See Chart Corrections

lying off its eastern side. Between the southern point of the reef and the dividing tongue of land there is a channel having depths of from 5 to 7 fathoms.

A patch with a depth of 3½ fathoms lies about ¾ mile east-northeastward of Pitt Islet.

Water may be obtained near the head of the western arm, but it is not practicable to obtain it in bulk, owing to the shallowness of the water and the distance inland.

Anchorage.—Vessels may obtain anchorage in a depth of 16 fathoms, over mud, in the eastern arm of Sineigaro Kipakipa Bay.

Good anchorage may be obtained by vessels with local knowledge in depths of from 14 to 16 fathoms, mud, southwestward of Pitt Islet. This anchorage is protected from the northwest monsoon.

8–77 Mudge (Hewoli) Bay.—To the westward of North Point are two small bays, and farther westward is Mudge Bay, about a mile in length and one-half of a mile in breadth at the entrance. A coral reef extends 200 yards northward from the western entrance point of the bay. A small stream flows into the head of Mudge Bay, eastward of the village, but it is so barred as to prevent the entrance of any craft, except small canoes.

Anchorage.—Well-protected anchorage, except from northerly winds may be obtained in Mudge Bay in a depth of 10 fathoms, over sand and mud.

8–78 Coast.—White Point (*10°36′ S., 150°56′ E.*), situated about 4 miles westward of the western entrance point of Mudge Bay, is the northeastern point of the entrance to Fortescue Strait. A belt of coral and sand shows white against the dark mangrove foliage behind the point. About three-fourths of a mile northeastward of the point there are a stream and a village.

Between Mudge Bay and White Point the coast consists of a series of shallow coves, the shores of which are fringed by a strip of coral reef.

Water may be obtained from a stream which flows into the sea about 2 miles westward of Mudge Bay. Boats should cross the bar at the entrance at high water, and the water will be found about 120 yards inside the bar.

Caution.—The northern coast of Basilaki Island is not closely surveyed, and caution must be used in navigating this area.

Shoals.—Steep-to coral patches with depths of from 2 to 3 fathoms lie from ½ to 1¼ miles off the northern coast of Basilaki Island between Mudge Bay and White Point.

Off-lying islet.—Grant Islet, situated about 1¾ miles north-northeastward of North Point, with a depth of 4 fathoms between, is composed of coral. The islet has a small sandy beach, and is surrounded by reefs extending one-fourth of a mile offshore. A small sand patch, covered with bushes, is situated on the southwestern side of the reef, 200 yards from the islet.

Westward of Grant Islet, discolored water, in which depths of 4 and 5 fathoms were obtained, was reported to extend toward North Point and Goodman Point on Sideia Island.

8–79 CHINA STRAIT is the narrow deep-water channel between the southeastern extremity of New Guinea and Sariba Island. It is about 4 miles in length in a northeast and southwest direction and about 1,500 yards in width in its narrowest part, which is at its northern entrance. The eastern side of the fairway may be considered free from danger, with the exception of the shallow water extending about one-half of a mile northwestward from Isu Hina, the northwestern extremity of Kwato Island, and the coral patch with 2½ fathoms 800 yards north-northeastward of Isu Bobo on the northwest coast of Sariba Island.

For steamers bound to the northern coast of New Guinea or the Bismarck Archipelago, this strait is of great value, but as the waters off the northern coast of New Guinea are but partially examined, this route cannot be recommended to vessels bound to more distant ports. For these the safest route is through Bougainville Strait. (See sec. 6–10).

8–80 **Tidal currents.**—In the narrow part of China Strait the currents run from 3 to 6 knots, decreasing to 2 or 3 knots in the wider parts and to still less in the approaches. The northeast-going current commences about 3 hours before high water by the shore and runs until about 3 hours after; the southwest-going current runs for the remainder of the 12 hours. The currents, however, vary an hour or more on either side of the times given. Strong easterly winds retard the northwest-going current considerably.

In West Channel the currents follow approximately the trend of the coast. At quarter flood by the shore at Samarai Island the southwest-going current is slackening all over the strait; shortly afterwards the northeast-going current begins to make itself felt outside West Channel, and, meeting the opposite current, causes overfalls and tide rips between Kwato Island, Bonarua Hilihili, and Weku Una Rock. There is comparatively little current in the bight of the New Guinea side, westward of Gesila Island.

In East Channel the tidal currents set strongly through the passes between Rogeia and Doini Islands, but they are not nearly as strong as those in the West Channel. The southwest-going current through the China Strait, impinging on Rogeia Island, runs partly through the West Channel and partly to the southeastward along the island shore, while close along the southern shore of Sariba Island there is little or no current.

The northeast-going current impinging on Sariba Island, is partly deflected to the northwestward, and, uniting with the north-going current from West Channel, runs through the narrow parts of China Strait at a rate sometimes as much as 5 and 6 knots at springs, causing heavy tide rips and overfalls at the western point of West Iguari Island.

Eddies.—A strong eddy will be found on each side of China Strait close to the shore, and there is also an eddy current near the shore to the northwestward of Isu Matuma Taiara, the northern point of the northeastern entrance. It should be remembered that the ebb current sets obliquely on this point.

On the sunken barrier to the southward of China Strait the tidal currents run with a force of from 1 to 2 knots and a general direction of northeast and southwest, but at neap tides they may be considerably modified by the wind. In the neighborhood of Wari Island their direction inclines more to the north and south. Over Siriki Shoals the tidal currents run strongly, causing heavy tide rips.

In the vicinity of the Brumer Islands the currents are less strongly felt, and during the southeast monsoon season an almost constant current appears to set to the westward, which, however, is distinctly affected by the ebb and flood currents.

8–81 **Aspect—Southern approach to China Strait.**—During the southeast monsoon season the positions of the higher mountains, which on a clear day would be visible, are indicated by a thick cloud hanging over the land. While yet outside the sunken barrier reef the Brumer Islands show clearly. The most conspicuous peak on these islands is the castellated summit on the western island; and farther northward, in front of the darker coastal hills, the bright green hills of Deirina Island are visible.

Eastward of Brumer Islands the coastal hills, rising to Mount Bramble, and farther eastward to Mount Bossim, are conspicuous. On a clear day the summit of Gaburu Paipai, situated northeastward of Mount Bossim, is seen; and farther northeastward Mount Dohu, the highest of the range near the northeastern part of the peninsula, is occasionally visible.

When a vessel is near the fairway over the sunken barrier reef Rogeia Island is visible against the coastal mountains. The north-

western part of this island is well defined, and over its southeastern part Mount Bilobilolo on Sariba Island is visible. The other portions of Sariba and Sideia Islands then appear as rounded hills, under which is the double-topped island of Doni, and also eastward of Sideia Island the peaks of Basilaki Island are visible. A square-topped summit with two peaks resembling ass's ears is especially conspicuous. Between this conspicuous summit and Mount Fairfax the land falls considerably and gradually slopes to the eastward toward Katai Island.

Caution.—The land in the vicinity of China Strait is frequently obscured by rain.

8–82 **Directions.**—China Strait is entered from the southward by passing through either West Channel (sec. 8–43) or East Channel (sec. 8–44). Approaching China Strait from the southward it is recommended to make the Dumoulin Islets (sec. 8–34) which, lying 20 miles southeastward of Papua, frequently show clearly when the other islands can not be seen. There are several good approaches leading through the barrier reef to the westward of these islets and thence access to West Channel.

Vessels with a draft not exceeding 25 feet in approaching China Strait from westward through West Channel usually pass about 1 mile northward of the Brumer Islands and thence steer with Badila-Bedda-Bedda-Bonarua Island astern, bearing 245°, to the entrance of West Channel. This course leads over a 6½-fathom patch about 6 miles eastnortheastward of the island and close northward of a 7-fathom patch 4 miles further distant.

The track from westward leads through the barrier reef close southward of a 5¼-fathom patch about 20 miles distant from the island with the summit or the light on Badila-Bedda-Bedda-Bonarua Island bearing 093° to a position about 2½ miles from the light. Thence a vessel should steer on courses 071° and 077° to a position about ¾ mile northward of the northern extremity of the island, and thence steer on course 077° with Sapikunuri (sec. 8–36) bearing ahead to approach West Channel. The track from southwestward leads, in deep water, through the barrier reef in a position about 5 miles from the island with the lighthouse on its summit bearing 047°30′ and when about 1½ miles from the southwesterly extremity of the island a northerly course is taken to join the recommended track from westward. This same break in the reef may be crossed with the summit of Baibesiga Island *(10°43′S., 150°18′E.)* in range 350°. A good approach that also can be used crosses the barrier reef with the Arch Islets bearing between 033° and 001° taking care to avoid a 8½-fathom patch about 12 miles westward of Baiiri Islet.

Approaching West Channel the Iari Hau Peak and the northwestern point of Bonarua Hilibil in range 044°, lead eastward of Heath Patches. When safely past Heath Patches course may be altered to a mid-channel course between Weku Una light and the 4-fathom patch about 700 yards northwestward of Isu Hina. Mid-channel courses may be steered through China Strait, care being taken to avoid Manupisina Rocks, the 15-foot patch north-northeast of Isu Bobo Point, Sugutusi Rock, and Cull Patch. Isu Bobo Point, in range with Isu Matuma Laiara bearing 204°, leads east of Cull Patch. This range also leads east of Dorasi Shoal.

If proceeding to Samarai, Mount Bossim and Isu Hina in range astern, bearing 268°, lead 200 yards northward of the 1-fathom patch named Kwato Eina Kaba Kwasi, which can usually be discerned; and when the western extremity of Doini Island bears 150° and is well open eastward of Rogeia Island, a course may be shaped for the anchorage off the northwestern side of the island. Small craft wishing to evade the tidal current may pass inside Sugutusi Rock, which lies nearly in the center of Hiliwa Dara

Bay.

Abreast West Iguari Island the tidal current runs as much as 6 knots at times, causing strong overfalls off the western point of the island, which should not be approached too closely.

In entering from the northward these directions must be reversed.

East Channel, which leads northward of Doini Island, is free from dangers, with the exception of Yama Reef, which a vessel will pass eastward of by keeping the summit of Tuyam Island open of the northern point of Doini Island, bearing 139°, or Mount Weiadubi in range with the western point of Samarai, 327°. The southern extremity of Hatuno Rock in range with the southern summit of Doini Island, bearing about 144°, leads midway between Yama Reef and the southeastern end of Rogeia Island.

In approaching Samarai Island from the southward, Mount Weiadubi, open westward of Ebuma Island, bearing 334°, leads westward of Samarai Island Reef.

8–83 **MILNE (TAUWARA) BAY,** which is formed between North Foreland (sec. 8–22) and Killerton Point, about 9 miles to the northward, extends in a westerly direction and is about 20 miles in length, with an average breadth of 7 miles. To the westward of North Foreland, the southern shore of the bay continues bold and steep and is slightly indented by a succession of bights, which have not been examined. Cascades of fresh water abound in this locality. Immediately to the northward of the head of the bay the northern shore of the bay appears to be low, with foul ground extending some distance offshore. After rain, large mountain torrents flow into the bay and discolor the water for some distance from the shore, producing the appearance of shoal water.

The bay is very deep on its south side.

Aspect.—At the head of the bay a thickly populated plain extends 4 or 5 miles inland to a low mountain range, and thence westward rises the Owen Stanley Range, which may be called the backbone of the Territory of Papua. Running parallel to the latter range and separated by extensive valleys is the Stirling Range, extending along the northern coast of the island. Numerous villages dot the shores of the bay, and there is a considerable amount of cultivation on the southern shore.

Anchorages.—The main anchorages in Milne Bay are located at the head of the bay and are known as Waga Anchorage and Gili Anchorage.

Formerly temporary anchorage was reported off the southern shore of the bay in 14 fathoms about 3 miles northwestward of North Foreland.

Anchorage was also reported for small vessels in the small bays along the southern shore of Milne Bay, in depths of 15 to 20 fathoms, with sufficient room to swing clear of the rocks.

Caution.—Navigational aids are no longer maintained in Milne Bay. The wharves and facilities, most of which were constructed during World War II, are (1960) at an advanced stage of deterioration.

8–84 **Kana Kopi Bay** is entered between the western edge of Saraoni Island (sec. 8–23) and Kana Kopi Point, about 350 yards westward. The bay has general depths of 10 to 15 fathoms, to within 200 yards of its head, and extends for about 800 yards in a southerly direction. On the western shore near the head are two jetties which extend out beyond the shore reef. Dolphins are located off the ends of these jetties, and the chart indicates depths of 24 to about 30 feet in this vicinity. At the head of the bay there is a dock and three piers.

Measured distance.—A measured mile course is established on the southern side of Milne Bay about 7 miles westward of Kana Kopi Bay. The course runs in a 116½°–296½° direction, and the limits are marked at each end by a pair of white triangular **beacons** with black vertical stripes.

8–85 **Discovery (Waggawagga) Bay** *(10°25′ S., 150°25′ E.)*, situated on the southern shore of Milne Bay, is entered about 14 miles west-northwestward of North Foreland.

SEE SMART CORRECTIONS

From seaward the eastern part appears low and wooded, and the bright green trees in the background show its position. The western part of the bay is distinctly marked by a reef, which is partly awash. Bay Islet and some rocks lie on this reef. The entrance lies between the reef and Bismarck Point, the eastern entrance point.

Waga Waga is a village at the head of the bay, and water may be obtained.

Anchorage.—Vessels may anchor in the middle of Discovery Bay in 12 to 14 fathoms, sand and mud. The eastern shore of the bay should be favored by entering vessels, since it is steep to. The reef on the western side should be avoided, as its inner portion is not always discernible.

8–86 **Facilities.**—An L-shaped wharf is located at Bismarck Point. There is a depth of 17 feet alongside its northwestern face and 37 feet alongside its southwestern face. Piers, in ruins, for small craft are also located along the southeastern and southern shores of the bay.

8–87 **Waga Anchorage** is located in the southwestern part of the head of Milne Bay, and affords anchorage for several vessels inside the 20-fathom curve.

Dangers.—Between Discovery Bay and the head of Milne Bay the shore is fronted by reefs and shoals extending as far as 600 yards offshore in places.

Branson Rock has a least depth of 10 feet. This danger is located near the northern limit of the Waga Anchorage area in a position about 1 5/8 miles southeastward of the solitary mangrove standing on the large reef in the southern part of the Aleford Islets.

Detached shoals with depths of 5 to about 6 fathoms lie southward of the Waga Anchorage berths.

About midway between the solitary mangrove and Branson Rock are two small shoal areas situated close together and having depths of 7 to 8 feet.

Other detached shoals lie eastward and southward of the solitary mangrove, for the positions of which consult the chart.

8–88 **Facilties.**—A wharf is located on the shore abreast Waga Anchorage at a position about 1¼ miles westward of Discovery Bay. The wharf is connected to the shore by three aproaches 30 feet wide and is approximately 300 yards long along its face. There is a least depth of 34 feet at its eastern corner. A 680-foot pier extends out from the shore eastward of this wharf.

8–89 **Aleford Islets,** situated at the head of the bay, lie from 1 to 2 miles offshore. They are surrounded by reefs, but the depths eastward of them increase from 10 fathoms at one-half of a mile off to 20 and 30 fathoms from 1½ to 2½ miles off.

Hiwoli Island, the northernmost of the Aleford Islets, is 71 feet high to its treetops. On its north port is a conspicuous tree. A restricted area for seaplane landings extends from Hiwoli Island to the shore northwestward. A submarine cable is laid in this area. Immediately southward of this area are three anchorage berths.

Buoys—Mooring buoys.—Several buoys and moorings buoys, some of which are for the use of aircraft, are located westward of Hiwoli Island.

Caution is advised as there are obstructions in this area.

Lalava Islet, the easternmost of the Aleford Islets, is 45 feet high to its treetops. Between Hiwoli and Lalava there are numerous reefs. A narrow bank, on which there are depths of as little as 15 feet, extends about 1,200 yards eastward from Lalava.

Netuli Islet, 63 feet high to its treetops, and Kebolia Islet, 51 feet high to its treetops, are the westernmost of the Aleford Islets.

Near the middle of the large reef extending eastward from Netuli Islet there is a solitary mangrove tree. Southward of Kebolia Islet there are several small anchorage berths.

Several streams flow into the head of the bay, in the vicinity of which are situated several villages. Gibari (Laukaipu) River, at the southwestern corner of the bay, is navigable by boats for a distance of 2 or 3 miles. Sikaguru village lies about 1½ miles up the river, and inside the entrance to the river is the landing place for the gold fields which are situated on Hula Hula and Lindons Creeks.

8–90 Gili (Giligili) Anchorage, lying in the northwestern part of Milne Bay north of Aleford Islands affords shelter in 5 to 20 fathoms. It is reported to be gray mud and very good holding ground. Should protection from strong southeasterly winds, which blow strongly at times, be desired, anchorage can be found westward of Hiwoli Islet, or close westward of Laulau Islet. The latter island lies close off the shore about 1½ miles north-northeastward of Hiwoli Islet, and is 60 feet high to its treetops.

The shores in the vicinity of Gili Anchorage are flat and featureless, and the country is covered with dense groves of coconut palms. There is a heavy jungle about 2 miles inland, and farther to the north the Stirling Range rises steeply to about 3,000 feet. An airfield is constructed a short distance inland, and along the shores are several piers and wharves.

Dangers—Buoys.—Kwato Shoal, with a least depth of 8 fathoms, lies nearly 1 mile 160° from Laulau Island. It is a coral formation, 300 feet in diameter and circular in shape, and rises from surrounding depths of 17 fathoms.

Stringer Bay, northeast of Gili Anchorage, affords anchorage in 6 to 20 fathoms.

A shoal, with a depth of 5 feet, lies about 400 yards south-southeastward of Stringer Observation Spot on the west side of Stringer Bay.

A 7-fathom spot lies 940 yards south-southeastward of the observation spot.

Three can buoys are moored off the northern side of Laulau Island.

Tides.—The greatest tides experienced over a period of 15 days continuous observations in July were 3 feet.

Tidal currents are weak and negligible in the vicinity of Gili Anchorage.

Information about tides and tidal currents, although approximately correct, should be accepted with reserve, as observations were made only over a limited period.

Mean high-water springs rise 5 feet; mean high-water neaps rise 4 feet; and the mean sea level is 3 feet.

Directions.—Vessels approaching Gili Anchorage, after passing through China Strait and to the eastward of Dorasi Shoal, should alter course into Milne Bay to leave Saraoni Islet 2 miles on the port hand, and then steer 295° for Laulau Islet, distant about 19 miles.

When about 1 mile from the islet, a vessel should steer 280° until the concrete storehouse at the root of Giligili jetty bears 350°. Then she should steer northward toward the pontoon wharf at the sandbank, located about 400 yards northwestward of Laulau Islet. Then she should approach the pontoon wharf, passing about 200 feet southward of the sandbank, care being taken to prevent the vessel's bow from swinging toward the bank, especially during southeasterly winds. When the vessel is abreast the wharf, let go the starboard anchor and veer 30 fathoms of cable. Hawsers should then be run ashore and secured to bollards on the bank. Because of the nature of the bank, the bollards are not firmly rooted, therefore avoid excess strain on all lines

when making fast. Vessels drawing up to 24 feet can use the pontoon wharf.

