streams are all low, swampy, and covered with mangroves and nipa palms.

Channels run between and parallel to banks which are a continuation of the long tongues of land and lies in a north-northwest and south-southeast direction from Bevan Sound, Paia Inlet, and Era Bay.

7-36 Paia Inlet was ascended by a steamer of 6-foot draft and found to connect with the Aird River at the foot of Aird Hill. It had a depth of about 2 fathoms in the fairway. At 20 miles up it was 100 yards wide and had a tidal rise of about 8 feet. There were coconut trees and a sandy beach at Puri Point on the eastern side of the entrance. The streams eastward of Paia Inlet are all part of the delta of the Kikori and Kapaina Rivers.

In 1914 a vessel which steamed through Paia Inlet for a distance of 5 miles obtained a least depth of 5 fathoms.

During the southeast monsoon anchorage may be taken near the entrance to Paia Inlet.

7-37 Era Bay.—A main 19-foot channel leads eastward and northward of Gully Bank and thence in a north-northwesterly direction into Era Bay, in which there is ample room and deep water. Near the northern end of Gully Bank, about 6 miles south-southwestward of Bapai Point, the western entrance point of Port Romilly, there is a patch that dries 6 feet. Another and more direct channel, which leads along the western side of Gully Bank and into the main channel northward of Gully Bank, has a least depth of 19½ feet.

Era River empties into the head of Era Bay. This river is navigable by light-draft vessels for a distance of 33 miles.

7-38 Port Romilly (7°42'S., 144°48'E.) is a good harbor, with plenty of room. The approach is across the main direction of the banks and therefore not direct, but vessels can take the main channel for Era Bay as far as the northern end of Gully Bank and then take a branch channel which leads northeastward toward the entrance to Port Romilly; in this channel there is a general depth of 22 feet, but it leads over a flat on which there are depths of 10 to 16 feet. Inside the entrance this channel narrows between sandbanks, but afterward becomes wider and provides ample anchorage space for any vessel that can enter the port.

Opuki Creek, connecting Port Romilly and Era Bay, has more than 20 feet of water in it, except at the entrance, where it shoals to 10 feet.

Two other channels lead to Port Romilly; one leads close past Bapai Point as far as the bar, where it joins the channel mentioned

above, and the other, with a depth of 12 feet, leads along the eastern shore. None of these channels is direct, and all would require marking with beacons and buoys before they could be used. Vessels with local knowledge, can enter at low water springs during the northwest monsoon; at that season a tidal rise of 10 feet at springs and 6 feet at neaps may be allowed for. During the southeast monsoon vessels entering should allow 5 feet in addition to their draft.

Port Romilly and Kapaina River were ascended in 1887 by the *Victory*, drawing 9 feet; its course was through nipa and mangrove swamps. The river was followed in a northerly direction for 10 miles, where two wide streams, the Wame, coming from the eastward, and another river, coming from the northward, join. This latter stream was followed through a flat, scrub-covered country until the river narrowed to 60 yards; the vessel then anchored and sent a boat ahead as far as latitude $7^{\circ}14'$ south, longitude $144^{\circ}28'$ east, where the stream broke up into numerous deep-water creeks. The highest point reached was about 20 miles above Bald Head, the eastern entrance point of Port Romilly.

7-39 Anchorage can be taken in Port Romilly between Plum Point, which is situated on the east side of the bay 3 miles northward of Miri Point, and Wame Point, 5 miles farther northward. During the southeast monsoon, which sends in considerable swell, vessels should use the northern part of the anchorage, but during the northwest monsoon it is not necessary to go so far up. The holding ground is good.

Beacons.—A beacon with a white triangular topmark is located, respectively, on Miri Point and a point lying about $3\frac{1}{4}$ miles southeastward. The latter beacon has been reported (July 1962) destroyed.

Tidal currents in the anchorage have a rate of 3 to 4 knots.

