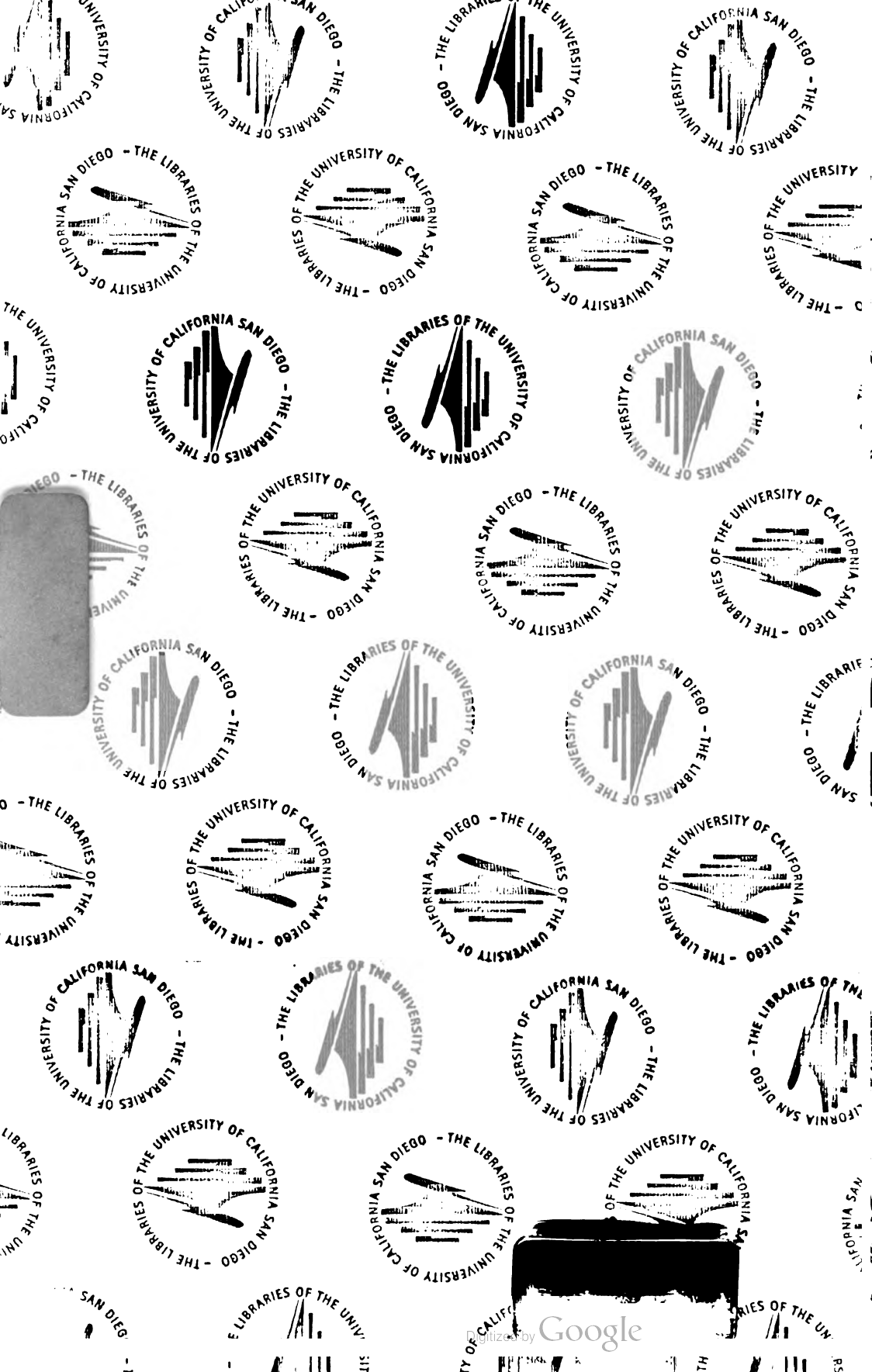
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THE

CHINA SEA DIRECTORY.

VOL. II.