8–91 **Facilities.**—Several wharves and piers are located on the shore abreast the Gili Anchorage area.

Repulse Wharf is located about 600 yards northeastward of Beacon "B" on Laulau Island, and has a depth of 28 feet alongside.

Lyal Wharf, next westward of Repulse Wharf, has a depth of 17 feet alongside.

It is reported that reefs extend out beyond either end of Lyal Wharf. Shore authorities state that the best way to approach this wharf is to avoid heading into it, and to let go at least one anchor when opposite or slightly beyond it. The vessel can then be worked in with the engines, end eventually by lines ashore.

Pontoon Wharf, with a depth of 15 feet alongside, is located about 600 yards westward of Lyal Wharf.

Giligili Jetty, with a depth of 5 feet alongside, is located about 350 yards westward of Pontoon Wharf.

Trafalgar Wharf, a T-head jetty with a depth of 38 feet along its head, is located on the shore about 1,300 yards westward of Laulau Island.

Nelson Wharf, consisting of two L-shaped arms extending from the shore three-fourths of a mile southwestward of Trafalgar Wharf, has depths of 24 feet alongside the seaward faces. A slipway is constructed in the area between the two arms.

The United States Navy Jetty, about 500 feet long, extends out to depths of 28 feet close southward of Nelson Wharf.

Several small jetties, suitable for motor boats, are located in the vicinity.

Water from the creeks should be boiled before using for drinking purposes, but at Ahioma, about 8 miles eastward of Laulau Island, good water is obtainable from a spring.

Malaria is prevalent in the vicinity.

8–92 **Ahioma Harbor**, on the northern side of Milne Bay about 8 miles eastward of Laulau Island, has docking facilities. Cargo is worked by ship's gear into trucks. Cargo is also worked from the anchorage ½ to 1 mile off the docks. The anchorage is in approximately 35 fathoms and the holding ground is good. There are a few lighters available.

Water is piped to the docks, but it must be boiled before drinking.

Several wharves, from about 300 to 400 feet long and with depths of 16 to 30 feet alongside, are located on the shore near Ahioma and to the westward, and in the vicinity of Gopi Point.

8–93 **KILLERTON BAY** (*center, 10°21′ S., 150°40′ E.*), situated eastward of Milne Bay, lies about 8 miles eastward of Ahioma. Low wooded land, partly cultivated, borders the shore of the bay. Mount Koia giligili, 1,635 feet high, and Mount Gera gera, 1,660 feet high, are situated about 2 miles northward of the bay, and give rise to two rivers which flow into the bay. Valley Hill, a round wooded knoll 367 feet high, is situated about a mile northward of the bay, on the southeastern extremity of a spur running down from Mount Koia giligili. Two villages are situated on the shore of the bay.

Island and shoals.—Killerton Islands, situated in the southwestern part of the bay, comprise three principal islands and four smaller islets. They are wooded and lie in a general east and west direction.

8–94 **Haro Wani**, the eastern island of the group, lies 1,600 yards southward of the northern shore of the bay. A village stands on Mission Point, the northwestern extremity of the island; and at its southeastern end there is a lagoon. A narrow reef fringes the greater part of the island, stretching off at the southeastern end to a distance of 200 yards, with shallow water nearly 400 yards beyond. Shallow water also extends 400 yards northward from Mission Point.

A coral patch with a depth of less than 6 feet lies one-half of a mile northward of Mission Point, and between this patch and the shoal water extending northward from Mission Point there is a channel 500 yards wide with a least depth of 6 fathoms.

8–95 **Mahabarina**, the middle island of the group, lies about 800 yards southward of the northern shore of the bay. Reefs extend 550 yards and 800 yards southward from the western and eastern ends, respectively, of the island. Three islets, lying in a north and south direction, are situated on the eastern reef. The passage between these three islets and Haro Wani Island is reduced to about 300 yards by the shoals extending off the eastern sides of the northern and southern islet.

8–96 **Wagu tu maiawa**, the western island of the group, is situated about one-fourth of a mile southward of the mainland, with a reef and shoal water between. About 600 yards northward of the northern point of the island there is an islet close to the mainland. A rock above water lies 100 yards southward of the islet. Between the rock and Mahabarina Island the channel is about one-fourth of a mile wide and has depths of from 15 to 16 fathoms.

A small islet is situated westward of Wagu tu maiawa. It lies on the extremity of a reef projecting southward from the mainland.

Gau hi lama Islet lies about 1,300 yards 215° from Mission Point on Haro Wani Island. This bush-covered islet is 47 feet high. Shoals, as defined by the 3-fathom curve, extend 670 yards westward and 800 yards north-northeastward from it.

A coral patch with depths of from 1 to 3 fathoms lies about 650 yards south-southwestward of Symonds Point, the eastern entrance point of the bay. A small drying reef lies 1,500 yards westward of the same point, and about midway between the drying reef and the point there is a patch with a depth of 2 fathoms.

8–97 **Dangers.**—The following reefs and shoals have been reported in Killerton Bay, distances and bearing from the 367-foot summit of Valley Hill:

A drying coral reef, known as Dawson Reef, approximately 150 yards in length, extending in an east-and-west direction, the center of which is located 1,660 yards 185°; a shoal with a least depth of 10 feet 1,540 yards 150°; a shoal with a least depth of 10 fathoms 3,200 yards 186°; a shoal with a least depth of 1 fathom, 250 yards in length and 200 yards wide, extending in a north-south direction with the center 3,100 yards 192°.

Caution.—Additional shoals probably exist in this area, and mariners are warned to use extreme caution.

Sullivan Patches, about 4 miles eastward of Haro Wani Island and 3½ miles southward of Nuamura Point, have a least charted depth of 3 fathoms.

Yunnan Shoal, with a depth of 9 feet, is located about 2,600 yards southward of Nuamura Point. A 5-fathom shoal lies about three-eighths of a mile north-northeastward of Yunnan Shoal.

Caution.—As the waters in this area have not been completely examined. It is not advisable to pass between Sullivan Patches and Yunnan Shoal.

8–98 **Anchorages—Directions.**—Anchorage may be obtained on the northern side of Haro Wani Island in 13 fathoms of water, over sand and rock, with Mission Point in range with the southwestern extremity of Waga tu maiawa, bearing 241°, and the southeastern point of Haro Wani bearing 142°. This anchorage is exposed to easterly winds and is unsafe except in fine weather.

The most sheltered anchorage is between Mahabarina Island and the mainland, where there is anchorage in a depth of 15 fathoms, but being close to the mangrove swamps it is not a desirable place to lie in.

Tides.—The high-water interval at full and change at Killerton Bay is 11h. 30m.; springs rise 3½ feet, neaps 2 feet.

8–99 COAST.—From Killerton Bay the coast trends for 2 miles in a northeasterly direction to Heinaheina, a low rounded point, with a wooded hill behind it. Thence to Nua Muri Point, 2¾ miles farther in the same direction, the coast forms several sandy bays off which foul ground extends for ½ mile.

Hameter (Kubui) Point, situated about 5¼ miles northeastward of Nua Muri Point, is bold and steep-to. It is dominated by a hill with a double summit, 405 feet high situated close to the coast. Between Hameter and Nua Muri Points there are some villages, but the landing is bad. From Hameter Point the coast trends northeastward for 3 miles to East Cape.

SEE SHORT CORRECTIONS

A 4-fathom shoal, having a radius of 1½ miles, lies nearly 1¼ miles southwest by westward of Hameter Point.

8–100 Aspect.—Mount Binumu, or Killerton, situated 2¼ miles northeastward of Mount Gera gera, attains a height of 1,610 feet. It is a conspicuous mountain, having a widespread summit, with rounded shoulders. From the southeastward and northwestward the summit shows in three round knobs or elevations, of which the central one is the highest. In approaching Goschen Strait from the westward this mountain affords a good mark, the top being seldom clouded.

Koia Koiraki and Koia are two sharp well-defined peaks eastward and east-northeastward respectively of Mount Binumu, having near their summits a group of trees. The summits are 1,060 and 830 feet high, respectively.

Towards East Cape the valleys between the hills become deeper, giving them, when seen at a distance, the appearance of islands.

8–101 East Cape (*10°14′ S., 150°53′ E.*) is the eastern extremity of the peninsula just described and of New Guinea. About 600 yards southwestward of East Cape there is a double peak, named Lulu guibiai, 420 feet high, which is the termination of the range of hills extending along this peninsula. This double peak is thickly wooded on the northwestern and southern sides but is clear and cultivated on the northeastern side. A narrow strip of sand fringes the coast and the village of Hehego is situated on the point. The whole of this peninsula is well populated; the villages are mostly on the northern shore, which is well watered and cultivated.

Discolored water was reported to exist about 1½ miles southwestward of East Cape.

8–102 ISLANDS AND DANGERS OUTLYING EAST CAPE.—The following islands and dangers lie in the approach to Goschen Strait when coming from the southward or eastward. The main channels have sufficient water for all classes of vessels, but being unbuoyed are in most cases only safely navigable with the sun in a favorable position. There are good objects, however, for fixing the position of a vessel.

8–103 Meimei Ara Island (*10°14′ S., 150°53′ E.*) is located on the insular shelf east-northeastward of East Cape. The island is thickly wooded, and near the middle of the island a grassy mound rises to a level with the top of the trees. There is a village on its western side.

A fringing reef extends one-fourth of a mile from its northern side, 300 yards from its southern side, and 400 and 200 yards from its eastern and western sides. Several rocks above water lie on the edge of the reef extending from the southern side.

A shallow bank, with depths of 10 to 18 feet over it, extends about ½ mile east-northeastward from the northeast extremity of Meimei Ara Island.

Meimei Ara Island is separated from East Cape by Hornbill Channel, through which the tidal current sets with considerable strength. With the wind from southeastward a breaking sea extends nearly across the passage, but by keeping close to the reef extending from the western side of the island, which is marked by two beacons, vessels with a draft of 12 feet can pass through.

A light is shown from the south end of the island.

A 160-foot high mast stands on the eastern shore of Meimei Ara Island.

Foul ground and numerous shoals exist within a radius of 1 mile southward through eastward of Meimei Ara Island.

8–104 Jackdaw Channel is a passage between the shallow bank extending east-northeast from Meimei Island and the detached shoals and foul ground southwestward

of Boiaboia Waga Island. The west tangent of Lelei Gana Island in range 165° with Fairfax Mountain on Basilaki Island leads through Jackdaw Channel and clear of the dangers mentioned.

8–105 Boiaboia Waga Island, also situated on the insular shelf, lies 1¼ miles northwestward of Meimei Ara Island. This wooded island, surrounded by a sandy beach and fringing reef, is 75 feet high. The drying reef extends one-fourth of a mile eastward from the eastern end of the island and has some rocks, which dry 3 feet, on its outer edge. A reef also extends 1,200 yards southward from the island. On this reef there are numerous rocks under water; and a drying patch, situated 1,200 yards southeastward of the island.

There is a bar and foul ground, with depths of less than 3 fathoms, between Boiaboia Waga and Meimei Ara Islands. A sandbank, awash at high water, lies about ⅛ mile westward of Boiaboia Waga Island.

Revelle Patch, with a depth of 19 feet in its western part, lies about 1½ miles northeastward of Boiaboia Waga Island.

Mount Binumu (Killerton), bearing 248°, just open northward of Kwiromi Point, 2¼ miles westward of East Cape, leads northward of Revelle Patch.

8–106 **Taodovu Reef**, the center of which lies 2 miles eastward of Boiaboia Waga Island, has depths of from 1 to 2 fathoms and sunken rocks all over it. It is 1½ miles in length from north to south and 600 yards in width at its broadest part. There is a deep channel, 700 yards wide, between the northern extremity of the reef and Revelle Patch.

Mount Tanorabua, the summit of Nuakata Island, in range with Hibwa Islet, bearing 144°, leads nearly 1½ miles northeastward of the 10-foot spot on Revelle Patch and 1 mile northeastward of Taodovu Reef.

8–107 Searley Reef *(10°14′S., 150°55′E.)* about 800 yards in length and width, lies southward of the reef projecting southward of the reef projecting southward from Boiaboia Waga Island. Northwestward, and separated by a passage about 125 yards in width with a least depth of 5 fathoms, lies another reef about the size of Searley Reef.

About 500 yards southward of Searley Reef is a shoal with a least depth of 4 feet.

Thobbs Reef lies southeastward of Searley Reef, from which it is separated by Messum Channel running in a north and south direction. A narrow reef lying close northward of Thobbs Reef forms part of the eastern side of Messum Channel.

8–108 **Messum Channel** is about 400 yards wide and, lying at right angles to the direction of Raven Channel, is valuable as an alternative route to Goschen Strait from the southward. Therefore, if Raven Channel be impracticable, this channel might be used, although there are no range marks for the channel proper, nor do the tidal currents set fairly through. The 4-foot shoal southward of Searley Reef is a hazard in the southern approach. The least known depth in the fairway is a 4¾ fathom patch on the eastern side of the southern part of the channel.

Tidal currents.—In Messum Channel the flood current sets northeastward and the ebb current southwestward.

Directions.—Approach Raven Channel (sec. 8–110) until Togisi Islet comes in range with the eastern extremity of Lelei Gana Island, bearing 175°, which mark astern leads to the southern entrance of Messum Channel. This

mark must not be depended on for more than a guide to the channel entrance. When between Thobbs and Searley Reefs alter course to pass between the reefs comprising the channel limits. When clear northward of the reefs alter course to about 006°. When Hibwa Islet bears 119°, open about three times its own width of the northeasternmost point of Nuakata Island, make good a course of 299°, which will lead midway between Revelle Patch and the reef extending eastward from Boiaboia Waga Island.

8–109 Diligaoli, a large irregular-shaped reef, lies eastward of Thobbs Reef, from which it is separated by a channel 400 yards wide. This channel, known as Crow Channel, has a least known depth of 7½ fathoms in the fairway. The southwestern end of Iabama Island (sec. 8–113) bearing about 182° astern leads through. A rock, which dries 3 feet, lies on the northeastern end of the reef. A 12-foot shoal patch lies about 600 yards northeastward of the eastern end of the reef.

Taori namu namu, a dipper-shaped reef, is situated southward of Diligaoli Reef; and between these two reefs is Raven Channel. Foul ground surrounds this reef to the southward and eastward.

8–110 Raven Channel is the best passage through the reefs northward of Obstruction Islands. The reefs just described on either side of the channel have depths of only a few feet and are steep-to. The edges show distinctly from aloft if the sun is favorably situated, but the edge of the reef on the northern side is reported to be much more clearly defined than that of the southern reef.

8–111 Shoals.–A shoal with a least depth of 16 feet lies about 2 miles 009° from Iabama Island 225-foot summit.

A 5-fathom patch lies about 2 miles northward of the previously mentioned summit.

8–112 Directions.—Approaching Raven Channel from the southwestward steer for East Cape bearing 023°, giving Dana Gedu Reef (sec. 8–116), the southwestern end of which generally breaks, a berth of 1 mile. When the southern extremity of Lelei Gana Island is in range with Gadahoa Point, bearing about 093°, alter and make good a course of 046° for about 4½ miles along the northwestern side of Dana Gedu and Tahiri Siga Reefs until Hibwa Island bears about 083½°. Alter course to about 083½° to pass about midway through Raven Channel. This course passes through the above-mentioned 5-fathom shoal patch and close to the northern edge of the 16-foot shoal patch. The channel is about 400 yards wide at its narrowest point.

The reefs on either side of the channel are usually clearly visible, but the 16-foot shoal patch is small and difficult to see.

Caution.—It was reported that the current in the western approach to Raven Channel has a strong northward flow, as strong as 5 knots at times.

A shipmaster with considerable experience gives the following directions for proceeding from Milne Bay through Raven Channel:

Raven Channel is exceptionally hazardous to navigate, and vessels have grounded on Taori namu namu and Diligaoli Reefs.

In approaching Raven Channel line up the buoys, and take continuous cross bearings. There is a conspicuous tree on Lelei Gana Island which is visible 15 miles in good weather. Bearings of this tree, East Cape, and Boiaboia Waga Island will keep a vessel off Sullivan Patches and the above-mentioned reefs. The best time to navigate Raven Channel is in early daylight hours. After clearing Sullivan Patches by ¾ to 1 mile off, steer 036° for about 9 miles until Hameter Point bears 264°; thence change course to

084°. A mid-channel course leads through Ravan Channel. Watch the set, as high water sets the vessel north and low water south.

Light draft vessels move crabwise. Continuous cross bearings of Lelei Gana and Boiaboia Waga Islands should be taken. When lining up to go through Raven Channel, get Hibwa Island ahead and Hameter Point dead astern. Keep them in line and the vessel is safe. Do not attempt to run in a squall; there are plenty of good anchorages around East Cape. After passing through the channel run about 1/2 mile past the point where Iabama Island and Lelei Gana Island open of each other, bearing 213°.

8-113 OBSTRUCTION ISLANDS—DANGERS.—Obstruction Islands take their name from the position they occupy in the passage between East Cape and Nuakata Island. They consist of three islands, the middle one being the highest and most conspicuous. The area surrounding these islands is encumbered with reefs.

IABAMA ISLAND (10°17'S., 150°56'E.), the northern island of the group, is 225 feet in height. It is wooded and partly cultivated, and there is a village on its southwestern side. A small 2-fathom shoal patch lies close northeastward of Iabama Island. Between Togosi Islet, situated south-southwestward, and the southern extremity of the island there is a shoal, with least charted depths of 5 fathoms.

LULU DUYA is a shoal with a depth of 3 fathoms, extending about 1/2 mile in a north-northwesterly direction from a point about 225 yards northward of Iabama Island.

TIDES.—The high-water interval at full and change at Iabama Island is 8h. 30m., springs rise 3 feet.

8-114 BANIBANI SIGA, lying about 1,800 yards east-southeastward of the eastern point of Iabama Island, is a sandbank which dries about 3 feet and is surrounded by a reef. Several other reefs with depths of from 2 to 5 fathoms lie northeastward, eastward, and southward of the sandbank.

Midway between Banibani Siga and Iabama Island there is a narrow reef 1 mile in length in a north and south direction, and 800 yards 049° from its northern end is a detached coral head.

8-115 LELEI GANA (PAHILELE) ISLAND, situated 1 mile south-southwestward of Iabama Island, is wooded, partly cultivated, conical, and 341 feet high, with a conspicuous tree on its summit. A village is situated on its northern end.

A reef, with rocks which dry from 3 to 10 feet, extends 800 yards northward from the northern end of the island. Togisi Islet lies about 100 yards southward of the outer end of the reef. This bush-covered islet is 27 feet high.

An almost continuous line of coral patches with depths of from 1 to 3 fathoms extends 1 1/2 miles southward of the island and thence eastward for a distance of 1 3/4 miles.