7-40 Baroi River is entered about 5 miles

eastward of Bald Head. At 11 miles above the mouth, where it has a width of 400 yards, it is joined by the Wame River; this latter river was traversed by the *Victory* in an easterly direction. Evarra village is about 3 miles westward of the junction. The Baroi was examined in the steam launch *Mabel*, drawing 6 feet, and found to divide near its mouth; the easternmost branch is the Arai River. The upper waters of this river system were further examined by both of these expeditions; the highest point reached was about 80 miles above the mouth of the river. The Baroi River connects with the Purari River at 35 to 40 miles above its mouth.

7-41 Villages.—Kaa village ($7^{\circ}42' S.$, $144^{\circ}39' E.$) is situated on a creek westward of Marea Point, and that of Baimuru on the Aia River near Bapai Point. On Kaimari Creek leading into Port Romilly, is Kaimari Village. At Evarra village, on the Wame, the ground is high enough to grow sago, breadfruit, bananas, and other products. A small sawmill is situated about 20 miles up the Wame.

Directions.—In approaching Deception Bay or any portion of the coast between it and Parama Island, to the westward of the Fly River, the lead is the only safe guide, because the water in nearly every part of it shoals gradually toward the banks fronting the coast.

7-42 The Delta of the Purari River comprises all the streams emptying into the sea between Bald Head and the Alele mouth of the Purari River, a distance of about 35 miles. Purari River proper is the easternmost and main mouth. Its estuary, which is about 3 miles wide, is divided by a long island into two mouths, the Alele and the Aivei, which connect 4 miles above their mouths. The points on both sides of the entrances of these passages are fronted by shoals to a distance of 1 mile or more. During the southeast monsoon the sea probably breaks across the mouth of each passage.

The Alele, Aivei, and Baroi mouths of the

Purari River have passages for small vessels over their bars, but, inasmuch as the passages shift and the depths change with the seasons, local knowledge is necessary in entering them.

Opiopi (Apiope) village is situated on the western side of Aivei Passage, about 3 miles up a creek. Above this village is another, named Maipua. The land in this vicinity is all mangrove swamp.

At about 30 miles above its mouth the Purari is joined by the Baroi and the Kairu (Panarsa); at the point of junction the river has a depth of about 1 fathom. The land on either side of the river is flat, 3 to 6 feet above the river, and covered with forest and occasional sago swamps.

At about 10 miles farther up the river the banks are higher and the trees are larger, low hills begin to appear, and the land is suitable for cultivation. About 25 miles above the Baroi junction the river runs for 12 miles along the base of a mountain about 2,000 feet high. In 1893 the river was ascended for about 80 miles above its mouth, at which distance it was 300 to 400 yards wide and 3 to 4 fathoms deep, but it was considerably swollen by the rain of the previous day, and the current had a rate of 5 to 6 knots.

Anchorage may be taken in a depth of about 4 fathoms in Alele Passage.

A mission station is maintained on Urika Island ($7^{\circ}48'S.$, $145^{\circ}04'E.$), in the mouth of the Urika River which empties into the sea at a position about 4 miles eastward of the mouth of the Baroi.

7-43 Orokolo Bay lies between the mouth of the Purari River and Maclatchie Point; it is about 14 miles across and has the village of Orokolo at its head and other villages on its eastern shore. The bay has moderate depths and is clear of dangers; the 5-fathom curve is charted about $1\frac{1}{2}$ miles offshore. The highest land around the bay is near the

easternmost village; at about $1\frac{1}{2}$ miles north of that village there is a flat hill, 200 feet high. There is a missionary station at Orokolo.

A 2-fathom shoal was reported in 1945 to lie about $14\frac{1}{2}$ miles southward of the western entrance point of Orokolo Bay.

7-44 Bailala (Vailala) River entrance, just westward of Maclatchie Point, has about 1 fathom on its bar; a bank extends about 1 mile off its eastern point. There is always a channel over the bar, but it shifts and should be buoyed. Local knowledge is necessary in crossing this bar; at times it is dangerous even for boats.