CONTAINING

DIRECTIONS FOR THE NAVIGATION OF THE CHINA SEA, BETWEEN SINGAPORE AND HONG KONG.

COMPILED IN THE HYDROGRAPHIC DEPARTMENT, ADMIRALTY.

SECOND EDITION.

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ADVERTISEMENT TO SECOND EDITION.

THE China Sea Directory, Vol. II., contains a description of the China Sea, between Singapore and Hong Kong; and also directions for its navigation in both monsoons.

The material used in the compilation has been gathered from the surveys of Captains Bethune and Sir E. Belcher; Commanders Bate, Ward, and Bullock; Lieutenant Gordon, and Navigating Lieutenants Richards, Reed, and Tizard, Royal Navy (1844–65); also of Captains Ross and Maughan, Indian Navy (1806–10); and various detached French and Spanish surveys. Horsburgh's Directory, the Nautical and Mercantile Marine magazines, recent Remark books of Her Majesty's ships, and various documents in the Hydrographic Office have further been consulted.

The islands and dangers between Singapore and Borneo are from the surveys of Navigating Lieutenant Reed made in 1862. South Natuna islands from Lieutenant Gordon in 1847; North Natuna and Anamba islands chiefly on the authority of Captain Laplace, French corvette *Favorite*, 1831; but as these groups are only partially surveyed, their coasts should be approached with caution.

The numerous scattered dangers between the shoals forming the western boundary of the Palawan passage and those fringing the eastern side of the Main navigable route through the China Sea, are little known, and no vessel can come within these limits without risk.

The description of the west coast of Borneo is chiefly from the survey of Lieutenant Blommendal, Netherlands Royal Navy; but as this is yet imperfectly explored, it should be navigated with caution.

The western coasts of the Philippine islands are only partially surveyed; the mariner is warned accordingly.

The coasts of Cochin China are at present but partially explored. Their description is chiefly from the surveys of Captains Ross and Maughan, I.N., 1806–10; and from French Government surveys, included between the years 1857–77.

J 958. Wt. 3963.

The information relating to the coasts of Haïnan island and strait, has been derived chiefly from the remarks of officers of H.M. ships employed on the China station. The south-east coast, from Gaalong bay to False Tinhosa island, is from an examination made by Captain Ross in 1817.

The coast from Haïnan to the Canton river is little known; the account is chiefly from the examination of Captains Ross and Maughan, I.N.

This volume was originally compiled in 1868 by Staff-Commanders Reed and King, Royal Navy. The present edition has been prepared by Staff-Commander Hitchfield.

As this volume embraces so large an extent of sea and coast, and so many dangers imperfectly explored, it must necessarily be considered incomplete, and will furnish frequent occasions for revision. Seamen are therefore invited to transmit notice of any errors or omissions they may discover.

F. J. E.

Hydrographic Office, Admiralty, London,
June, 1879.