8-116 DANA GEDU, the southwestern portion of the reefs surrounding the Obstruction Islands, extends westward intermittently from the southwestern point of Lelei Gana Island for a distance of 3 1/2 miles. About 800 yards eastward of the extreme point of Dana Gedu there are some rocks, which dry 3 feet, and the remainder of the reef has depths of from 6 feet to 2 fathoms.

TAHIRI SIGA is the continuation northeastward of Dana Gedu; together they form one

reef 4 1/2 miles in length, with depths of from 6 feet to 2 fathoms. The northern end of Tahiri Siga is separated from Taori namu namu by a channel one-half of a mile wide, with some shoal patches.

8-117 KANA KUBAKUBA ISLAND (10° 19′ S., 150° 58′ E.), the smallest and southeasternmost of the group, has a conical summit, 160 feet high. It is thickly wooded and uninhabited. Reefs and foul ground extend in a north-northwest direction from the island as far as Banibani Siga Reef. No navigable passage could be discovered between them. Foul ground also extends 800 yards southeastward from the southern end of the island.

A coral head with a depth of 2 fathoms lies about 1 mile northeastward of the island. A patch with a least depth of 3 fathoms, coral, is situated about 1 3/4 miles southeastward of the island. A sunken rock lies about 1 1/4 miles southward and three more sunken rocks lie 400, 1,000, and 1,700 yards, respectively, southwestward of the island. A 4-fathom coral patch lies about 200 yards southeastward of the last-mentioned sunken rock. The northern point of Daiwari Island just open south of Gadahoa Point and bearing 067° leads close southeastward of the 4-fathom patch.

Hawkihawki Reef consists of two patches of sunken rocks, the northern extremity of the reef lying about 1 mile southeastward of Kana Kubakuba Island. The northern extremity of Daiwari Island just open southward of Gadahoa Point the south extremity of Nuakata Island, bearing 067°, leads through the passage between Hawkihawki Reef and Kana Kubakuba Island. This passage should be used with caution.

8-118 BADILA DADUBONA REEF is the southernmost of the dangers lying in the immediate vicinity of the Obstruction Islands, and is the continuation of Hawkihawki Reef. It has two sandbanks, which dry 3 feet, on it, and is nearly always indicated by breakers. The northwestern sandbank lies about 2 1/4 miles south-southeastward of Kana Kubakuba Island.

About three-fourths of mile eastward of the southern sandbank there is a patch of sunken rocks, with two 3-fathom coral heads close northeastward of it.

WALTERS REEF, another patch of sunken rocks, lies about 1 3/4 miles northeastward of Badila Dadubona. A sunken rock lies about 1 1/4 miles southeastward of Walters Reef.

The western extremity of Hibwa Islet in range with Kurada i leiyu (Kabahuhu Point) the western extremity of Nuakata Island, bearing 355°, leads between Walters Reef and the reef about 1 mile southwestward of it. The southern extremity of Lelei Gana Island in range with the northern extremity of Kana Kubakuba Island, bearing 287°, leads northward of Walters Reef and the reef situated about 1 mile northwestward of it.

8-119 NUAKATA ISLAND—OFF-LYING ISLANDS AND DANGERS.—Nuakata Island, the principal island in the vicinity of East Cape, lies about 8 miles east-southeastward of it. A range of hills traverses the entire length and breadth of the island and to the southward forms a narrow peninsula. Mount Tanorabwa, the summit of the island, is conical, wooded, and 1,072 feet high; it is a con- (Continued on page 311)

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spicuous mark for vessels navigating in the locality. The principal village is located on the northern side of the island, but other villages are situated on the different bays around the coast.

8–120 Gadahoa Point (*10°19′ S., 151°01′ E.* [redacted]), the southern extremity of the island, terminates in a wooded bluff, 150 feet high. A sunken coral reef, detached from the fringing coastal reef, extends 800 yards southwestward from the point, and three-fourths of a mile southeastward of the same point is another reef, awash, with a rock which dries 3 feet. A sunken rock or shoal lies about 1¼ miles north-northwestward of Gadahoa Point.

Kurada i leiyu (Kabahuhu Point), off which a shoal with a depth of 5 fathoms extends nearly ½ mile west-southwestward, is the western point of the island.

8–121 Bwahi Kurada (Auweam) Bay, situated on the western side of the island, affords anchorage in a depth of 17 fathoms, over sand, with Kurada i leiyu, the southern entrance point of the bay, bearing 181°, distant 800 yards, and about one-fourth of a mile from the edge of the coral reef fringing the shore of the bay. It is protected from all winds eastward of south, but during October the strongest winds were generally from south-southwest, making the anchorage somewhat exposed.

Dudawali Bay, located close southeastward of Bwahi Kurada Bay, affords anchorage during the northeast monsoon in 18 fathoms, over sand, with the northwestern entrance point bearing 293° and the southeastern entrance point 170°.

8–122 Haliwa Una Bay, lying on the northern side of the island, has shoals extending 700 yards northwestward from the eastern entrance point and three-fourths of a mile northward from the western entrance point. Anchorage may be obtained in the bay in a depth of 19 fathoms, sand, with Weuwuna Point, the western entrance point of the bay in range with East Cape, bearing 288°, and Hurarea Point the eastern entrance point 049°, at one-fourth of a mile from the beach. This position is exposed to northeasterly squalls, which are sometimes experienced, and during the southeast trade, when blowing fresh, heavy and sudden gusts come off the high land from all directions, but their force is expended almost before a vessel comes back on her chain.

8–123 Hibwa Islet (*10°15′ S., 151°00′ E.* [redacted]) lies 1¾ miles north-northwestward of Sekwia kwioa Point, the northwestern point of Nuakata Island. The islet is, 10 feet high, and sandy and has a clump of bushes at its eastern end. Coral ledges extend about 200 yards northward and 800 yards south-southeastward from it. The islet is reported difficult to make out. A beacon stands on the islet.

Bagshaw Patch, the northeasternmost of a number of patches situated westward of Nuakata Island, lies 1¼ miles southwestward of Hibwa Islet and has a depth of about 6 feet.

Fallows Reef, which is narrow, lies with its southern extremity about three-fourths of a mile eastward of Hibwa Islet, and extends three-fourths of a mile north-northwestward. Two submerged rocks lie about 1 mile and 1¼ miles, respectively, eastward of Hibwa Island.

Kana Kubakuba Island, just westward of Hibwa Islet, bearing 197°, leads westward of Fallows Reef. The southeastern extremity of Kana Kubakuba Island in range with Loku tao ubiri Point, the north entrance point of Bwahi Kurada Bay, bearing 213°, leads southeastward of Fallows Reef and the two detached sunken rocks. Boirama Island open eastward of Nuakata Island, bearing 151°, leads northeastward of these dangers.

Flounder Reef, situated 1¼ miles northeastward of the northeastern point of Nuakata Island, is 800 yards in length and 400

yards in width at its northern part, and has 6 feet over it.

The summit of Daiwari Island in range with the western extremity of Boirama Island, bearing 171°, leads about 750 yards westward of the reef, and the same summit in range with the southeastern extremity of Boirama Island, bearing 186°, leads about the same distance eastward.

8–124 **Boirama (Stanwell) Island** is separated from the eastern part of Nuakata Island by a narrow channel, which should not be attempted without local knowledge. Its summit, about 290 feet high, is covered with grass.

A few huts are grouped together near the beach on the northwestern side of the island. Reefs extend one-fourth of a mile from its northwestern and southeastern ends.

8–125 **Daiwari (Gibbons) Island,** situated 1¼ miles southeastward of Nuakata Island and about one-half of a mile southward of Boirama, is conical, 515 feet high, thickly covered with grass from base to summit, and fringed by a reef which extends three-fourths of a mile to the southward, 800 yards to the eastward, and 800 yards northward.

Between the coral reefs extending off Daiwari and Boirama Islands the dark color of the water indicates a channel, but it has not been sounded.

When approached from the southward, Daiwari Island affords an excellent landmark, its bright green summit being seen for a considerable distance. The island is uninhabited.

Shoal.—A shoal, with depths of from 1 to 2 fathoms and 2½ miles in extent, lies parallel to and about 1 mile eastward of Daiwari and Boirama Islands, with deep water between.

8–126 **Mid Sand Bank** (*10°24′ S., 151°03′ E.*), situated about 5½ miles southward of Nuakata Island, dries 4 feet. A 7-foot reef, which sometimes breaks, lies about 2 miles westward of the bank.

Four detached reefs, less than ½ mile apart, lie between 1½ miles north-northeastward and ¾ mile south-southeastward, respectively, of Mid Sand Bank. The depths over these reefs are best shown on the chart.

Caution.—This area must be navigated with great caution.

Cocked Hat (*10°21′ S., 151°06′ E.*) [redacted] a conical rocky islet, is about 50 feet in height. Reefs, upon which the sea constantly breaks, extend 1¾ miles west-northwestward from the islet.

8–127 **Grace Islet,** composed of coral and situated 1½ miles east-northeastward of Cocked Hat, is small, low, and thickly wooded. A coral reef with depths of from 3 to 5 fathoms, and probably less, extends 4¾ miles southeastward from the southern side of the island, and from the western side a similar reef with depths of from 1 to 3 fathoms extends 2½ miles west-northwestward. The sea was seen to break on the extremity of this latter reef.

Hull Islet, lying 4½ miles southeastward of Grace Islet, is less than one-half of a mile in length and has a narrow strip of sand bordering its coast. This coral islet is oval-shaped, low, and wooded. Coral ledges project 100 yards from its northern and western sides; from the southern side a reef with a least depth of 14 feet extends southward almost to Blakeney Islet. A 16-foot shoal patch lies 1 mile south-southeastward of Hull Islet.

8–128 **Blakeney Islet** lies 3 miles southeastward of Hull Islet and occupies a central position in the main route to Goschen Strait when approaching from the southward. The islet is low, oval-shaped, and thickly wooded, and has a sandy beach surrounding it.

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A coral reef extends one-half of a mile west-northwestward from the northern side of Blakeney Islet with a depth of 3 fathoms at its outside extremity. Between this reef and the reef projecting southward from Hull Islet is a very narrow passage with a 16-fathom depth. A reef extends 1½ miles southward from Blakeney Islet and has a least charted depth of 1¼ fathoms. Within three miles southwestward and southward of the southern end of the reef are numerous 19-foot to 6¼-fathom patches, the southernmost of which is a 3¼-fathom patch lying 2½ miles southward of Blakeney Islet.

Mesley Patches, with depths of 2 to 4½ fathoms, lie 3½ to 5 miles westward of Blakeney Islet.

Anchorage has been taken in a depth of 8½ fathoms, white sand, close eastward of the spit which projects from the northwestern side of Blakeney Islet, with the center of the islet bearing 136°, distant one-fourth of a mile. Anchorage has also been obtained 400 yards off the western side of the islet in a depth of 23 fathoms, coral and sand.

8–129 Gallows Reef (*eastern extremity, 10°17′ S., 151°12′ E.*), situated in the fairway at the eastern end of Goschen Strait and northward of the four islets just described, is an extensive horseshoe-shaped ridge of coral, open to the westward. A few dry spots are visible at low water on the eastern part of the reef, and a sandbank, which dries about 3 feet, is situated on the southern arm. On the northern arm is Ketch Islet, with a conspicuous tree and a clump of bushes on it. Jack Islet, a sandbank which is sometimes covered, lies at the west end of the reef.

The sea breaks heavily upon the southeastern side of Gallows Reef, which is steep-to, no bottom being found at 120 fathoms at one-fourth of a mile distant. A break in the northern arm affords a passage for a boat to the lagoon within the reef, but the latter, where examined, abounded in coral knolls.

Caution should be used in approaching this part of Goschen Strait, as the tidal currents set strong in the vicinity, and the lead gives no warning of the approach to dangers.

8–130 Shortland Islet and Reefs.—The islet (*10°31′ S., 151°05′ E.*) is oval-shaped and about 115 feet high to the top of the trees. Encircling the islet are coral reefs, extending one-half of a mile westward and 3½ miles eastward. The eastern reef is horseshoe-shaped and almost joins Byron Islet. Upon the reefs there are occasional sand cays with bushes on them.

Between Shortland Islet and Grant Islet, situated to the southwestward, there is a channel 2½ miles wide, but it is narrowed to 1½ miles by the reefs of both islets and a detached 5-fathom patch. On the southeastern side of a line joining these islets, depths of 25 and 34 fathoms were found and increased suddenly to 57 fathoms, and no bottom was found on the northwestern side of the line.

A heavy tidal race is almost always to be found here, and only a steam vessel should attempt this passage.

Light.—A light is shown from the north part of Shortland Reefs.

Byron Islet, low and covered with trees, is nearly joined to Shortland Reefs, and marks well the southern extremity of that danger. A sandy beach surrounds it, and coral ledges extend about 200 yards from its eastern and western points. A shoal with a least depth of 16 feet extends northeastward for about 700 yards from the islet. Another shoal, detached, lies one-half of a mile northwestward of the islet and has a least depth of 14 feet.

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8–131 **ENGINEER GROUP** lies east-southeastward of Shortland Islet with Bright Reefs in the passage between them. The group consists of three principal islands, ranging from 428 to 647 feet high.

8–132 **Slade (Berriberrije) Island** (*10°35′ S., 151°12′ E.* [redacted], 1¾ miles in length in a northwest and southeast direction by about three-fourths of a mile in breadth, is the northwestern and most conspicuous of the Engineer Group. Its summit, 647 feet high, is well wooded and situated near the center of the island. A well-defined green bluff marks the western point. Off the northern extremity of the island, and connected with it by a reef, is Butchart (Dekatua) Islet, 148 feet high. A village is situated on the western side and another on the northeastern side of the island. Black Rock, 20 feet high, lies close off the southeast point of the island. The channel between Black Rock and Skeleton Island, about 600 yards wide, has a least depth of 28 feet.

Shoals.—An 11-foot shoal, a little less than one mile long, east-west, lies about ½ mile northward of the north side of Butchart Islet. A 14-foot shoal lies about 600 yards westward of the islet. A drying rock lies close northeastward of this shoal. Two detached shoals, having depths of 2½ and 4 fathoms, lie ¾ mile and 1¼ miles, respectively, north-northeastward of the southeast end of Slade Island.

8–133 **Skelton (Naranara Wai) Island,** situated close southeastward of Slade Island, is about 2½ miles in length to three-fourths of a mile in breadth, and 571 feet in height. A coral reef, with sand cays having bushes on them, circles 1 mile westward from the southeastern point of the island, forming a natural basin with an opening to the westward. The basin appeared deep enough for small craft.

Sandfly Bay lies on the southwestern side of the northwestern end of Skelton Island and a village is situated at the head of the bay. A swell sets in with an east-southeasterly wind.

Anchorage.—Restricted anchorage, partially sheltered from southeasterly winds, may be obtained about 700 yards from the head of the bay in depths of from 15 to 20 fathoms, with the southern entrance point bearing 141°. Care must be taken not to anchor in a depth of less than 15 fathoms, as the shore reef fringing the bay shoals rapidly, and off the southern entrance point there is a broken coral bottom with depths of 3 fathoms at a distance of one-fourth of a mile.

8–134 **Watts (Kuriva) Island,** the southeasternmost of the Engineer Group, is more than 2 miles in length in an east and west direction by 600 yards in breadth. The summit, 428 feet high, near the western end, is well defined and thickly wooded. Toward the center the island dips considerably and near the eastern end rises to a tableland, about 350 feet high, which terminates in steep cliffs on the southern side. The northern shore of the island appears steep-to, but the southern has a small beach bordered by a sunken reef, with deep water inside. A large village is situated along this beach.

The channel between Watts and Skelton Islands is about one-half of a mile wide in the fairway, and has a least charted depth of 8 fathoms over a bottom of sand and coral. It has generally a strong tidal race across it, with the appearance of shoaler water,

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and, not having been thoroughly examined, should be avoided.

To the northeastward of the Engineer Group are a string of six coral islets thickly wooded and described below. The space between these and the Engineer Group is generally deep, but beset in parts with patches of coral, rising perpendicularly from the bottom.

Caution.—No vessel should attempt to pass between these islands except in fine weather and with a good lookout from aloft.

8–135 **Bright Islet,** the westernmost of the small islets just mentioned, lies about 2¾ miles north-northeastward of the northern point of Slade Island. Foul ground extends three-fourths of a mile northward from Bright Islet.

A 31-foot spot lies 2½ miles northwestward of Bright Islet, and 2½ miles northward of the same point there is a coral head with a depth of 31 feet.

Light.—A light stands on the northern extremity of Bright Islet.

Bright Reefs, situated 1¼ miles westward of Bright Islet and on the eastern side of the fairway between Shortland Reef and Slade Island, are a group of coral patches, having depths of from 7 to 19 feet and deep water between them. A 5¾-fathom shoal lies about 1 mile southwestward of Brights Reefs.

The western extremity of Bentley Island in range with the western extremity of Slade Island, bearing 161°, is a good mark in clear weather for passing between Bright and Shortland Reefs. This course passes within one-fourth of a mile to the eastward of the 5¾-fathom shoal.

8–136 **Deedes Islets (Good Islet and Deedes Islet),** two in number, lie eastward of Bright Islet. These low and wooded islets are nearly 1½ miles apart, Good Islet the westernmost being situated 2 miles from Bright Islet.

A 15-foot reef extends about three-fourths of a mile westward from the northern end of Good Islet. A detached shoal patch with a depth of 34 feet lies midway between Good and Bright Islets. A reef extends 1½ miles northeastward from Good Islet with shoal spots of 13 feet at its extremity. A 3-fathom shoal patch lies about three-fourths of a mile southward of the islet.

Deedes Islet is nearly surrounded by dangerous reefs extending from it for over a mile in places.

Caution.–A dangerous area extends from a position about 1½ miles eastward of Deedes Islet southeastward to Haszard Island. These waters have not been thoroughly examined. Discolored water was reported about 4½ miles eastward of Deedes Islet.

Pender Islet lies about 2 miles southward of Deedes Islet. A reef extends 1 mile southward from the islet, and another reef projects 600 yards eastward from the eastern side of the islet. Bush-covered sandbanks are situated on these reefs.

8–137 Powell Islet *(10°35′ S., 151°17′ E.),* 60 feet high, lying about 1½ miles southeastward of Pender Islet, is surrounded by a coral ledge, which extends about 1,400 yards from its northern point, and has a few sand patches on it.

Messum Islet, situated 1¾ miles southeastward of Powell Islet and composed of coral, is 40 feet high. A coral reef extends almost a mile northeastward from the northern side of the islet, and on the extremity of the reef is Split Rock, 67 feet high.

8–138 **Haszard (Tuatua) Islands,** consisting of two islands lying north and south of each other, are situated 3½ miles eastward of Messum Islet. These two low islands are almost connected by coral reef.

Hummock, the southern island, has at its southern end a remarkable hill, 194 feet high. The center of the island is flat and sandy, rising gradually at the northern end to a low hill.