At Kauaheri village, on the western entrance point, there is a missionary station. On the eastern point is Herauviri (Bairara) village.

There are coconut groves near the mouth of the river; above the mouth there is a mixture of mangrove, pandanus, and breadfruit trees. At 10 to 12 miles above the mouth the land near the river consists of rich alluvial soil. The river has a width of 200 yards and a depth of 3 fathoms at 6 miles from the mouth.

At about 20 miles above the mouth the land becomes hilly and continues so on to the central chain of mountains which lies about 20 miles beyond the highest point reached, 100 miles above the mouth of the river.

7-45 Coast.—Maclatchie Point, the continuation southeastward of the eastern entrance point of the Bailala River, is low, but it is the most prominent point in the vicinity. Vessels coming from the southeastward will see flat and wooded hills over this point. These hills are remarkable in that they are the westernmost limit of the highland in this vicinity; between them and Orokolo Bay the land is marshy and only a few feet above high water.

Shoal.—A shoal, which sometimes breaks,

lies 4 miles south-southeastward of Maclatchie Point. Shoals extend 1 mile west-northwestward from this shoal, but otherwise the surrounding depths are more than $4\frac{1}{2}$ fathoms.

The coast from Maclatchie Point trends eastward for about 19 miles to Kerema Bay, into which the Matupe River discharges. Keuru, a small river, empties into the sea at about midway of this stretch of coast, and a bold bluff, with a ledge of rocks extending $\frac{7}{8}$ mile southward from it, lies about 7 miles eastward of the mouth of the Keuru. A dangerous breaking shoal is reported to lie about $2\frac{1}{4}$ miles southwestward of the entrance to Keuru River. At a distance of 3 to 14 miles northward of the bluff there are some isolated hills.

7-46 Kerema Bay ($7^{\circ}58'S.$, $145^{\circ}45'E.$), the estuary of the Matupe, is large but almost blocked by sandbanks. There is a boat passage along the western shore, and a narrow channel with a depth of $1\frac{1}{2}$ fathoms leads between the banks. Rollers are prevalent with onshore winds. The bar is bad and shifting.

Villages.—Ipisi is situated on the eastern entrance point of Kerema Bay. Close eastward of Ipisi is Kerema where there is a mission and a government station for the Gulf District of Kerema. Mei is situated on the western entrance point of the bay.

Aspect.—Keauna Hills, 600 feet high, lying about 3 miles eastward of Ipisi and northward of Cape Cupola, are prominent. The Nabo Range, about 4,000 feet high, is situated 12 miles northward of these hills. The Albert Mountains, about 7,000 feet high, lies eastward of the Nabo Range.

7-47 Coast.—Cape Cupola, the southern extremity of the Keauna Hills, is a bold headland, eastward of which are coastal hills ranging in height from 200 to 300 feet and extending nearly to Korova Creek, a distance

of $8\frac{1}{2}$ miles. On the eastern side of this creek is Karama mission station.

From Korova Creek the coast trends south-eastward to Mapu River, a distance of $10\frac{1}{2}$ miles. Port Chalmers is about $1\frac{3}{4}$ miles southeastward of the mouth of the Mapu River. This coast is lower and more heavily wooded than that to the westward and is backed for a few miles by a range of moderately high hills.

7-48 Freshwater Bay is a bight located northwestward of Mapu River. Vessels at anchor in this bight at a distance of 1 mile outside the bar of the Mapu River have filled their tanks with fresh water taken from the surface of the sea. When the vessels in question were there the flow of water out of that river was so great that there was fresh water on the surface for a distance of at least 2 or 3 miles offshore.

Alice Mead Lagoon, northward of Port Chalmers, has very good anchorage for small vessels in a depth of 2 fathoms; the entrance is easy, but as there are no marks, local knowledge is necessary. Port Chalmers is a small inlet with depths of $1\frac{1}{2}$ fathoms.