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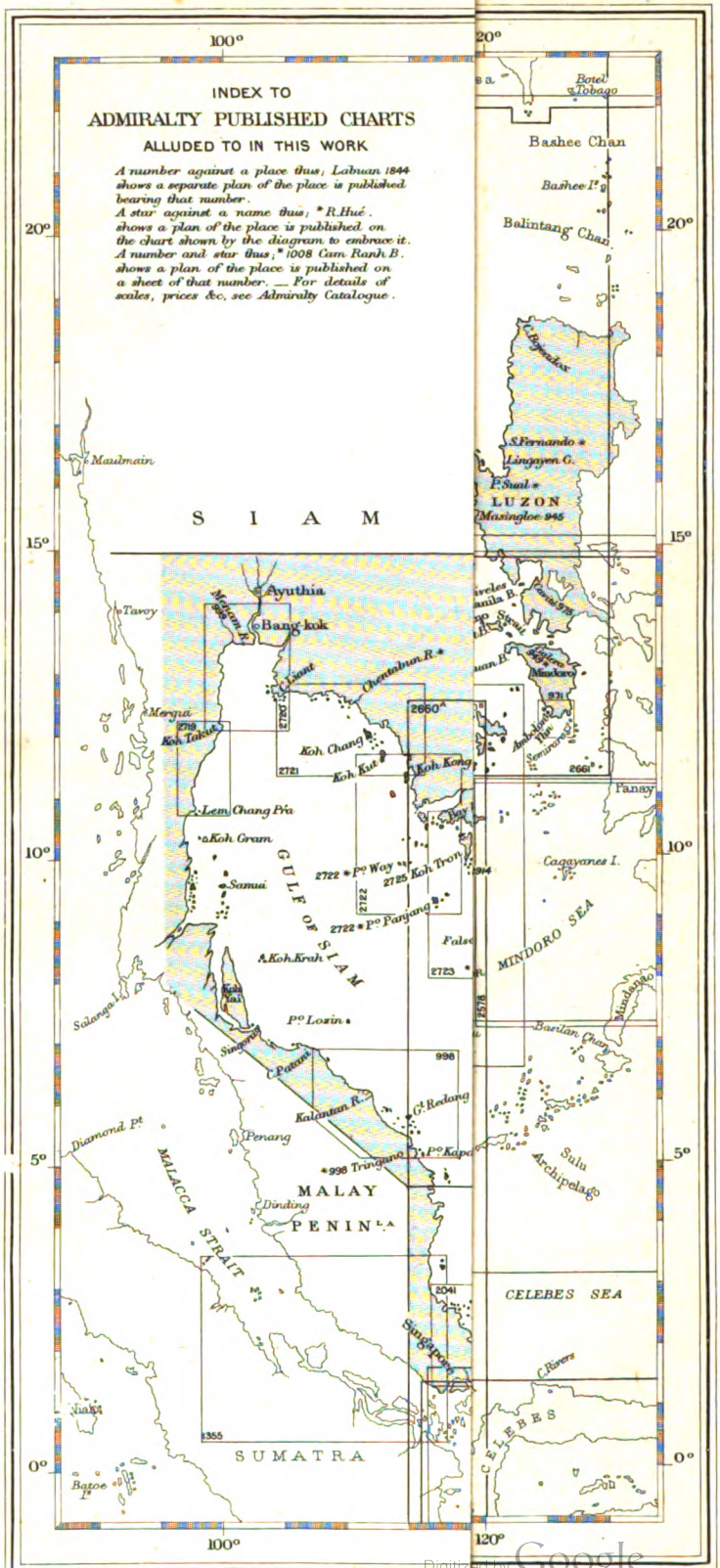
THE DISTANCES ARE EXPRESSED IN SEA MILES OF 60 TO A DEGREE OF LATITUDE.

A CABLE'S LENGTH IS ASSUMED TO BE EQUAL TO 100 FATHOMS.



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THE

CHINA SEA DIRECTORY.

VOL. II.

CHAPTER I.

MONSOONS, TYPHOONS, CURRENTS, AND TIDES IN THE CHINA SEA.—WITH DIRECTIONS FOR MAKING PASSAGES.*

The South-west Monsoon† generally commences in the China sea about the middle or end of April, and continues to the beginning or middle of October, liable to an acceleration or retardation of twelve or fifteen days. It sets in sooner about the gulf of Siam and Tong King gulf, and along the western coasts, than in the open sea, or near the coasts of China, Palawan, and Luzon. It also continues longer to the southward of the parallel of 11° N. than in the northern part of the sea, where it generally terminates about the first week in September; for southerly winds frequently prevail between Singapore and Pulo Sapatu until the middle of October, when north-east and easterly winds are blowing on the China coast.

In May the winds are often light and variable in the open sea, and easterly or south-east winds are likely to occur for a day or two at a time during the whole of the south-west monsoon; particularly in the northern part of the China sea, where these winds are frequently experienced in both monsoons.

The south-west monsoon is strongest, and least liable to change, in June, July, and August, at which period there is at times much rain and cloudy weather all over the China sea; in these months, and also in May, sudden hard squalls blow sometimes out of the gulf of Siam,‡ as far as Pulo Condore and Pulo Sapatu. When dense clouds are perceived to rise, indicating the approach of these squalls, sail ought to be reduced without delay.