Flat Islet, about 335 yards northeastward of the northern point of the southern island,

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lies on the reef which extends northward nearly to Haszard Island, the northernmost of the group.

Haszard Island, 60 feet high and wooded, has a cove on its western side. A village is situated on the shore of this cove. Foul ground extends 5¼ miles west-northwestward from the northern end of the island.

Button Islet is situated on the reef extending southward from Haszard Island. A shoal patch, having a least depth of 3½ fathoms, lies about 1¼ miles west-southwestward of Button Islet.

Night Bank, with a least depth of 3 fathoms, is situated 1¼ miles northeastward of Haszard Island. A heavy tide rip generally marks its position.

Tidal currents.—The tidal currents in the vicinity of the Haszard Islands run at the rate of 2 knots at springs, the flood northward and the ebb southward.

8–139 **Bentley (Anagusa) Island** (*10°43′ S., 151°15′ E.* [redacted]) lies about 5¼ miles southward of Skelton Island, the middle island of the Engineer group. A gorge divides a solitary cliffy hill from the main tableland of the island, the division appearing prominent from the northwestward and southeastward. Both tableland and detached hill appear to be about the same height, namely, 350 feet. The eastern portion of the island is low, cultivated land, bordered by a sandy beach, and a village is situated on the northeastern side.

The island is surrounded by a reef which extends three-fourths of a mile from the western point and about the same distance from the southeastern side, in which direction there are several bush-covered cays. Depths of from 5 to 10 fathoms, sand and coral, were obtained at a distance of 200 yards from the northern edge of the reef, the bottom being uneven. Shallow depths are found around most of the rest of the island within about 300 yards of the reef. Depths of 2½ and 4½ fathoms extend about ½ mile, respectively, from the east and south sides of the island.

8–140 **Mudge (Narri) Island** is situated about 3½ miles east-southeastward of Bentley Island. The island is triangular, with its eastern side in nearly a north and south direction. This low, thickly wooded, coral island is surrounded by a reef, within which, on its southwestern side, there is a salt-water lagoon. There is a government coconut plantation on the island. A bank, with a depth of 9 fathoms, lies about 6¼ miles east-northeastward of Mudge Island. Its position is approximate. A 4-fathom shoal extends west-northwestward from the west point of the island.

8–141 **Hardman Islets** (*10°25′ S., 151°19′ E.* [redacted]), two in number, lie in a west-northwesterly and east-southeasterly direction and are about one-half of a mile apart. These low islets are composed of coral, thickly wooded, and uninhabited. An extensive coral reef surrounds them and blocks the channel which would otherwise separate them.

There are several patches of discolored water between Hardman Islets and Haszard Islands and the area is not completely surveyed. Eastward of the Hardman Islets are reefs and shoals which have not been surveyed.

8–142 **Laseinie Islands,** situated northeastward of Hardman Islets, consist of six islets lying upon a straggling reef.

Dawson, the largest islet, lies 6 miles east-northeastward of Hardman Islets, and is about 1 mile in length and about 450 feet in height. When the summit of this rocky and thickly wooded island is seen from the eastward or westward, it appears flattened, but if seen from the northward or southward, conical.

Two islets, the largest of which is 250 feet high, lie within 1½ miles southeastward of Dawson Island.

Northwestward of Dawson Island are three islets, smaller and of much less height than those to the southeastward. Kegawan, the northernmost islet, is low and thickly wooded, and lies about 2½ miles northwestward of Dawson Islet. Two small detached islets lie 2 miles eastward of Kegawan Islet.

A coral reef appears to connect the whole

group, having a few sand cays upon it immediately northward of Dawson Island, and foul ground extends 1½ miles eastward of the northern end of the same island. The area is incompletely surveyed and numerous shoals and reefs exist there.

Breakers.—The sea was seen to break westward of Dawson Island, and the area between the islets and rocks southward of Dawson Island and Hardman Islets appears to be very foul.

Light.—A light is shown from Kegawan Islet.

8–143 **SOUTHERN COAST OF NORMANBY (DUAU) ISLAND.—Cape Ventenat (Karitahua)** (*10°12′ S., 151°13′ E.* [redacted]), the southeastern point of Normanby Island, forms the northeastern entrance point of Goschen Strait. The Prevost Range slopes gradually towards the cape, forming a wedge-shaped point, well defined when seen from the eastward or westward. A strip of sandy beach borders the cape, and a coral ledge extends about 400 yards southward of it.

8–144 **Ventenat (Digaragara) Islet,** two wooded islets with well defined summits, lie 1 mile southwestward of Cape Ventenat and one-half of a mile apart in a northwesterly and southeasterly direction, the southeastern islet being 250 feet high and the northwestern 200 feet high. A coral reef, upon which the sea often breaks, joins them and extends about 1,200 yards westward from the northwestern islet.

Grind Reef, a barrier reef of sunken coral, skirts this part of the coast. It extends from about 2 miles southwestward of Ventenat Islets, in a north-northeasterly direction for about 9 miles, and has depths of from 1 to 3 fathoms. A sandbank, which dries 3 feet, lies on the barrier reef one-half of a mile eastward of Ventenat Islets. Depths of 24 fathoms were found westward of the sandbank, and deep water appeared to extend along the eastern coast of Normanby Island inside the reef as far as 3 miles northward of Cape Ventenat.

8–145 **Coast.—Centipede (Gadimuru Bay),** lying 3 miles northwestward of Cape Ventenat, is open to the southward. The head of the bay is one-half of a mile wide and has a sandy beach fronting a lagoon, the water of which is fresh when the tide is low. A village stands on a hill on the eastern side of the bay.

Anchorage has been taken in a depth of 26 fathoms, stiff mud, about 200 yards offshore and one-fourth of a mile from the eastern end of the beach. Westward of this position no bottom could be found with a 40-fathom sounding.

Mekeya Point, 1¾ miles westward of Centipede Bay, has a coral ledge extending off it. The coast westward of this point continues steep and without marked features for a distance of 3 miles to Makumaku Point, which also has a coral ledge extending off it. Thence to Cape Prevost the coast continues its westerly direction for 9 miles in almost a straight line, and is steep-to, no bottom, with 60-fathom soundings being obtained at less than 1 mile from the coast.

8–146 **Cape Prevost (Diamadimara Point)** (*10°06′ S., 150°58′ E.* [redacted]), the southwestern point of Normanby Island and the northwestern limit of Goschen Strait, is well defined and steep. The Prevost Range rises above it at a steep angle to a conical peak, appearing rounded from the southeastward.

No bottom was found with a 120-fathom sounding at one-fourth of a mile southward of the point, which, with other deep soundings in the same vicinity, clearly points out

that this part of the coast of Normanby Island is also steep beneath the water, as it is seen to be above. The western and northern coasts of Normanby Island of the D'Entrecasteaux Islands are described in section 10–30.

8–147 Goschen Strait.—Goschen Strait lies between East Cape of New Guinea and the islands southeastward of it on the south and the southern coast of Normanby Island on the north. It is about 16 miles in length in an east and west direction and 6¾ miles in width at its narrowest part between Cape Prevost and Boiaboia Waga Island, northeastward of East Cape.

Gallows Reef (sec. 8–129) lies in the fairway at the eastern end of Goschen Strait and leaves a navigable channel 1¾ miles wide on its north side which is preferable on account of the northern side of the reef being marked by Ketch Islet. The south channel, about one mile wide, has unmarked dangers on each side.

The channels off East Cape, from the southwestward, are described in sections 8–108 and 8–110.

8–148 Aspect.—On the northern shore of Goschen Strait the Prevost Range, 3,600 feet high, is covered with dense tropical forest and descends in steep slopes to the water's edge, being intersected by numerous ravines. About the center of this range, or nearly midway between Cape Prevost and Cape Ventenat, a remarkable gap occurs, the position of which is placed upon the chart, and will be found an unmistakable mark for fixing a vessel's position in cloudy weather when passing through the strait. This gap is not visible when nearer than about 5 miles.

Caution.—It should be borne in mind in navigating these waters that time did not permit of such an exhaustive examination as to insure there being no other dangers than those indicated on the chart; therefore a lookout from aloft is indispensable, and it will be prudent to take those passages which will bring the sun in a favorable position for distinguishing discolored water ahead.

8–149 Tidal currents.—Between Grind Reef and Gallows Reef the flood sets west by north, and the ebb east by south, with a velocity of about 2 knots; between the islands westward it is no doubt stronger, and probably is much influenced by the prevailing wind.

8–150 Directions.—A vessel can cross the sunken barrier reef northeastward of Uluma Reef and enter Goschen Strait from the eastward. Vessels using this route pass between Uluma Reef and Stuers Islets, and cross the barrier reef indepths of 5½ to 9 fathoms, with Mamaramama Weino Islet, 2¼ miles west-northwestward of the western end of Wari Island, bearing 344°.

The passage eastward of Wari Island is not recommended, as a depth of 2½ fathoms was obtained about 3 miles south-southeastward of the eastern end of the island, and the locality has not been sufficiently examined.

When nearing Mamaramama Weino Islet, course is altered to pass 1 mile westward of it, and when abeam, make good a course of 029° so as to pass about 1 mile eastward of Babagarai Islet. When approaching this

islet, Katokatoa Islet, close westward of it, is seen first, as it is much higher and has a well-defined peak.

When abeam Babagarai Islet, alter course to pass 1½ miles westward of Slade Island, and then the western extremity of Slade Island in range with the western extremity of Bentley Island, bearing 161°, leads between Bright and Shortland Reefs. When Shortland Islet bears 249° the southeastern Hardman Islet in range with the southern point of Dawson Island, bearing 069°, forms the recommended course, but note that it leads over the 3¼-fathom patch 2¾ miles southward of Blakeney Islet.

When Blakeney Islet bears 310° alter and make good a course of 356°, which leads up about 2 miles eastward of Gallows Reef, care being taken to check the position of the vessel by cross bearings, as the tidal current sets at the rate of about 2 knots to the eastward or westward in the approach to Goschen Strait. When the northern point of Nuakata Island is open northward of Ketch Islet, bearing 268°, then shape a midchannel course through Goschen Strait.

Alternately the above route may be followed as far as Babagarai Islet. Having passed the islet to the eastward, shape a course to pass in midchannel between Grant and Shortland Islets, avoiding the 3½-fathom shoal situated 1 mile northwestward of Cape Lookout. It should be borne in mind that the tidal currents in the passage between Grandt and Shortland Islets are very strong and a vessel should be conned from aloft. Then steer for Nua Muri Point, 8½ miles southwestward of East Cape, and thence through Raven Channel (sec. 8–110) or Messum Channel (sec. 8–108) into Goshen Strait.

A vessel may pass between Lebrun Islets and Siga Islet and northeastward of Doini Island, getting into China Strait by East Channel (sec. 8–44), and thence by Raven or Messum Channels to Goschen Strait.

Vessels from the southeastward may enter the inner waters, northward of the sunken barrier reef, through Jomard Entrance (sec. 9–9). From this entrance there is a clear passage, as shown on the chart, to Engineer Group, and thence by any of the routes already described.

Vessels passing through Raven or Messum Channels find themselves westward of Gallows Reef; those using the old route find themselves eastward of it. There would seem to be a very decided advantage in getting clear of Gallows Reef by the safest and quickest route.

Generally speaking, steam vessels from the southwestward can cross the sunken barrier reef near Brumer Islands, and, following the New Guinea coast, pass through West Channel and China Strait (sec. 8–79), cross Milne Bay towards East Cape, and get into Goschen Strait by way of Raven or Messum Channels. The 6-knot tidal current in China Strait is a factor in choosing this route, and it should not be attempted by a vessel unable to comfortably stem such a current.

Vessels are recommended to make the northeastward passage in the afternoon and

the southwestward passage in the forenoon, so that the sun will be in its most favorable position for seeing the reefs.

The usual route followed by mail steamers after passing through China Strait and bound northeastward is as follows: From a position 1 mile north of China Rock, a course of 087°, to pass through the passage southward of Blakeney Island, has been found safe. When Bright Islet comes in range with the western end of Slade Island a course of 029° leads clear to the northward. When fixing position from China Rock eastward, bearings of the land to the southward have been found satisfactory. On account of the tidal currents, frequent fixes are advised.

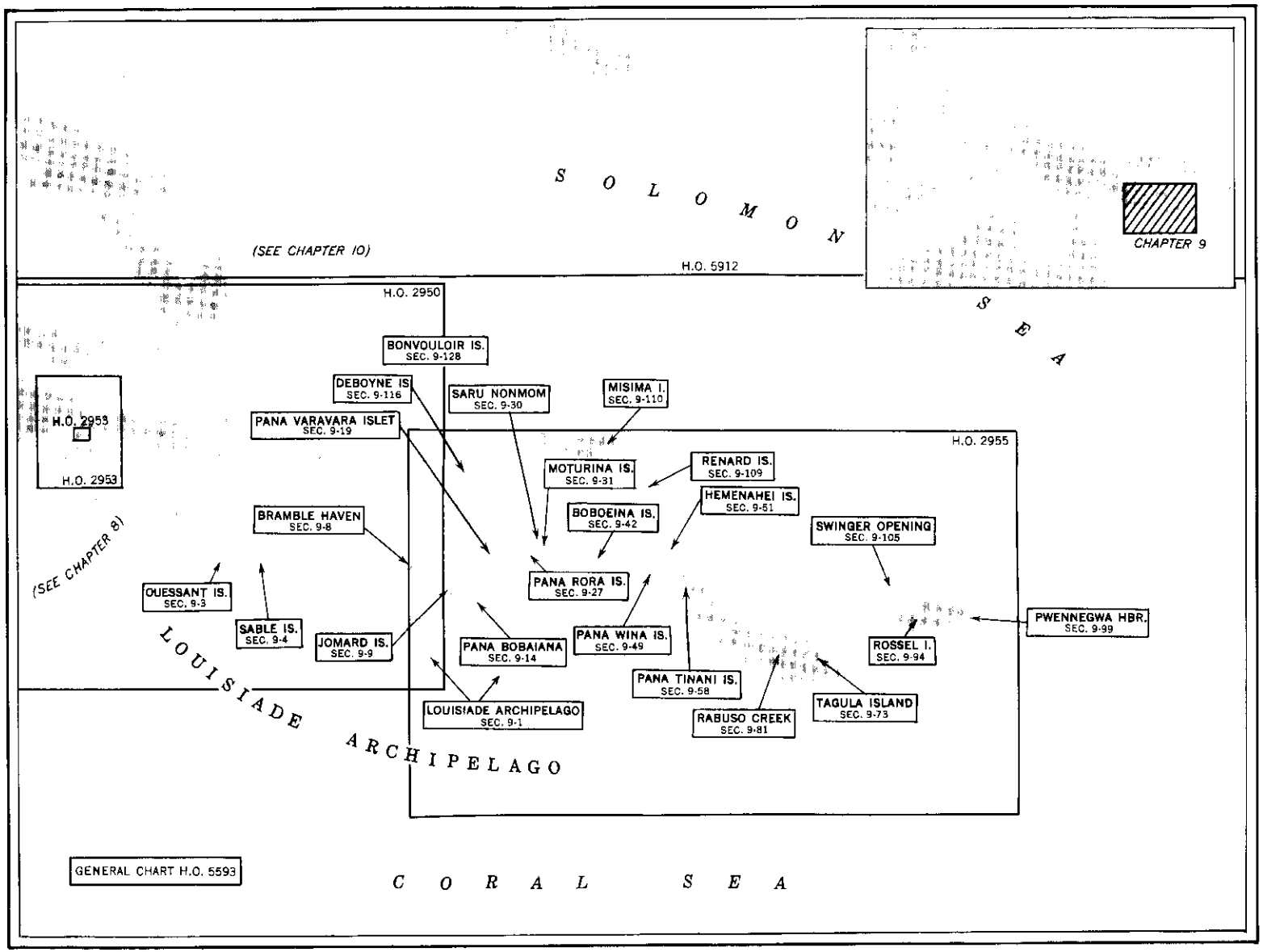

Chart limits shown are of the best scale charts issued to naval vessels by the U.S. Navy Hydrographic Office.
Section numbers refer to the place in the text where a description of the designated locality begins.

CHAPTER 9—GRAPHIC INDEX

SEE CHART CORRECTIONS

CHAPTER 9

LOUISIADE ARCHIPELAGO

9–1 General remarks.—The Louisiade Archipelago comprises 10 volcanic islands and numerous coral reefs lying within the parallels of 10° 10' S. and 11° 50' S. and the meridians 150° 55' E. and 154° 30' E., with the exception of Basilaki and several small islands lying close eastward of it. A few of the islands lying in the southeastern approach to Goschen Strait have been already described in chapter 8.

The archipelego is part of the Territory of Papua.

With the exception of Pana Tinani, Tagula, Rossel, and Misima, the islands are small; of those named the three latter are high and mountainous, while the former reaches a considerable elevation. The main portion of the group is encircled by a barrier reef through which there are numerous passages, while Rossel Island is surrounded by a separate reef of considerable extent. A large portion of the archipelago has been surveyed. Little is yet known in the area at the western end of the archipelago, and between that archipelago and Mura with its adjacent islands, and the D'Entrecasteaux Islands, and navigation in that locality is therefore attended with some risk.

Products.—These islands possess considerable natural wealth. Alluvial and reef gold have been found, and for many years gold mining yielded the largest returns. The industry has dwindled in the last few years. Numerous beds of pearl shell exist, but the great depth of the water in which they are found prevents the fishery being extensively prosecuted.

The inhabitants of the archipelago are generally of a dark copper complexion with frizzly hair; the cartilages of the nose and ears are perforated and much extended, a large polished shell being usually worn in the former. They are of a peaceful disposition.

9–2 Barrier reef eastward of Stuers Islets.—From Stuers Islets (sec. 8–26) the barrier reef extends in an easterly direction for nearly 60 miles to Jomard Entrance. The reef is awash and steep-to on the seaward side, with openings in places, but the waters to the northward of this part of the reef have not been sufficiently explored to render them safe for navigation.

9–3 Ouessant (Tariwerwi) Island (*11°09' S., 151°15' E.* [redacted]) lies about 6½ miles eastward of Stuers Islets. This low, wooded, coral island is situated on the northeastern end of a reef forming a portion of the barrier reef. Three reefs nearly occupy the space between the island and Stuers Islets. A large reef lies close southeastward of the island.

Anchorage, sheltered from southeasterly winds, may be obtained under the lee of the reefs lying between Ouessant Island and Stuers Islets, but it is not good, the bottom being of coral with irregular depths of from 6 to 22 fathoms. There are depths of from 7 to 9 fathoms northward of Ouessant Island, but there is no shelter, as the swell sets

SEE SHORT CORRECTIONS

through the openings between the reefs on either side.

Imbert, a low wooded islet, is situated 8½ miles northward of Ouessant Island, and has a coral reef extending about one-half of a mile southward of it. Two reefs, awash, lie about 1½ miles southward and 2 miles southwestward, respectively, of the islet.

Rapid Patches are two patches with depths of 6 and 4 fathoms, lying 5¾ and 8¼ miles eastward, respectively, of Imbert Islet.