Oraruru ($8^{\circ}03'S.$, $145^{\circ}59'E.$) and Wamai villages lie between Karama and Port Chalmers. Coconut groves are seen in place along this coast. The 3-fathom curve is charted at $1\frac{1}{2}$ to $2\frac{1}{2}$ miles offshore, but the ground within that line has not been examined. Mopu Inlet (McIlwraith Harbor), a small bight into which the Kaurefrena River empties, lies about 2 miles southeastward of Wamai village.

Albert Mountains.—The country northward of Freshwater Bay is very hilly; the Albert Mountains, about 7,000 feet high, extend nearly 35 miles in a northwesterly direction from a position about 12 miles northward of the bay.

7-49 Tauri and Lakekamu Rivers.—The delta of these two rivers, about 4 miles in

extent, is composed chiefly of mangrove swamps.

The northern and main entrance to the Tauri is named Mapu; the southern mouth, the main entrance to the Lakekamu, is situated about 1 mile northwestward of Toaripi (Motumotu) village, where there is a mission station. Several creeks connect these mouths and lead to Mobiabi (Moviavi), a large village about 4 miles up the Tauri.

The mouths are apparently barred during strong winds but are available for boats at other times.

The Tauri for about 12 miles is 100 yards wide, with depths of 1 to 2 fathoms. Good land begins at Mobiabi, but it is only 1 to 2 feet above high water; this land is covered with sago, coconut, and breadfruit trees. At about 20 miles up the river there is much good land, 3 to 9 feet high, that is covered with forests.

The Lakekamu passes through sago groves for the first 12 miles, but above that the ground rises. After the first 20 miles there are large areas of deep alluvial soil covered with great forest trees; at 40 miles low, wooded hills are reached; and at 50 miles the river divides. There is a large quantity of land fit for settlement here. From the sea to this junction there would apparently never be less than 1 fathom of water in the river channel.

7-50 Coast.—Naratu River, which discharges at a position about $4\frac{1}{2}$ miles southeastward of the Lakekamu entrance, is apparently barred like the other rivers along here. Some low hills back the coast for the next 10 miles southeastward.

Biaru (Coombes) River, southward of the range of low hills, has two shallow mouths about 5 miles apart. Lese is a large village at the northern mouth.

The Biaru was ascended for about 25 miles by boats; at that position it turned southeastward with low and swampy banks.

For the first 2 miles from its mouth it passes through mangroves, thence it traverses flat alluvial land that is covered with grass or sparse forest growth. Apanaipa village is situated on the right bank of the river about 14 miles from the mouth.

Villages—Mission.—Jokea, a mission station, is situated on the coast about 3 miles southward of the southern mouth of the Biaru River. Oiapu village lies 5 miles farther south-southeastward.

7-51 Coast.—Between Jokea and Cape Possession the coast, trending south-southeastward for $12\frac{1}{2}$ miles, is bolder and is backed by a ridge of rather high hills that rise abruptly from the shore; the coast near this cape consists of cliffs and valleys. One Tree and Northwest Hills lie, respectively, northeastward and southeastward of Jokea, and Wedge Hill lies eastward of Oiapu. Between Wedge Hill and Cape Possession is Clump Hill, peaked and well defined. The southern portion of the coast is fronted by a reef that extends offshore for a distance of about 1 mile; this reef breaks at low water.

7-52 Cape Possession ($8^{\circ}36' S., 146^{\circ}24' E.$, *H. O. Chart 2946*) is a bold point that forms the southern termination of the coast range already mentioned.

The water is deep at 2 miles off Cape Possession, but nearer the shore no soundings have been taken. There is a heavy surf at times, as there is also along the entire coast between this cape and Parama Island.

Tidal currents.—At a distance of 10 to 20 miles off the shore between Cape Blackwell and Cape Possession the flood and ebb currents were found to set nearly west and east, respectively, following the general direction of the coast, and to have a rate of 2 to 3 knots.

7-53 Owen Stanley Range.—The southeastern portion of the Territory of Papua, eastward of the Gulf of Papua, rises to lofty mountains, contrasting in a very striking