From the gulf of Siam to cape Padaran, the south-west monsoon blows nearly parallel to the coast; and if close in, a light wind from the land is at times experienced at night, succeeded by a short interval of calm on

* Eastern routes to China :—*See* China Sea Directory, vol. III., 1874, pages 44–55 and 564–572.

† *See* Admiralty Wind and Current charts for Pacific, Atlantic, and Indian oceans, 1879.

‡ For Winds and Weather in the gulf of Siam, *see* page 294.

the following morning. The monsoon breeze then sets in, and generally continues brisk during the day. These land and sea breezes prevail most on the coast of Cochin China, from cape Padaran northward to Tong King gulf; for the sea wind dies away almost every evening on this coast during this monsoon, and a land breeze comes off in the night, although not at a regular hour. This is followed by calms or light airs, which frequently continue until noon; the sea breeze then sets in from the south-east.

In September and in the greater part of October the winds off the north extremity of Borneo and the south-west end of Palawan (*see* page 5) generally blow strong from the south-westward, with dark cloudy weather and much rain.

In March and April there are land and sea breezes on the coast of Luzon, with fine weather; but after the south-west monsoon sets in strong in June, and from that time until it abates in October, the weather is mostly cloudy; and the winds blowing from the sea upon that coast are generally accompanied with much rain.

On the coasts of China, both monsoons are subject to the same variations generally as those in the China sea. In the south-west monsoon the winds are not so constant from one quarter of the compass as they are in the north-east monsoon; land and sea breezes occur near the coast, so that there is not the difficulty in getting southward against the south-west monsoon, as there is in getting northward against the north-east monsoon. On the south-coast of China, the winds during the south-west monsoon prevail frequently at South and S.S.E. Strong north-east gales have been sometimes experienced on the coast of China during the south-west monsoon.

The North-east Monsoon usually begins in the northern part of the China sea about the end of September or early in October; but in the southern part it seldom blows steadily till November; light southern or variable breezes prevailing the greater part of October. This monsoon generally sets in with a gale, which sometimes comes down without warning, and with a violence that has exposed several vessels to great danger: therefore, when the monsoon is about to change, they should avoid anchoring in exposed positions, and weigh instantly if caught, as the swell rises with such rapidity as to cause a difficulty in getting the anchor. The first burst of the monsoon frequently lasts a week or ten days. The weather in some years is settled and fine, during September and October; but the equinox is a very precarious period, for within a few days of it storms are likely to happen.

In December and January the north-east monsoon blows more steadily and with greater strength. The weather in these months is frequently cloudy, with much rain and a turbulent sea, particularly about Pulo Sapatu, and thence to the entrance of Singapore strait; there are, however, considerable intervals of fine weather. On the coast of Palawan (*see* page 5) the winds are variable in November, and the early part of December, by which vessels pass along that coast either to the north-

east or south-west, but the weather is often dark, rainy, and cloudy. On the coast of Luzon the winds are frequently variable during this monsoon, generally from the northward and north-east; but veer to the north-west and westward at times, and blow strong, with cloudy weather and rain. In Tong King gulf, in November, there are sometimes light land breezes close to the coast; but the north-east monsoon prevails along the coast of Cochin China, as far southward as cape Padaran, generally from September or the early part of October, to the beginning or middle of April.

In February the strength of the north-east monsoon abates. During this month and March it blows moderately, with steady weather all over the China sea, inclining to land and sea breezes on the coast of Luzon.*

On the southern coast of China, when the north-east monsoon prevails, the winds blow mostly from E.N.E. parallel to the shore: they veer, and blow off the land at times, and also from the south-east, but there are seldom any regular land or sea breezes on that coast.

Typhoons.—These dangerous tempests occur in the northern part of the China sea, near Formosa, the Bashi islands, and the north end of Luzon; also to the eastward of those islands, and between Formosa and the Japan archipelago. They usually blow with the greatest fury near the land; as the distance is increased to the southward from the coast of China, their violence generally abates, and they seldom reach to the south of lat, 14° N., although a severe gale has been experienced at times two or three degrees farther southward.