9–4 Sable Islets, consisting of three sand cays, are situated on the northwestern side of a large reef lying about 5½ miles east-southeastward of Ouessant Island. The southwestern cay has a few trees on it. The sand cay at the northeastern end of the reef was covered with vegetation, the middle one being bare, but is possibly now overgrown like the others.

Between Sable Islets reef and the reef lying close southeastward of Ouessant Island there is an opening about 3½ miles in width. Green water, appearing like a shoal, was seen from aloft, and heavy rollers were also observed.

Anchorage, having smooth water during the southeast monsoon, may be obtained one-half of a mile northwestward of the northeastern sand cay.

Anchorage Reefs, two in number, extend 7½ miles eastward of the northeasternmost Sable Islet, and lie close together. The western reef is separated from Sable Islet reef by a channel, almost 1 mile wide, with a least depth of 7 fathoms.

9–5 Kosmann (Maragili) Islet, situated 11 miles northeastward of the northeasternmost Sable Islet, is low and wooded. The islet is encircled by a number of small reefs, and the reef lying eastward of the islet has bushes on it.

Several dangerous coral shoals, not marked on the chart, were reported to lie southwestward of Kosmann Islet.

Anchorage.—The best anchorage off Kosmann Islet is in a depth of 6 fathoms, coral, about 1 mile northwestward of the islet.

Long Reef, the southwestern end of which lies close eastward of Anchorage Reef, is an extensive atoll reef, being 20 miles in length in an east and west direction and from 2 to 7 miles in breadth.

The lagoon, which appears navigable but has not been surveyed, is enclosed on its southern and northern sides and at its eastern end by an almost continuous barrier reef. On the northern side the reef is always above water and has several sand cays and much driftwood on it; near the western extremity, 3 to 4 miles southeastward of Kosmann Islet, are several cays with mangrove bushes on them. There are some rocks above water near the center of the reef on the southern side.

No opening could be found into the lagoon from the southward or eastward, but it is probable there are passages between the patches which stretch across its western end.

There is a narrow opening between the southwestern extremity of Long Reef and Anchorage Reefs, but it has not been sounded.

There is an opening in the barrier reef from 2 to 3 miles wide between the eastern end of Long Reef and the atoll forming Bramble Haven. Tidal currents run at a considerable rate through this passage. No bottom could be obtained with a 100-fathom sounding, and the same was true southward of Bramble Haven. This opening is reported to be a good passage, but there are no islets on the southern reefs; and the reefs are difficult to see, making approach from the south difficult.

9–6 Lejeune Islet, low and wooded, lies on the northern side of Long Reef, about 3 miles westward of its eastern extremity.

ANCHORAGE.—Good anchorage during the southeast monsoon may be obtained in the bay formed between the patches which lie at the western end of Long Reef, Anchorage Reef, and Kosmann Islet, the water being smooth and depths regular.

9-7 DUPERRE ISLETS, consisting of five low wooded islets and a sand cay, are situated on the northern side of an atoll, the middle islet lying 11 miles eastward of Lejeune Islet. Punawan, the eastern islet, is 100 feet high (to tops of trees, probably).

ANCHORAGE.—Good anchorage in a depth of from 7 to 10 fathoms may be obtained one-fourth of a mile northeastward of the middle Duperre Islet.

9-8 BRAMBLE HAVEN (center, 11° 14′ S., 152° 00′ E.) is the lagoon of the above atoll, which is about 10 miles in length in an easterly and westerly direction and 6 miles in breadth. The depth in the haven, as far as it was sounded, was found to be from 6 to 18 fathoms, sand and coral. The water was smooth and sheltered from every direction by the surrounding reefs awash.

The haven has four entrances, but the only safe one, which is three-fourths of a mile in width and has depths of from 6 to 10 fathoms, is at the southwestern corner. A vessel entered the haven by a dangerous gap, encumbered by rocks, between the easternmost Duperre Islet and the sand cay, situated eastward of the islet, with the assistance of a strong tidal current. A vessel left the haven by the pass between the middle Duperre Islet and the islet next northwestward and found a least depth of 4 fathoms.

9-9 JOMARD ISLANDS (western island, 11° 15′ S., 152° 08′ E.), consisting of two islands, which are wooded and uninhabited, lie at the southern end of Jomard Entrance. Pana Waipona, the western and larger island, lies about 7 miles southeastward of Punawan Island of the Duperre group and is 80 feet in height. A steep-to reef extends about 1 mile southward of the island.

WRECK.—A stranded wreck lies on the southwest extremity of the reef which extends southward from Pana Waipona Island. Another stranded wreck lies on the southeast side of the reef, about 1 mile southeastward of the west extremity of the island.

A reef extends about 100 yards from the western side of the island. It was reported: that when approaching Jomard Island from the south it is easily identified by the lone coconut tree that stands about 300 yards northward of the southwestern end of the island. In 1958, the coconut tree was not observed, but the WRECK was prominent from both southward and northwestward.

LIGHT.—A light stands on the western extremity of Pana Waipona Island.

A bank with a depth of 20 fathoms was reported (1945) to lie about 2 3/4 miles west-northwestward of the light structure.

Pana Rairai, the eastern island, lies 2 miles east-northeastward of Pana Waipona Island and on the northwestern part of Uruba Reef; and a shallow spit extends 1,400 yards north-northwestward from the island. Uruba Reef is crescent-shaped, 3 miles long, and 1 mile wide.

9-10 JOMARD ENTRANCE, a deep, clear channel between the eastern part of the barrier reef surrounding Bramble Haven and the western side of Uruba Reef, is used by vessels trading between Australia, China, and Japan.

The passage is about 5 miles in width, and has depths over 100 fathoms. Pana Waipona Island lies toward the eastern side of mid-channel, and there are depths less than 150 fathoms between it and Uruba Reef.

In 1948 a vessel submitted the following information on landmarks:

The approach to Jomard Entrance was made from the south-southeastward on a

course of 345°. The first land sighted was Misima Island, bearing about 022°, distance about 70 miles. The next landmark sighted was Pana Sia Island, bearing 020°, distance about 30 miles. This island presented the best landmark for making the approach to Jomard Entrance prior to sighting Pana Waipona Island. The latter island was sighted at a distance of 13 miles. The Duperre Islets were not sighted until the vessel was within 5 miles of Pana Waipona Island.

A vessel which navigated Jomard Entrance in 1944 made the following comments on landmarks:

When approaching Jomard Entrance from the south the Duperre Islets, located about 9 miles northwestward of Pana Waipona Island, are the best landmarks. When about 10 miles southward of Jomard Entrance these islets appear to lie in an east-west direction and to be equally spaced. The easternmost islet is the largest, and the others decrease in size from east to west.

Pana Sia Island, located about 14 miles northeastward of Pana Waipona Island, will usually be sighted soon after the Duperre Islets are picked up.

TIDAL CURRENTS.—The tidal currents run through Jomard Entrance at the rate of 3 to 4 knots; the flood sets south by east, the ebb north by west. It was reported that under certain conditions of wind the currents may overrun high or low water at the shore by as much as three hours. The currents cannot be allowed for with absolute certainty. In Jomard Entrance and in the vicinity of the Torlesse and Deboyne Groups, tide rips are frequently encountered but are not strong enough to be dangerous

DISCOLORED WATER was reported in 1945 about 60 miles southward of Jomard Entrance.

9-11 DIRECTIONS.—Deep-draft vessels, northbound through Jomard Entrance, should follow the recommended track. This route passes about 1 1/2 miles westward of the lighthouse on Pana Waipona Island (sec. 9-9), passes then about 3 1/2 miles eastward of Lunn Island (sec. 9-126), then trends northwestward passing about 3 miles southwestward of the lighthouse on Hastings Island, (sec. 9-128), then north-northwestward passing about 5 miles westward of the lighthouse on the northernmost of the Strathord Islands (sec. 9-129). The courses and distances along this track are best known on the charts.

A vessel bound for Deboyne Lagoon, after clearing Jomard Entrance, should lay a course to the eastward of the Torlesse Group and enter Deboyne Lagoon by the West Passage.

In 1925 a vessel made a passage from Bramble Haven to a point 4 miles eastward of East Island and reported that the water was deep and clear.

9-12 BARRIER REEF.—Eastward of Jomard Entrance the barrier reef encircles many of the western islands of the Louisiade Archipelago. One part of the barrier reef extends in an easterly direction for about 30 miles as a much-broken and partly submerged obstacle. There are some islands and reefs near Jomard Entrance, but eastward of these islands there are, in many places, considerable depths over the reef, which is known again as the Sunken Barrier. Eastward of this submerged portion the character of the reef changes completely, and for over 80 miles runs in an east-southeasterly direction, maintaining a solid and almost unbroken front, to a point 12 miles eastward of Tagula Island.

The other part of the barrier reef runs in

a northeasterly direction for about 36 miles from Jomard Entrance, whence it runs in a southeasterly direction and eventually connects with the first branch eastward of Tagula Island.

Tidal currents.—The tidal currents run with considerable force through the passages in the reefs, generally setting straight through.

On the sunken barrier, eastward of Duchateau Islands, the currents were observed to run as much as 4½ knots, the strength of the flood setting south-southwest and the ebb north-northeast. This velocity was only apparent during strong southeast winds; at other times their usual rate is about 2 knots.

On the sunken barrier the first portion of the flood sets about southwest, gradually changing its direction to the southward, the last quarter running to the southeast; then, with hardly any period of slack water, the first of the ebb makes to the northeast, gradually changing to north and northwest. The change of current coincides very nearly with the times of high and low water, but in the passages the currents may continue to run for perhaps an hour longer. It was reported in 1944 that under certain conditions of wind the currents in the passages may overrun high or low water at the shore by as much as three hours. The currents cannot be allowed for with absolute certainty.

In the eastern part of the Louisiade Archipelago the flood current runs southwestward and the ebb in a contrary direction, but these are modified by the reefs and the trends of the coast. The current turns, approximately, at high and low water by the shore.

Through the narrow openings the tidal currents run from 3 to 5 knots, and this is more especially the case in the passages through the outer barrier reefs, where they cause overfalls and tide rips. From three days before to three days after full and new moon there is not much change in the strength of these currents. During this period they have their maximum strength, and there is little or no interval of slack water. In the intervening period their rate diminishes considerably and suddenly.

9–13 ISLETS ON THE BARRIER REEF.—Montemont Islands, consisting of two small, bush-covered islets, lie 1¼ miles apart in an east and west direction, the western islet lying 7 miles southeastward of Pana Rairai, one of the Jomard Islands.

Iataui, the western islet, lies on the northern edge of a small coral reef, and is 40 feet high. A smaller reef lies 1½ miles westward of Iataui Islet, and has foul ground off it except on the southern side. The passage between these two reefs, which are steep-to on their southern sides, should not be attempted as the bottom is uneven, with heavy overfalls and tide rips.

A coral patch with a least depth of 4 fathoms lies 1½ miles northward of Iataui Islet.

Pana Boba, the eastern and larger islet, is 50 feet high, and lies in the center of a crescent-shaped reef, the western extremity of which is separated from Iataui Islet Reef by a narrow channel. The eastern edge of the crescent-shaped reef, on which the sea breaks heavily, is a mile from the island, and foul ground extends one-fourth of a mile outside the breakers. Rocks and foul ground exist for 1 mile from the islet in the northwest quadrant.

Channel.—Between the southeastern end of Uruba Reef (sec. 9–9) and the reef lying 1½ miles westward of Iataui Islet there is a channel across the barrier reef in depths of from 6 to 8 fathoms; but as a spit with depths of from 4 to 5 fathoms or less extends 1 mile southeastward from the breakers on Uruba Reef, the channel is narorwed to a width of 1½ miles. A small 5-fathom

patch lies in the southeastern part of the channel.

Anchorage.—Fair anchorage may be obtained in depths of from 12 to 15 fathoms, sand and mud, off the northern side of Montemont Islands, outside the limits of the foul ground.

9–14 **Duchateau Islands,** lying northeastward of Montemont Islands, consist of three low wooded islets, which are inhabited. The tops of the coconut palms on the islets are visible from a distance of 10 or 12 miles.

Pana Bobaiana (*11°17′ S., 152°21′ E., H. O. Chart 2956*), the westernmost and largest islet, is 75 feet in height, and is surrounded by a sunken reef. This reef extends one-fourth of a mile from the southeastern side of the islet and 200 yards from the northern side, but on the northwestern side the reef is broken, affording landing on the sandy beach.

Hacker Patch and Ellery Patch, two 4-fathom coral shoals, lie about 1¼ miles and three-fourths of a mile, respectively, northward of the northern extremity of Pana Bobaiana.

Pana Rurawara (Raymond) and Kukuluba, the two eastern islets, are situated on the northern and northwestern edges of a reef which dries and is about 2 miles in length in an east and west direction. Within the limit of the 10-fathom curve off the northern and northwestern sides of this reef there are patches of foul ground.

Between the reefs surrounding Pana Bobaiana and Pana Rurawara Islets there is a narrow channel with depths of from 4 to 8 fathoms; but it is not a good one, owing to the heavy swell and the overfalls caused by the strong tidal currents. A patch with a depth of 11 feet lies in the northern entrance.

Channel.—There is a channel 1¾ miles wide between the edges of the reefs surrounding Pana Bobaiana Islet and the eastern Montemont Islet. It is clear of dangers and has depths of from 6 to 11 fathoms on the western side of the midchannel.

9–15 **Anchorage.**—Shelter may be obtained during the southeast monsoon, in depths of from 17 to 19 fathoms, sand and shells, one-half of a mile northward of Pana Rurawara Islet. Smoother water, however, was found by the British naval vessel *Dart* in a depth of 9 fathoms, sand and coral, northwestward of Pana Bobaiana Islet, with the northern point of Kukuluba Islet just open to the northward of Pana Bobaiana Islet bearing 090° and the southwestern extremity of the latter 156°. In this position the currents are not so strong, and the southeasterly tendency of the last of the flood and beginning of the ebb, which is the most troublesome feature of open anchorages during a strong southeasterly wind, is avoided.

Tides.—The high-water interval at full and change at Duchateau Islands is 9h. 00m.; springs rise 5 feet; neaps 3½ feet.

Tidal currents.—The change of the tidal currents coincides very nearly with high and low water, but in the channels the currents may continue to run for perhaps an hour after high and low water by the shore.

The flood current sets to the southward and the ebb to the northward.

Barrier reef.—Ten and a half miles eastward of Duchateau Islands the sunken barrier reef projects out again in patches for a distance of 6 miles. The depths over these patches are from 2½ to 5 fathoms.

Anchor Patches (*11°20′ S., 152°34′ E., H. O. Chart 2956*), consisting of 3 patches with a least depth of 4 fathoms, are the westernmost of the above patches and lie on the eastern side of Duchateau Entrance. One and a half miles southeastward of Anchor Patches there is a shoal with a least depth of 2½ fathoms, and between this shoal and the reef awash, southeastward, there are other 5-fathom patches.

It is not advisable to cross the barrier reef eastward of Anchor Patches unless quite certain of the vessel's position.

9–16 Duchateau Entrance.—The best approach from the southward and westward to the inner waters northward of the barrier reef is over the sunken barrier reef between the Duchateau Islands and Anchor Patches. The edge of the reef surrounding the eastern Duchateau Island may be clearly seen, and immediately eastward of this reef the barrier may be crossed in depths of from 7 to 16 fathoms. Five and a half and seven miles eastward of the same island there are two other passages from one-half to three-fourths of a mile in width, having depths of from 12 to 16 fathoms. The depths over other parts of the sunken barrier reef are from 4 to 10 fathoms.

9–17 CALVADOS CHAIN is a long succession of mountainous islands extending in a general east-southeasterly direction from Pana Sia Island, situated about 13 miles northeastward of Pana Waipona Island in Jomard Entrance, and terminating with Hemenahei Island, about 43 miles eastward of Pana Sia.

The larger islands are densely wooded, especially on their southern sides. They are but scantily inhabited, the villages being usually on the northern sides of the islands.

Caution.—Great caution is requisite when navigating among these islands, as the reefs are all difficult to see except in a very good light.

9–18 Western entrance over barrier reef.—Between Pana Rairai, the eastern of the Jomard Islands, and Pana Sia Island, situated 11 miles northeastward, there is a passage leading into the inner waters from the westward. It is blocked at its northeastern part by Keikei Reef, and the navigable channel is further contracted by reefs and patches to a width of about 2¾ miles between the 10-fathom curves. This is reported to be a good passage.

Mabb Patch, lying 2½ miles northward of Pana Rairai and in the middle of the above navigable channel, has a depth of 3 fathoms, coral.

Keikei Reef, 3½ miles in length and 2 miles in breadth at its southwestern end, lies in a northeasterly and southwesterly direction. The northwestern side of the reef is steep-to, but shallow water and foul ground extend 2½ miles from its southern extremity and southeastern side. This locality should be avoided.

Keikei Reef is separated from Pana Varavara Islet Reef, situated eastward of it, by Howai Tinua Passage, which is so encumbered with shoals that it is useless as a channel.

9–19 Pana Varavara Islet (*11°08′ S., 152°18′ E., H. O. Chart 2956 and Chart 5983*), lying 10 miles northeastward of Pana Rairai, is rocky and wooded, and has a sharp summit 345 feet high. A sandspit runs off the northern end, on the eastern side of which there is a village and good landing. The islet stands on the southeast end of a reef, between which and Horrara Gowan Reef there is a channel about ½ a mile wide.

Channel.—This channel is clear of danger, though somewhat tortuous, and has depths in its center of from 7 to 16 fathoms, but its southern approaches are so much encumbered by the numerous detached coral patches, extending 2 miles southeastward of Pana Varavara, that it is not recommended.

Passing through it, the southwestern edge of the fringing reef off Pana Sia Island should be followed closely to avoid the foul ground farther to the southwestward.

Tidal current.—The tidal current sets

through this channel with great strength, forming strong eddies.

9–20 **Pana Sia (Real) Island,** situated close southeastward of Pana Varavara and separated from it by the channel just described, is 2 miles in length and one-half of a mile in width at its eastern end. The other portion of the island is narrow, terminating in a rocky point at the western end. The island is remarkable for its rugged and abrupt shape. It is composed of cliffs, nearly perpendicular, with ravines between them. The summit, 530 feet high, is near the center of the island.

9–21 **Horrara Gowan Reef** extends about 4 miles northwestward of Pana Sia Island and is 1½ miles in width. The drying outer edges enclose a lagoon in which there are numerous shoals, making it unsuitable for vessels to enter. The northeastern side of the reef, being broken, is not safe to approach when using Cormorant Channel.

Ehiki Islet, 50 feet high and wooded, lies on the northern end of the reef, and another, Nasakoli, on its western side.

Tawal Reef, separated from Horrara Gowan Reef by Cormorant Channel, is an extensive horseshoe-shaped reef. It is open to the southward, but the opening is encumbered by several reefs. One of the Sloss Islets lies on its northeastern edge.

No ina (Burnett) Islet (*11°05′ S., 152°21′ E., H. O. Chart 2956 and Chart 5983*), small and wooded, lies on the northeastern side of Cormorant Channel and 3¼ miles northward of the eastern end of Pana Sia Island. It is situated on the western end of a small reef separated from Tawal Reef by a channel 800 yards in width.

Shoals.—A 3-fathom shoal lies 1¼ miles eastward of No ina Islet. A coral patch with a least depth of 4 fathoms lies 1 mile south-southeastward of No ina Islet, and extends one-half of a mile farther southeastward with a depth of 8 fathoms. During flood current there are heavy overfalls over this patch.

A 5-fathom patch, which can usually be seen from aloft, lies nearly in midchannel of Cormorant Channel and about 2 miles northward of the eastern part of Pana Sia Island.

9–22 **Cormorant Channel,** between Tawal Reef and Horrara Gowan Reef, is about 1½ miles in width. The least depth is about 15 fathoms except for the above 5-fathom patch. It is reported to be a good passage.

Tidal currents.—The tidal currents run through Cormorant Channel with considerable strength, the flood setting southeastward and the ebb northwestward.

9–23 **Utian (Brooker) Island,** the western end of which lies 4¾ miles east-northeastward of No ina Islet, is situated in the middle of a lagoon enclosed by a coral reef, the edges of which, for the most part, dry. There is a boat channel into the lagoon about one-third of a mile southwestward of the western peak of the island; and the channel, though encumbered with coral patches, has depths of from 7 to 10 fathoms.

The summit, near the middle of the island, is 460 feet high, conical, and wooded. A ridge traverses the island throughout its length, rising to a height of 350 feet at the western end. There are two bays on the northern side of the island.

9–24 **Sloss Islets,** lying about 1 mile apart in an easterly and westerly direction, consist of two small wooded coral islets. Rara, the westernmost islet, 115 feet high, lies on the northeastern edge of Tawal Reef; Pana Roba, the other islet, 110 feet high, lies on the northwestern edge of the reef between Tawal Reef and Utian Island Reef.

9–25 **West Brooker Passage,** separating the two reefs on which the Sloss Islets stand, has a width of 650 yards in the middle but widens from 1,400 to 1,600 yards at each end. The reefs on either side of this channel are steep-to, except immediately westward

of Pana Roba, where shoal water extends off a short distance.

In the southern half, on the western side of the channel, a narrow ridge with depths of 4 fathoms or less extends to a position three-fourths of a mile southeastward of the southeastern extremity of Tawal Reef. Foul ground extends one-half of a mile southward from the southern end of the reef forming the eastern side of the channel. These spits are usually marked by overfalls and tide rips.

9-26 EAST BROOKER PASSAGE lies westward of Utian Island, separating the reef surrounding that island from the reef on which Pana Roba stands. The southern half of this channel is divided by a pear-shaped reef, which may be passed on either side, but to the southward and southeastward of it shallow water extends 650 yards. The passage to the westward of this reef is to be preferred and has depths of 28 to 32 fathoms.

TIDAL CURRENT.—The tidal current runs through East Brooker Passage at the rate of from 5 to 6 knots at springs, the flood setting south-southeastward and ebb in the opposite direction.

CAUTION.—Approaching from the southward, it is not desirable to take either of the Brooker Passages on the ebb (that is, with the tide), and the spits of shoal water off the southern edges of the reef render caution necessary, as they can not always be seen. The west passage is the better of the two, being wider and therefore having less strength of current.

When navigating these narrow channels and particularly when there is a bend in the bordering reef, the effect of the eddies on the vessel must be watched closely.

NO ANCHORAGE.—There is no anchorage in the vicinity of the islands and reefs just described; the northern or lee sides are too steep and the southern sides too exposed to wind and sea during the southeast trade. In the channels these evils are aggravated by the strength of the tidal currents.

9-27 PANA RORA (EDDYSTONE) ISLAND (11° 07′ S., 152° 30′ E.), 4 miles southeastward of Utian Island, is rocky and has a 540-foot peak near its eastern end. The island is most conspicuous when seen from the eastward, as it then has the appearance of a lofty conical tower. It is surrounded by a reef extending farthest offshore on the northwestern side, where there is a village.

SHOALS.—HAIKUIRI SHOAL, a coral patch lying about 1 mile northwestward of the northwestern end of Pana Rora Island, breaks heavily with any swell. It is steep-to on its southeastern side, with a deep channel between it and the reef surrounding Pana Rora Island. Shoal water extends 400 yards northward from the shoal, and about one-half of a mile north-northwestward of the northern end of the breakers is a 5-fathom patch.

About three-fourths of a mile north-northeastward of the northern end of Haikuiri Shoal there is a shoal one-half of a mile in length with a least depth of 1 1/2 fathoms.

A shoal was reported to lie 1 mile southward of the eastern extremity of Pana Rora Island.

TIDES.—The high-water interval at full and change at Pana Rora Island is 9h. 00m.; springs rise 5 feet, neaps 3 1/2 feet.

9-28 PANA UDUUDI ISLAND, lying 1 1/4 miles eastward of Utian Island, is 390 feet in height. Toloi awa Islet, 240 feet high, lies close off the southeastern end of the island.

Two triangular reefs, separated by a channel, extend about 2 miles southward from Pana Uduudi Island.

SPIRE ISLETS, two in number, are situated on a small reef close eastward off the south-

eastern extremity of Utian Island Reef and on the western side of the channel to be described. These bush-covered coral islets, lying one-fourth of a mile apart, are from 20 to 30 feet in height. A shoal extends 300 yards southward from the southern islet.

CHANNEL.—A deep channel, which is from 600 to 1,000 yards in width and 3 miles in length, lies in a north-northwesterly and south-southeasterly direction between the reefs encircling Utian and Pana Uduudi Islands.

The best entrance to this channel from the southward is close eastward of Spire Islets, avoiding Haikuiri Shoal and the shoal patches north-northwestward and north-northeastward of it. The tidal currents in the channel run very strongly, the flood setting to the southward and the ebb to the northward.

9-28 GULEWA ISLAND, lying about 1 mile eastward of Pana Uduudi Island, has a peak near each end. The southern peak, 315 feet high, is covered with trees; the lower northern peak is bare. The island is cultivated and has a village in the cove on the southeastern side.

Sibumbum, 75 feet high, and Tobaiam, 145 feet high, are small islets lying, respectively, 1,200 yards northeastward from the northern point and 400 yards southward from the southern point of Gulewa Island.

AIWA BUNA REEF forms the northern side of the lagoon in which lie Pana Uduudi and Gulewa Islands. It is 4 miles in length, the northern edge falling steeply to depths of over 100 fathoms. In the lagoon, which has not been closely examined, there are depths of from 6 to 12 fathoms, but coral patches are numerous. Two passages lead into the lagoon, one with a depth of 4 fathoms to the northward of Pana Uduudi Island and the other to the westward of Tobaiam Islet, but neither of them can be recommended for a vessel.

HANA HAWAWAN REEF consists of a series of reefs extending about 2 1/4 miles in a north-northeasterly direction from Tobaiam Islet, leaving a narrow passage between its northern end and the eastern end of Aiwa Buna Reef.

9-30 SARU NOMNOM ISLET (11°02′ S., 152°33′ E.), 50 feet high and wooded, is situated on the northern end of a reef which lies eastward of Gulewa Island and is 1 mile in length.

PANA TATONI ISLET, 85 feet high, is situated about 1,600 yards southeastward of Saru Nomnom and on the western edge of a reef 1,200 yards in length in an easterly direction.

HOIAKI AKIL PASSAGE, between the two reefs on which the islets of Saru Nomnom and Pana Tatoni stand, is 350 yards in width. The southeastern extremity of Venariwa Island in range with the western extremity of Ululina Island, bearing 207°, leads through the passage, close westward of the 3-fathom patch lying about 400 yards northward of the western end of Pana Tatoni, and close eastward of the sunken rock situated about one-half of a mile southwestward of the above 3-fathom patch. This passage is not recommended.

HORAKIRAKI PASSAGE, an opening in the barrier reef close eastward of Aiwa Buna Reef, is about one-half of a mile in width. The eastern part of the passage is encumbered with coral heads, but there is a fairway on the western side which may be used with safety by small vessels with local knowledge, the only danger being a coral ridge, with a depth of 2 fathoms, lying 200 yards northward of Hana Hawawan Reef.

The narrowest part of the channel is between this ridge and a 2-fathom coral head 300 yards to the eastward. Here the tidal current runs with considerable strength in a somewhat oblique direction, necessitating strict attention to the range marks, and a careful lookout for the patches, which will usually be seen.

The central and highest tree on Pana Ta-

toni Island, in range with the summit of Panua Keikeisa Islet, bearing 142°, leads directly through the channel. The eastern extremity of Pana Tatoni, just touching the southern extremity of Ninan Islet, bearing 138°, leads close to the southwestward of the coral heads on the northeastern side, but passes rather close to the northeastern corner of Aiwa Buna Reef; however, as this reef is steep-to and distinctly visible, it can be rounded by eye and this latter range is probably preferable, as the summit of Panua Keikeisa is not easy to see over Pana Tatoni.

Howahoaimo Passage, between the southeastern side of Hana Hawawan Reef and the western side of the reef on which Saru Nomnom Islet stands, leads into the Horakiraki Passage. There is a small patch, nearly dry at low water, lying about three-fourths of a miles southwestward of the southern end of Saru Nomnom and in the center of the channel, which is there narrowed to 400 yards. The edge of the reef on the eastern side is fairly steep, and on this side is the best passage. A tongue of shoal water extends 300 yards in a northwesterly direction from the northern end of Saru Nomnom Islet Reef.

The eastern extremity of Pana Rora Island, in range with the western extremity of Venariwa Island, bearing 203°, leads through the channel between the coral patch and the edge of the reef on the eastern side.

9–31 **Moturina (Mewstone) Island** (*southern extremity, 11°06′ S., 152°34′ E., H. O. Chart 2956*), 3 miles in length and 1¾ miles in breadth, rises to a pyramidal hill, 990 feet high, at its western end, and is densely wooded and of irregular shape. The hill is most conspicuous when seen from the southeastward, but appears flat-topped when seen from the southwestward.

The southeastern side of the island forms a bay fringed by a reef on which the sea breaks heavily. A coral patch lies about one-half of a mile off the middle of this side of the island. Several villages are situated on the shore of the bay.

The eastern coast, which is fringed by a reef but has no off-lying dangers, is exposed to the prevailing wind.

Off the southwestern side of the island, about 1,400 yards west-northwestward of the southern point of the island, there is a patch, which breaks occasionally and is 400 yards in extent, with a 4-fathom patch 400 yards farther in the same direction. A 3-fathom patch lies between the southern point of the island and the patch which breaks occasionally. There are depths of from 7 to 10 fathoms between these shoals and the reef fringing the island.

Anchorage.—Good and sheltered anchorage may be obtained in Riman Bay on the northwestern side of Moturina Island in a depth of 10 fathoms, sand, with Moturina Peak in range with a rocky point in the middle of the bay, bearing 159°, and the northwestern point of Moturina Island in range with the western summit of Ululina Island, bearing 241°. This anchorage is the best in this part of the archipelago and is out of the influence of the tidal currents.

Ninan Islet lies about one-half of a mile northward of the northeastern point of Moturina Island, with shoal water between them. The islet has a peak at each end, the higher, wooded northern peak, having an elevation of 175 feet.

9–32 **Ululina Island** lies westward of Moturina Island, from which it is separated by Ara Gumgum Passage, which is one-fourth of a mile in width. The wooded summit, 325 feet high, is on the eastern end, and on the western end, where the village is situated, there is a grassy peak, 170 feet high.

A reef extends 1,400 yards westward from the western end of the island, and a shoal with depths of from 3 to 4 fathoms projects 400 yards from the northeastern side of the island. Foul ground, which does not break

in calm weather, extends 800 yards southward from the southeastern side of the island.

9–33 Ara Gumgum Passage, between Ululina and Moturina Islands, is 400 yards wide at the southern end between the foul ground extending southward from Ululina Island and the patches lying off the southwestern side of Moturina Island. Between the islands the passage is 300 yards wide and has depths of from 7 to 9 fathoms.

Tidal currents.—The tidal currents set strongly through Ara Gumgum Passage, the ebb to the northward and the flood to the southward. The range marks are good, and the channel presents no great difficulty.

9–34 Directions.—Approaching Ara Gumgum Passage from the southward, steer in with the eastern extremity of Ululina Island in range with the southwestern end of Saru Nomnom Islet, bearing 002°, which leads 200 yards eastward of the foul ground lying southward of Ululina Island, and between it and the shoals to the southeastward, crossing the connecting barrier in a depth of 7 fathoms.

Continue on this range until the southwestern extremity of Ululina comes in range with the northeastern point of Utian Island, bearing about 298°, when course should be altered to 015°. When the southwestern point of Moturina Island bears 167°, bring this point astern on this bearing, which leads midway between the fringing reef on the Moturina side and the shoal extending from the northeastern side of Ululina Island.

9–35 Venariwa Island (*11°04′ S., 152°32′ E., H. O. Chart 2956*), lying northwestward of Moturina Island and close northward of Ululina Island, is grass-covered and 500 feet high. The island presents a sharp peak when seen from the northwestward or southeastward, but from other directions it appears more or less flat-topped.

Its southern and western sides are fringed by a reef, at the southern end of which, 100 yards southward of the island, is a rock awash at high water. Extending 400 yards southwestward from this dry rock are some rocky patches awash at low water.

Gowan Passage, between Venariwa and Ululina Islands, is only 100 yards wide between the rocks awash off the former island and the edge of the 2 to 3 fathom bank extending from the latter. The tidal currents run through this channel at the rate of from 4 to 5 knots at springs, the flood to the eastward and ebb to the westward, and it can not be recommended.

Guaawana Passage, between Venariwa Island and Tobaiam Islet lying about 1 mile northwestward of it, has depths of from 18 to 19 fathoms.

Tidal currents.—Due attention must, however, be paid to the tidal currents, which run with considerable strength through Guaawana Passage, the flood to the southward and ebb to the northward, these general directions being modified by the trend of the reefs.

9–36 Off-lying shoals.—Emerald Shoal (*11°08′ S., 152°34′ E., H. O. Chart 2956*), lying 1½ miles southward of the southern extremity of Moturina Island, has a least depth of 2½ fathoms. It lies in the fairway of vessels making for Boiu Passage from the westward, and must be approached with care, as there is no good clearing mark for it.

A shoal with depths of 6 fathoms lies about 3¼ miles southeastward of Emerald Shoal and in the southwestern approach to Migemmagemma Passage.

Bramble Patch, situated 5 miles southwestward of the southern extremity of Moturina Island and 2¾ miles southward of Pana Rora Island, has a least depth of 2¾ fathoms.

A 4-fathom shoal lies 2⅓ miles southeastward of Bramble Patch, and a bank with a

least depth of 9 fathoms lies 5 miles west-southwestward of the same patch.

The southern peak of Gulewa Island, open eastward of Pana Rora Island, bearing 000°, leads eastward of Bramble Patch and the reported shoal lying 1 mile southward of Pana Rora Island and westward of the 4-fathom shoal.

9–37 Panua Keikeisa Islet (*11°06′ S., 152°36′ E., H. O. Chart 2956*), wooded and 130 feet high at its northern end, lies three-fourths of a mile east-southeastward of the southeastern point of Moturina Island and on the northwestern side of Boiu Passage. The islet is surrounded by a reef, extending one-half of a mile eastward from its eastern side, with a rock 50 feet high at its extremity. Shoal water extends one-half of a mile southward from the islet.

In the middle of the passage between Panua Keikeisa Islet and Moturina Island there is a rock, 3 feet high, situated on the northern edge of a bank about 1¼ miles long with a least depth of 4 fathoms.

9–38 Laiwan Islet, 1¾ miles eastward of Panua Keikeisa Islet, is flat-topped and wooded, the tops of the trees being 100 feet high. A rock, 60 feet high, stands 670 yards southwestward from its southern end, and from each extremity shallow water extends ¼ mile.

Boiu Passage, between Laiwan and Panua Keikeisa Islets, is about 1¼ miles wide, having depths of from 11 to 40 fathoms. No dangers exist except close to the reefs surrounding the islets. The tidal currents set strongly through this passage, causing heavy overfalls and tide rips, frequently dangerous to boats. It is reported to be a good passage.

9–39 Bonnawan Island is situated about 1¾ miles southeastward of Laiwan Islet. This grass-covered island has a well-defined peak 335 feet high. A reef extends one-half of a mile westward from the southwestern point of the island and the same distance southward from the southern extremity. Shoal water with depths under 3 fathoms extends one-half of a mile southeastward from the extremity of the latter reef. A detached islet 30 feet high lies on the reef off the southwestern point of the island.

Migemmagemma Passage, about 1¼ miles wide, lies between Bonnawan and Laiwan Islands and is clear of danger. Tidal currents set strongly through this passage, causing heavy overfalls and tide rips, frequently dangerous to boats. It is reported to be a good passage.

9–40 Bagaman (Stanton) Island, the eastern part of which is named Pababaga, is situated just eastward of Bonnawan Island, from which it is separated by Panamun Passage. The western part of the island rises to an elevation of 720 feet, the eastern part to 490 feet. It is thickly wooded, except on some of the northern slopes, and has a village on its western side.

The eastern and western parts of the island are joined by a narrow neck, nearly one-half of a mile wide, thus forming a bay on the northern and southern sides of the island.

Aurobu Islet, which is rocky, wooded, and 150 feet high, lies about 200 yards southward of the eastern entrance point of the bay on the southern side of the island; a smaller islet, 27 feet high, lies 200 yards southward of the western entrance point of the same bay.

A narrow reef, one-half of a mile in length, lies about one-third of a mile southward and parallel to the above two islets. There is a depth of 6 feet on the reef, and the sea breaks on the eastern end.

9–41 Panamun Passage, between Bagaman and Bonnawan Islands, is about one-

third of a mile in width. The southern entrance, about 1,200 yards wide, lies between the reef southward of Bagaman Island and the reef extending 1 mile southeastward from the southeastern point of Bonnawan Island. The depth of the water in the narrow channel between the two reefs is from 4 to 5 fathoms. The tidal currents set strongly through this passage.

The western extremity of Bagaman Island, bearing 353°, leads between the reefs in a depth of 5 fathoms, but the southern entrance was not sufficiently examined to insure that there is nothing less.

Anchorages.—There is anchorage in the northern part of Panamun Passage, off the village situated in the western side of Bagaman Island, in a depth of 11 fathoms, sand, with the two points to the southward in range, bearing 198°, and the northern point of Bonnawan Island in range with the center of Laiwan Island, bearing 302°.

This anchorage is not affected by the tidal currents, but frequently heavy squalls come off the land.

Vessels also may obtain anchorage in the middle of the eastern part of the bay on the northern side of Bagaman Island in depths of from 14 to 16 fathoms, sand and coral, with the eastern entrance point of the bay in range with the northern point of Boboeina Island, bearing about 065°. The bay on the southern side of the island is too exposed for safe anchorage, and the approach to it is partially obstructed by a sunken reef.

Gedge Shoals, which lie about 2½ miles southward of Bagaman Island, consist of the easternmost, a 3-fathom patch and a 3½-fathom patch about 1½ miles northwestward, with deep water between them.

Webb Patch, lying about 2 miles southwestward of the northwestern Gedge Shoal, has a least depth of 3½ fathoms.

Yule Patches consist of three coral patches, the easternmost of which has a least depth of 2 fathoms and lies 5¾ miles southward of the eastern entrance point of the bay on the southern side of Bagaman Island. The other two 4-fathom patches lie about 2 miles southwestward and about 1¾ miles west-northwestward, respectively, from the 2-fathom head.

9–42 Boboeina (Huxley) Island (*center, 11°08′ S., 152°44′ E., H. O. Chart 2956*), thickly wooded and 800 feet high, lies 1 mile eastward of Bagaman Island.

Gilia Islet, connected with the western side of Boboeina Island by a reef, is grass-covered and 260 feet high. Between Gilia and Bagaman there is a clear passage about 400 yards wide, except for a rock, which breaks, lying about 200 yards southwestward of Gila.

Shoals.—Woriwori Patches, two heads composed of sand and coral, have a least depth of 3 fathoms, and always show well. The southeastern head lies 800 yards northward of Hanamanawi Point, the northern extremity of Boboeina Island. Between these two heads and the point, which is steep-to, there are depths of from 13 to 15 fathoms.

Stanton Patch, with a depth of 3 fathoms, lies about 1¾ miles north-northwestward of Hanamanawi Point.

A bank with a least depth of 4 fathoms lies about 1⅓ miles southward of Boboeina Island. A 3½-fathom coral shoal lies about ¼ mile westward of the western extremity of the bank.

Anchorage.—There is anchorage on the western side of Boboeina Island in a depth of 14 fathoms, sand and coral, with the eastern extremity of Gilia Islet bearing 187°, and the summit of Moturina Island in range with the northern extremity of Bagaman Island, bearing 285°. This anchorage is affected by

the tidal currents, as they set strongly through the passage and over the reef on either side of Gilia Islet.

9–43 **Mabneian Islet,** wooded and 240 feet high, lies 1 mile eastward of Boboeina Island, from which it is separated by Kivikivi Passage. A reef extends 1 mile southward from the islet. There is no anchorage, as the tidal currents sweep around the islet with great strength.

Pana Kuba and Leiga are two wooded islets, 210 and 155 feet high, respectively, and 300 yards apart, lying on the southern end of the reef, extending southward from Mabneian Islet. Shoal water extends 600 yards southwestward from Leiga Islet.

Kivikivi Passage, lying between Mabneian Islet and Boboeina Island, is a safe channel about 1 mile wide. The tidal currents cause a breaking sea in the passage, making it dangerous for boats.

9–44 **Pana Numara Island,** 430 feet high, lies one-half of a mile southeastward of Leiga Islet and is separated from it by Bahil Passage. The shores of the island are generally steep-to, except at the western end, where shoal water extends off 200 yards. A small village is situated on the northeastern side of the island. Kurupan Islet, 150 feet high, lies close off the northeastern point.

Bahil Passage, between Pana Numara Island and Leiga Islet, is over one-half of a mile in width and clear of dangers.

Anchorage.—Good anchorage may be obtained in Hoba Bay, on the northern side of Pana Numara Island, in a depth of 15 fathoms, sand. This anchorage, which is sheltered from the prevailing wind, is not affected by the tidal currents.

Yaruman Island, lying 1,200 yards northeastward of the northeastern point of Pana Numara Island, is separated by a channel 200 yards wide from Kurupan Islet. This wooded island is 285 feet high.

Panangaribu Island, densely wooded and 295 feet high, lies 400 yards eastward of Yaruman Island. The channel between them is clear of dangers in midchannel, but the sides are not steep-to. The tidal currents run through this channel with considerable force, causing a heavy breaking sea.

Nunuan Islet, which is wooded and 200 feet high, lies 200 yards southward of Panangaribu Island.

9–45 **Panantanian (Sharp) Island** (*11°09′ S., 152°50′ E., H. O. Chart 2956*), situated 1 mile southeastward of Panangaribu Island, is thickly wooded and 410 feet high. Shoal water extends about 600 yards in a northerly direction from the northern point of the island. There is a village on the northwestern side, but landing is difficult, except at high water, when the reef is covered.

Pornani Passage, between Panantanian Island and Nunuan Islet, is about three-fourths of a mile in width, with depths of from 12 to 16 fathoms. The channel is clear of dangers, and the sides are fairly steep-to. The sea breaks heavily on the weather side.

9–46 **Pana Krusima (Earle) Island** lies 1¾ miles eastward of Panantanian Island. The island, wooded throughout, rises to an elevation of 360 feet near its southern end, the northern part being low. The southern part of the island is fringed by a reef, which on the eastern side extends one-third of a mile off and is steep-to, with islets on it.

A tongue of shoal water, as defined by the 5-fathom curve, extends 1 mile southward from the island. The summit of Bagaman Island in range with the southern extremity of Pana Numara Island, bearing about 287°, leads southward of this shoal water.

Pori Passage, between Pana Krusima and Panantanian Islands, has some patches with depths of from 5 to 6 fathoms in it, for position of which see chart. The northern approach to this passage is somewhat restricted by Reiga Shoals.

Reiga Shoals, consisting of two shoal

spots, lie on a crescent-shaped bank, which connects the northern point of Panantanian Island with the northern point of Pana Krusima Island. The western patch with a least depth of 4 fathoms lies 1¼ miles north-northeastward of the northern point of Panantanian Island; the eastern with a depth of 5 fathoms lies 1 mile northwestward of the northern point of Pana Krusima Island.

The bank, which has general depths of from 7 to 10 fathoms, shows clearly and is marked by heavy tide rips. The two shoal spots should be avoided, as the depths may be less than charted.

Tauara Shoal, with a least depth of 1½ fathoms, coral, lies about 1¾ miles northeastward of Su waian Point, the northern extremity of Pana Krusima Island. This shoal shows clearly in a good light.

Dawson Banks, consisting of three banks extending for a distance of 5 miles in a west-northwesterly and east-southeasterly direction, have several shoal spots with depths of from 2 to 5 fathoms, for position of which see chart. The middle part of these banks lies about 4 miles southwestward of the southern extremity of Pana Krusima Island.

Dayman Banks, consisting of three shallow banks, lie southward and parallel to Dawson Banks. The central and largest bank with a least depth of 1½ fathoms lies about 5¼ miles southward of Panantanian Island. The other two banks, lying 2 miles west-northwest and 2½ miles east-southeast of the central bank, have a least depth of 3 fathoms and 4 fathoms, respectively.

Sullivan Patch, with a least depth of 2½ fathoms, lies 2 miles southwestward of the middle Dayman Bank. A patch with a least depth of 3 fathoms lies 2¼ miles southeastward of Sullivan Patch.

9–47 **Abagagaheia Island** (*southern extremity, 11°11′ S., 152°55′ E., H. O. Chart 2956*), lying about 1½ miles eastward of Pana Krusima Island, is 595 feet in height near its southern end. From this summit a ridge extends northward, terminating in a sharp, wooded hill, 550 feet high. The southern shores of the island are bold and cliffy.

Gigila Island is connected to the southeastern part of Abagagaheia Island by a reef. The island, 420 feet high, is wooded, but has some grassy slopes on the northern side. The two islands form a bay, lying northward of the connecting reef, but it does not afford good anchorage.

Waia Islet, 165 feet high, lies close southward of the eastern extremity of Gigila Island.

A 3-fathom coral patch lies three-fourths of a mile southward of Waia Islet. Two other patches with depths of 2 and 3 fathoms lie one-half of a mile southward of Gigila Island.

Uli Bonnabonna Passage, between Gigila Island andYakimoan Island, situated three-fourths of a mile to the eastward of it, is clear of danger, except for a reef which extends 300 yards off Gigila Island. It is reported to be a good passage.

Taifaur Islet, 270 feet high and grass-covered, lies 300 yards northwestward of the northwestern point of Abagagaheia Island, and is connected with it by a reef.

Einamu is a quoin-shaped rock, 140 feet high, lying about one-half of a mile westward of the southern extremity of Taifaur Islet. Shoal water extends about 200 yards eastward and southward from the rock, but the channel on either side is clear of danger.

9–48 **Robinson Anchorage.**—Anchorage may be obtained in the outer portion of the western bay on the northern side of Abagagaheia Island in depths of from 13 to 16 fathoms, sand and coral, with the two northern points of the island in range, bearing 097°, and the western hill, bearing 221°. The shore of the bay is fringed by a reef, and a rock with a depth of 1 fathom lies 200

yards off the point on the southwestern side of the anchorage.

Tides.—The high-water interval at full and change at Robinson Anchorage is 9h. 00m., springs rise 5 feet, neaps 3½ feet.

Ward Rock, with a depth of 1½ fathoms, lies 2⅓ miles northeastward of the northern extremity Taifaur Islet.

Power Patch, a coral head with a depth of 3 fathoms, lies about 1½ miles north-northwestward of Ward Rock.

Musters Patches, consisting of three shoal spots with depths of from 3½ to 5 fathoms, lie 4¾ miles south-southwestward of the southern extremity of Abagagaheia Island.

Conflict Patches, with depths of from 2 to 2½ fathoms, lie about midway between Musters Patches and Abagagaheia Island. They extend in a west-northwesterly and east-southeasterly direction for a distance of 3½ miles.

9–49 Pana Wina (Kaluma) Island (*center, 11°11′ S., 153°01′ E., H. O. Chart 2956*), situated about 1¼ miles eastward of Gigila Island, is the largest island of the Calvados Chain, being about 4 miles in length and breadth. Two ridges of hills run north and south on each side of the island, the highest parts being near the southern end, where the western ridge rises to an elevation of 945 feet, and the eastern 800 feet.

A bay with depths of from 12 to 17 fathoms lies on the southern side of the island. It appears that the creek at the head of this bay runs to the northward and connects with the bay on the northern side, thus dividing the island.

Boiama Point, the eastern entrance point to the bay, is also the southern extremity of Pana Wina Island. A reef extends 200 yards from the point, with shallow water beyond the reef for nearly 200 yards. Koia Kun, a conspicuous hill 800 feet high, lies northward of the point.

Pipidai Point, the southeastern extremity of Pana Wina Island, is low, bold, and covered with grass; foul ground extends to a distance of one-half of a mile in a northeasterly direction and one-fourth of a mile to the southeastward. From Pipidai Point the low mangrove coast turns northward to Pei, the northeastern point, the whole of which is fronted by the extensive reef on which lies Hemenahei Island.

The northern coast, which is generally lined with mangroves and fringed by a reef 600 yards wide, is indented by a shallow bay.

On the northwestern side is another bay with depths of from 7 to 12 fathoms, but, though sheltered from the southeasterly winds, it is not beyond the influence of the tidal currents, which run with considerable strength, the flood setting to the southwestward and the ebb in the opposite direction.

The only village seen is near the northeastern end, where the slopes are cultivated. The island is now inhabited both by Europeans and natives.

9–50 Yakimoan Island, 300 feet high, is separated from the western extremity of Pana Wina Island by Ulgari Passage. A fairly steep-to reef with Taval Rock on its outer extremity extends 800 yards northeastward from the island.

Ulgari Passage, one-fourth of a mile wide, has narrow and steep-to reefs extending from both sides. The tidal currents run with considerable strength through this passage.

Anchorage.—There is convenient anchorage in a depth of 8 fathoms, sand, one-third of a mile northward of Yakimoan Island, with the northern extremity of Gigila Island bearing 263°. Though protected from the wind and sea, this anchorage is to some extent exposed to the strength of the tidal currents.

Beagle Rock, with a depth of 6 feet, lies on the northwestern end of a small 3-fathom shoal 1 mile southward of Manbaun Point, the western entrance point of the bay on the

southern side of Pana Wina Island. To pass between Beagle Rock and Pana Wina Island, keep the southern peak of Pana Krusima Island just open southward of Abagagaheia Island, bearing 291°.

Dangers northward of Pana Wina Island are given in section 9–56.

9–51 **Hemenahei (Flat) Island** (*center, 11°10′ S., 153°04′ E. H. O. Chart 2956*), the easternmost of the Calvados Chain, lies 600 yards eastward of the northeastern point of Pana Wina Island. The space between the two islands is occupied by a flat of sand, coral, and mud, drying in patches at low water springs.

The island, which is traversed by a ridge of grass-covered hills having a wavelike appearance, is everywhere fringed by mangrove swamps, the only convenient landing place being on the northeastern side, where they are thinner. Except on the western side, the fringing reef extends from 100 to 600 yards from the shore. This island is considered unhealthful.

A shoal with a depth of 1 fathom lies one-half of a mile 063° from the eastern extremity of the island.

The islands eastward are continued in section 9–58.

9–52 BARRIER REEF NORTHWARD OF CALVADOS CHAIN.—From Horakiraki Passage, described in section 9–30, the barrier reef extends northeastward in patches for about 10 miles, where it reaches its most northerly point; thence it extends in an east-southeasterly direction to Sabari Island, a distance of about 26 miles.

Pana Sagusagu Islet (*10°58′ S., 152°37′ E., H. O. Chart 2956*), 120 feet high to the top of the trees, lies on the barrier reef, about 6 miles northeastward of Horakiraki Passage. This low and wooded islet is situated on the northern apex of a triangular reef, the base of which is about 1 mile long.

The openings through the barrier reef, between Horakiraki Passage and Pana Sagusagu Islet are not suitable for a vessel to pass through.

Passage.—Immediately northward of the reef on which Pana Sagusagu Islet lies is a passage about one-third of a mile in width. About one-half of a mile eastward of the islet there is a 3-fathom patch, and another with a depth of 5 fathoms lies one-half of a mile southeastward of the 3-fathom patch. Vessels using this passage should pass northward of these two shoals, as the depths are more regular on that side, and the barrier reef forming the northern side of the passage is steep-to.

The tidal currents run with considerable strength through this passage, the flood current setting toward the reef on which Pana Sagusagu Islet lies.

Bushy Islets, a group of wooded islets from 45 to 66 feet high, are situated on the outer edge of the northern extremity of the barrier reef, which is steep-to on its northwestern side. The northeasternmost islet lies about 4¼ miles northeastward of Pana Sagusagu Islet and one-half of a mile northwestward of the extremity of the reef forming the northwestern side of Debagarai Passage.

Basses Islands are a group of low coral islets, with trees from 60 to 100 feet high, lying on the eastern side of Debagarai Passage. Gumaian, the easternmost and largest, lies 7 miles eastward of Pana Sagusagu Islet, and forms the northwestern side of Wuriwuri Passage. Abaevara, the western islet of the group, is situated 2¼ miles westward of Gumaian. A small coral patch with a depth of 3 fathoms lies one-half of a mile southwestward of Isu Rauaraua, the southern islet.

9–53 Debagarai Passage, the opening in the barrier northwestward of the Basses Islands, is 1 mile wide, but is obstructed in the center by a large shoal with depths of

from 4 to 6 fathoms, and possibly less than charted. There is a deep but narrow passage between this shoal and the edge of the reef on the northwestern side of the channel, but the tide swirling over the point of the reef makes it difficult to distinguish the edge of the shallow water.

The channel southeastward of the shoal has two patches with depths of 3 and 5 fathoms, situated, respectively, 400 yards northward and one-half of a mile northwestward of Abaevara Islet. There may be less water on these shoals, and as the tidal currents are strong, with heavy overfalls, the channel should only be used under very favorable circumstances.

Tawatawa Mal Reef, the northeastern portion of the barrier reef lying northward of the Calvados Chain and Pana Tinani Island, extends from the Basses Islands in an east-southeasterly direction for 39 miles to Hudumuiwa Passage. The reef dries in patches and has numerous boulders on its outer edge, some of which are from 3 to 15 feet high. The northern side of the reef is steep-to, no bottom being found with 100-fathom soundings within 2 miles of its edge, but the southern or inner side has in many places shallow water extending off for some distance.

Between Basses Islands and the northwestern extremity of Sabari Island, a distance of about 24 miles, there are three ship channels through Tawatawa Mal Reef—Wuriwuri, Dunalabwa, and Chubudi Passages—besides numerous minor openings too obstructed to be of any use. Southeastward of Sabari Island the reef is impenetrable to ships of any size until Hudumuiwa Passage is reached.

9–54 **Leiga Islet** (*10°59′ S., 152°47′ E., H. O. Chart 2956*), 100 feet high to the top of the trees, is situated on the northwestern extremity of Tawatawa Mal Reef and on eastern side of Wuriwuri Passage.

Wuriwuri Passage, between Gumaian Islet, the easternmost of the Basses Group, and Leiga Islet, 3 miles east-southeastward, is by far the safest and easiest opening in this part of the barrier reef. On approaching the position of a vessel may be readily fixed by cross bearings of the islets on either side.

Near the middle of the passage, dividing the passage into two parts, is a shoal with a least depth of 2 fathoms. It is recommended that the channel northwestward of this shoal be avoided, as the depths are irregular, and there are heavy tide rips. A 5-fathom patch is situated westward of the detached reef lying southwestward of and parallel to the reef on which Leiga Islet lies. The distance between this patch and 2-fathom shoal is 1¼ miles, and the depths are from 22 to 27 fathoms.

Pearce Patch, a 3-fathom patch which usually shows, lies in the southern fairway of Wuriwuri Passage, 2½ miles 242° from Leiga Islet.

Siwaiwa Islet (*11°03′ S., 152°57′ E., H. O. Chart 2956*), bush-covered and 40 feet high, lies on Tawatawa Mal Reef, about midway between Leiga Islet and Sabari Island. Southward of the elongated reef on which this islet lies is a cluster of shoal patches with depths of from 2½ to 3 fathoms.

Dunalabwa Passage, one-third of a mile wide, is situated 2 miles eastward of Siwaiwa Islet. It may be recognized by a bush-covered sand cay, 10 feet high, situated on the reef which forms the eastern side of the passage. The reefs on each side are steep-to, and the least depth over the bar is 6 fathoms.

The tidal currents set directly through the channel, forming heavy tide rips and overfalls on the bar.

Myriad Shoals, a group of coral heads with depths of from 1¼ to 3 fathoms, lie from 1 mile to 1¾ miles southward of the reef on the eastern side of Dunalabwa Passage. Two patches, with depths of 6 and 5 fathoms, are situated about 2 and 2½ miles, respec-

tively, southward of the same reef.

9–55 Sabari (Owen Stanley) Island, the northwestern end of which lies 8 miles east-southeastward of Siwaiwa Islet, is 4 miles in length by one-third of a mile in breadth. The island is low and thickly wooded, the tops of the trees having an elevation of about 180 feet. There is a village near the southeastern end of the island.

The coast line of the island is low and cliffy, with an occasional small sandy beach. On the southwestern side, near the center, there is an opening, with a reef across it, which widens out into a circular basin one-fourth of a mile in diameter. Northwestward of this opening a chain of islets fronts the coast.

Mabui and Pana Kuba Islets, 100 feet high, form part of a chain of islets and rocks extending 800 yards from the northwestern end of Sabari Island.

Rarahaiwa Islets, two in number, lie close off the southeastern end of Sabari Island, and are 100 yards apart.

9–56 Chubudi Passage lies 3½ miles southeastward of the sand cay on the eastern side of Dunalabwa Passage and 1½ miles northwestward of the outermost islet lying off the northwestern end of Sabari Island. The passage is about 400 yards in width, but in the southern part is a coral patch with a least depth of 1½ fathoms. The fairway lies westward of this patch and has depths of from 13 to 17 fathoms.

The tidal currents set directly through the passage, but there are tide rips and overfalls.

This channel presents more difficulty than those already described, being narrower, having its southern approach fronted by Hiscock Reef and other dangers, and no islet marking its entrance.

Hiscock Reef (*11°07′ S., 153°01′ E., H. O. Chart 2956*), which nearly dries, is situated about 1 mile southwestward of the southern end of the reef forming the eastern side of Chubudi Passage and is in the southern approach to this same passage. A 2-fathom patch lies one-fourth of a mile eastward of this reef, and a 3-fathom patch the same distance southward, with foul ground between.

The 590-foot peak at the southwestern end of Pana Wina Island seen just open westward of the northwestern point of the same island, bearing 204°, leads westward of Hiscock Reef, but note that this range leads over Hanover Rock.

Hanover Rock, with a depth of 1 fathom, lies on the western side of a 4-fathom patch situated nearly midway between Hiscock Reef and the northwestern point of Pana Wina Island. There is another 4-fathom spot one-fourth of a mile eastward of this rock.

Blind Rock lies 1 mile east-southeastward of Hanover Rock and has a depth of 1½ fathoms. Between Blind Rock and the fringing reef of Pana Wina Island there is a rock with a depth of 1 fathom.

Galley Rock, over which there is a depth of 1½ fathoms, lies 1,700 yards 060° from Blind Rock.

Caution.—In using these passages through the barrier reef a good lookout from aloft is necessary, for the difficulty of sounding them closely in such strong tidal currents and rips was so great that the least depths may not have been found; they should, therefore, not be taken with the sun ahead or during the strength of the current.

Tidal currents.—Westward of Pana Wina Island the flood current sets southwestward with a velocity of 1 knot, the ebb northeastward with a velocity of three-fourths of a knot; northward of the same island the flood current sets southeastward with a velocity of 1 knot, the ebb northwestward with a velocity of one-half of a knot.

9–57 Directions.—The dangers described render navigation to the southward of Chubudi Passage somewhat intricate; but having entered by that passage, if proceeding east-

ward, the best passage is northward of Hiscock Reef. From the southwestward, and proceeding eastward, the passage between Hanover Rock and Hiscock Reef is recommended. The latter can nearly always be distinguished from aloft, but the other shoals are not so easily seen, the water being not so clear as in the more open parts of the archipelago.

The northern extremity of Hemenahei Island, bearing 105°, leads between Hiscock Reef and Hanover Rock, and midway between Blind Rock and Galley Rock. When the southwestern end of Hemenahei Island opens clear of Pana Wina, bearing about 153°, the vessel will be eastward of Galley Rock, and a course may be steered for the southeastern end of Sabari Island, passing the northern side of Hemenahei at a distance of one-half of a mile to avoid the rocks off the northeastern side of that island. The directions here given should only be used with the greatest caution and with a good lookout from aloft.

9–58 PANA TINANI (JOANNET) ISLAND is separated at its northwestern end from Hemenahei Island by Magamaga Passage. It is 10½ miles in length in an east-southeasterly and a west-northwesterly direction and from 2 to 3 miles in breadth. A ridge of hills extends the whole length of the island, with the exception of about 2 miles of low wooded land near its northwestern end. These hills rise abruptly from the southwestern coast and slope down gradually to the northward and northeastward. This well-wooded island has a fertile appearance, with numerous groves of coconut palms near the sea. Both Caucasians and natives inhabit the island.

Mount Guyuba (*11°15′ S., 153°11′ E., H. O. Chart 2956*), situated about 4 miles westward of the eastern extremity of the island, attains an elevation of 1,110 feet and is the highest on the island.

Between the spurs of the hills trending northeastward from Mount Guyuba and the coast range near the eastern end of the island there is a valley through which a stream runs, discharging into the sea on the northeastern coast.

9–59 The northeastern coast is mostly flat and nearly straight, with the exception of four slight indentations, behind each of which the land is flat and swampy toward the foot of the hills. This coast is difficult to approach, owing to the fringing reef and the numerous patches along its whole length.

Barrier Reef.—That part of Tawatawa Mal Reef which lies between the southeastern end of Sabari Island and Hudumuiwa Passage, a distance of 13½ miles, dries in patches on its outer edge. Depths of from 100 to 200 fathoms are found at a distance of one-half of a mile from the outer edge. The reef is from ½ mile to 1½ miles wide, the inner part being of sand and coral, with depths of from 1 to 3 fathoms. The several openings through the reef are only available to boats during the finest weather.

The intermediate area between the barrier reef and the northeastern side of Pana Tinani Island is so encumbered with reefs as to render navigation very difficult for any but the smallest vessels, and then only under favorable circumstances. The dangers in this area can best be seen on the chart; therefore a description of them will not be given.

9–60 The southeastern coast of Pana Tinani Island is comparatively bold and backed by a steep range of hills.

Panamuti Point, the eastern extremity of the island, is covered with mangroves and has a ridge sloping down to it. A reef extends 1,300 yards eastward from the point and foul ground 200 yards beyond.

Heihuti Bay, situated on the southeastern side of the island, is formed by the main body of the island and Gudau Peninsula. It is

fringed by a narrow reef, which, toward the head, extends one-fourth of a mile offshore.

Anchorage.—Vessels may obtain good anchorage during the northwest monsoon in depths of from 12 to 13 fathoms, sand and clay.

9–61 **The southwestern coast** of Pana Tinani Islands is irregular, consisting of four projecting hilly points with bays between them. In each of these bays anchorage may be found. The coast is fringed by reefs and there are some off-lying islets and dangers.

Gudau Peninsula, the southern extremity of the island, attains an elevation of 905 feet, and projects both to the eastward and westward, forming a bay on either side. The southern coast of the peninsula is a succession of rocky points with sandy beaches between them, and is fringed by a reef, which is fairly steep-to and is easily seen.

Nieivi Reef lies southward of Gudau Peninsula and is separated from it by Doga Siusiu Passage. A sandbank, which dries, is situated on the southeastern end of the reef.

9–62 **Doga Siusiu Passage,** which is clear of dangers, has a least depth of 11 fathoms, and is three-fourths of a mile in width.

Tidal currents.—The tidal currents run through this passage with a velocity of 2 to 3 knots, the flood setting to the west-northwestward and the ebb to the east-southeastward.

9–63 **Directions.**—The southern extremity of Osasai Islet (sec. 9–76) in range with the southern extremity of Heiwok Islet (sec. 9–74), bearing 112°, leads through Doga Siusiu Passage in a depth of not less than 8 fathoms; but as this range leads rather close to Nieivi Reef, a vessel will be more in the fairway by bringing the southern extremity of Osasai over Heiwok and keeping in depths of not less than 11 fathoms.

9–64 **Hati Lawi (Joannet) Harbor** *(11°16′ S., 153°10′ E., H. O. Chart 2956)* lies on the western side of Gudau Peninsula. Pana Bobo Islet is situated 200 yards westward of the western extremity of the peninsula. A reef with dry rocks on it extends 200 yards beyond the islet, and is steep-to on its northern edge. There is a stream of excellent water on the eastern shore of the harbor, about 1 mile from the head.

Anchorage.—Hati Lawi Harbor, which is easy to enter, affords good anchorage during the southeast monsoon, but is exposed during the northwest monsoon. The depths shoal gradually from 9 and 10 fathoms in the middle of the entrance to 6 fathoms within 400 yards of the head of the bay. The bottom is composed of mud.

Tides.—The high-water interval at full and change at Hati Lawi Harbor is 9h. 00m., springs rise 5 feet, neaps 3.8 feet.

Islet.—Five miles northwestward of Hati Lawi Harbor is an unnamed islet 440 feet high. It was actually part of the main island until the natives cut a channel through the low neck of land by which it was connected.

The village of Pana Wina lies on the southwestern side of the islet. Here the fringing reef is about 200 yards wide, making landing difficult.

Bounce Point, the western extremity of this island, is a reddish-colored cliff about 70 feet high. The fringing reef of the island extends 400 yards westward of the point and is fairly steep-to.

Walibi Islet, grass-covered and 145 feet high, is situated on the fringing reef extending from the eastern side of the unnamed islet.

Pana Bahai is a grassy, peaked islet, 200 feet high, encircled by the reef which extends off the southern point of the unnamed islet.

Feu de Joie Anchorage.—Indifferent anchorage may be obtained off the southwestern side of the unnamed islet in a depth of 12 fathoms, coral, but there is no protection from the winds and tidal currents.

9–65 **Imadi Bay** lies eastward of the un-

named islet. Gawn Point, the eastern entrance point of the bay, lies at the foot of the projecting headland, 490 feet high, situated 2 miles eastward of the unnamed islet. The shores of the bay are lined with mangroves, and the northwestern part is encumbered with reefs.

Pudsey Rock, with a depth of 1½ fathoms, is situated 1¼ miles westward of Gawn Point, and a rocky patch lies one-fourth of a mile northward of the rock.

Fisher Reef, which dries, lies one-half of a mile southeastward of Pudsey Rock, with a depth of 13 fathoms between.

Anchorage.—Vessels may obtain anchorage in the southeastern part of Imadi Bay, about 500 yards 339° from Gawn Point, in depths of from 9 to 10 fathoms, mud.

9–66 Islands and dangers southwestward of Pana Tinani Island.—Wanim (Grass) Island (*southern end, 11°16′ S., 153°06′ E., H. O. Chart 2956*), 390 and 370 feet high at its northern and southern ends, respectively, lies southward of Pana Bahai Islet, from which it is separated by a channel. This channel, which may be used by small craft, is 300 yards wide and has depths of 3 fathoms. Craft using this channel may pass within 100 yards of Pana Bahai.

Rocks and foul ground extend 600 yards 322° from the northwestern point of the island; the western extremity of Daddahai Island just open of the southwestern point of Wanim, bearing about 159°, leads westward of them. The reef skirts the northern point of the island closely, but extends 300 yards to the eastward, the outer edge being marked by a rock which dries at half tide. A reef extends from 200 to 400 yards from the southern and southeastern points of the island.

A village is situated on the southeastern side of the island.

Anchorage.—The western side of Wanim Island forms a bay, where anchorage may be obtained in a depth of 16 fathoms, sand and coral, with the southwestern point of the island bearing 187°, distant 700 yards. This anchorage is out of the tidal influence, and during the southeast monsoon the water is smooth, though strong gusts come down over the land.

Sibumbum Islet, lying about one-half of a mile southward of the southern point of Wanim Island, is situated on the center of a reef, one-third of a mile in diameter. The islet has an elevation of 96 feet and is surmounted by a few trees. In the channel between the surrounding reef and the reef extending from the southern point of Wanim Island there is a 5-fathom patch, the depth being probably less than charted.

9–67 Daddahai (Brierly) Islet (*11°20′ S., 153°07′ E., H. O. Chart 2956*), 380 feet high, is situated 2¾ miles south-southeastward of Sibumbum Islet. The islet, which is wooded, is cultivated in places and on the northeastern side there is a village.

The islet is surrounded by Pakabuk Reef, which extends 700 yards westward and 1 mile northward from the islet. Shoal water extends 400 yards off the northern end of the reef; otherwise the reef is steep-to. Near the middle of the reef is a sand cay.

Anchorage.—Indifferent anchorage may be obtained off the western side of Daddahai Islet, about 350 yards from the reef, in a depth of 16 fathoms, sand and coral.

9–68 Popomweni Passage, between Sibumbum Islet and the northern extremity of Pakabuk Reef, is 1½ miles in width.

Green Patch, with a least depth of 2¼ fathoms, is situated on the northern side of the fairway and about 1,200 yards southward of Sibumbum Islet.

The northern extremity of Nimoa Island, situated in Coral Haven, in range with Utana Point, the southern extremity of Pana Tinani Island, bearing 087°, leads through the

fairway between Green Patch and Pakabuk Reef.

Seihauho (Henderson) Reefs, the main reef of which dries in patches at low water and is steep-to on its eastern side, are separated from Pakabuk Reef by a deep channel, 1½ miles in width. Shoal patches with a patch awash extend 1 mile southward from the southern side of the main reef; foul ground exists on the bank extending 1½ miles westward from the western side of the main reef.

Brierly Reefs, lying westward of and separated from Seihauho Reefs by a narrow, deep channel, extend 5 miles in an east and west direction. The general depths are from 1½ to 7 fathoms, and some spots dry at low water. The reefs form the eastern part of the northern edge of a large area that has not yet been examined.

Owen Stanley Bank, situated westward of Wanim Island, lies 2¼ miles northward of and parallel to Seihauho and Brierly Reefs. The bank extends 4¾ miles in an east and west direction, and has general depths of from 3 to 9 fathoms. Huxley Reef, lying at the eastern end of the bank, dries at low water; Sandfly Rock, lying at the western end of the bank, has a depth of 6 feet, being surrounded by shoal water to a distance of 400 yards. Other dangers than those charted may exist, therefore mariners are cautioned not to cross the bank.

The northern extremity of Wanim Island, in range with Mount Guyuba (Pana Tinani Island), bearing 093°, leads close northward of the bank; Sibumbum Islet, in range with the 875-foot peak, the southernmost peak of Pana Tinani Island, bearing 096°, leads southward of the bank.

9–69 Southwestern coast of Pana Tinani Island (continued from section 9–66).—**Hanagili Point** (*11°12′ S., 153°05′ E., H. O. Chart 2956*), the western extremity of Pana Tinani Island, is bold and descends abruptly from Mount Heibuk, a flat-topped, grassy hill 280 feet high.

9–70 Hessessai and Buvara Bays.—Between Hanagli Point and Bounce Point (sec. 9–65), a distance of 2¼ miles, the southwestern coast of the island recedes 1 mile. Hevaisi Islet, grass-covered and 275 feet high, divides this large bay into two parts, and is connected with the mainland by a reef.

Hessessai Bay is on the northern side and Buvara Bay on the southern side of this island. The approach to the former is obstructed by a a shoal with a depth of 1 fathom, lying 800 yards southwestward of Hevaisi Island, and by foul ground extending for a distance of 1,800 yards southward from Hanagili Point, and also by the Bridge Shoals. There are depths of from 7 to 10 fathoms in Hessessai Bay, but in consequence of the patches in its northern portion it does not afford protected anchorage. There is a grassy islet, 70 feet high, on the reef in the northwestern part of this bay.

Buvara Bay is fringed by a reef which extends from a few yards to 300 yards from the shore, skirting the shore closely at one-fourth of a mile northward of Bounce Point.

Anchorage.—During the southeast monsoon vessels may obtain anchorage in the southern portion of Buvara Bay in depths of from 10 to 12 fathoms, sand and clay. The best berth, out of the influence of the tidal currents, is with Bounce Point bearing 165°, distant 700 yards. The northeastern part of the bay is too confined for a vessel of any size, and the bottom is irregular.

Bridge Shoals comprise a series of 1½-fathom patches lying from 1 mile to 1½ miles southward and south-southeastward, respectively, of Hanagili Point. They impede the approach to Buvara and Hessessai Bays when coming from the northward or westward.

About three-fourths of a mile northwestward of Bridge Shoals are two rocky patches with depths of 2 fathoms, and one-half of

a mile farther northeastward is the extremity of the shallow water extending from Pana Tinani Island.

Sibumbum Islet, bearing 143°, open southwestward of the southwestern point of Wanim Island, leads one-half of a mile southwestward of Bridge Shoals.

Nigahau Islet is situated on the fringing reef of the northwestern point of Pana Tinani Island. This wooded, narrow islet attains a height of 95 feet.

Skin Reef, awash at low water, lies 1,200 yards westward of Nigahau. A tongue of shoal water, with depths of from 4 to 5 fathoms, extends 600 yards southwestward from the reef. A 3½-fathom ridge connects Skin Reef with another reef lying 600 yards southeastward of it.

A 3-fathom patch is situated 1 mile eastward of the southeastern point of Hemenahei Island.

9–71 **Magamaga Passage** leads between Hemenahei and Pana Tinani Islands. Westward of Skin Reef the navigable channel is only one-fourth of a mile in width. It has fairway depths of from 6 to 10 fathoms, but the channel with these depths is reduced to a width of 200 yards between the edge of the 3-fathom bank, with patches awash, extending 500 yards northward from Nigahau Island, and a 2-fathom patch lying on the northern side of the fairway and about 800 yards northward of Nigahau Islet.

The tidal currents run through this passage with a velocity of 2 to 4 knots, and have very short periods of slack water, the flood current setting to the southwestward and the ebb to the northeast. The passage should not be attempted during the first three hours of either flood or ebb, as at those times the current runs with the greatest strength.

9–72 **Directions from the southward.**—This passage should only be used by vessels possessing local knowledge. Being in a position midway between Bridge Shoals and Pipidai Point, steer 024° (allowing for a tidal current) until within 400 yards of the edge of the fringing reef southward of Hemenahei Island; then alter course to 052°, keeping at a distance of about 200 yards off the reef, which is always plainly visible.

When Hanagili Point bears 165° or when Wanim Island disappears behind Hanagili Point, the southwestern end of Skin Reef will be abeam. As soon as the northern point of Pana Tinani Island opens northward of Nigahau Islet, bearing about 097°, the course may be altered to 075° until the eastern extremity of Hemenahei bears 007°, when a 052° course will lead out through the northern entrance.

The vessel should be a good 200 yards from the northern shore reef when the western end of Nigahau is between the bearings of 165° and 210°, so as to avoid the 2-fathom patch which lies about 100 or 200 yards southward of it.

Coming from the northwestward, vessels are cautioned to give a berth to the 1-fathom patch situated 1 mile 063° from the eastern extremity of Hemenahei Island.

9–73 **TAGULA (SUDEST) ISLAND** (*H. O. Chart 2955*), the northwestern end of which lies 1¾ miles southward of the southern extremity of Pana Tinani Island, is the largest of the Louisiade Archipelago, being about 39 miles in length and 7 miles in average breadth. A densely wooded mountain range, with occasional grassy spurs on the northern side, extends throughout the island, the summit being near the center. On the southern side the mountains are steeper and there is a more extensive area of flat country. This island is one of the healthiest of the southeastern district of the Territory of Papua.

Aspect.—Mount Madau (*11°22′ S., 153°12′ E., H. O. Chart 2955*), the most conspicuous