Typhoons are liable to occur in both monsoons; but they are usually less severe in the China sea, in May, November or December; although in the vicinity of Formosa and the Bashí islands there are sometimes furious gusts in November. From December to May they seldom happen; those that have been experienced in June and July were the most violent; many vessels have been dismasted and sustained other damage by them. The months of August, September, and October are also subject to these tempests. The September equinox is a very precarious period, particularly if the change or perigee of the moon coincide with the equinox; when this has been the case, typhoons have happened several years at the equinox in September, on the coast of China, and many vessels have been dismasted on the 21st or 22nd of that month.

To prognosticate these tempests would be very useful to navigators, but this cannot be done with certainty, for they frequently commence without giving much indication of their approach. The clouds having a red aspect

* These remarks are from Horsburgh,—but Navigating Lieutenant J. W. Reed, R.N. observes, "From my own experience, and from inquiries made of many captains accustomed to the navigation of the China sea, I am of opinion that strong winds and unsettled weather will generally be experienced during the month of February, and that moderate breezes and settled weather are exceptional in that month."

is not a certain warning of the approach of a typhoon; for, at the rising, but more particularly at the setting of the sun, the clouds, especially those opposite to it in settled weather, are sometimes tinged with a deep red colour by the reflected light. Neither is an irregular swell a good criterion to judge of their approach; for near the coast of China a cross swell frequently prevails during steady settled weather. A hazy atmosphere, preventing land from being seen at great distances, is no unfavourable sign on the coast of China; for this is generally its state in settled weather. A serene sky, with the horizon remarkably clear, should not be considered an indication of a continuance of favourable weather; for a series of fine weather and calms, favouring an increase of heat above the mean temperature, is likely to be succeeded by a typhoon. When the horizon is very clear in some parts, and the summits of the hills or islands obscured by dense black clouds, there is some irregularity in the atmosphere, and stormy weather may be apprehended; but in reality, typhoons are seldom preceded by any certain sign or indication. The barometer affords the best means of anticipating their approach; for, on the south coast of China, there is a greater fall of the mercury than might be expected within the tropics.*

Typhoons always come from the eastern limits of the China sea, and assume a course generally W.N.W., but varying from that to W.S.W., and sometimes northward and southward of these bearings. There is, however, now considerably less danger in meeting these furious tempests, owing to the skill and research of Mr. W. C. Redfield, Colonel Sir William Reid, Mr. H. Piddington, and others who have collected a vast number of facts bearing upon the subject. It is found that their progress is governed by a general law, and consequently the vortex can be avoided, and the vessel's safety assured by attention to a practical rule, which is this:†—Look to the wind's eye,—set its bearing by compass,—and the 8th point to the *right* thereof, in North latitude, will be the bearing of the centre of the storm. For example, suppose the vessel to be in lat. 18° N., the wind East, and the barometer and sky indicating a coming gale,—then, look at the compass, take the 8th point to the *right* of East, and South is the bearing of the brewing storm, *if it be* of a revolving type. In this case, the vessel will be on the northern edge of the storm-field.

In the northern part of the China sea, a low barometer for several days previous, an ugly threatening appearance, and heavy swell, will give sufficient warning, and, provided it be taken, will enable vessels

* We rode out two heavy typhoons during the month of July 1841. The first, which occurred on the 21st in Macao outer roads, was prognosticated by calms, sultry weather, increased temperature, and by the barometer falling gradually to 29·40 before the typhoon burst upon us; its lowest was 28·80. The other, which occurred on the 26th at Hong Kong, gave but little warning of its approach; the barometer fell to 28·40.—Mr. J. W. King, Master, H.M.S. *Modeste*.

† *See* Remarks on Revolving Storms, published by order of the Lords Commissioners of the Admiralty, 1875.

to get sufficient sea room so as to avoid the centre of the storm, or to secure safe anchorage.

Gales sometimes blow steadily from E.N.E. or N.E. several days at a time, in September or October, near the south coast of China. In the same months they are liable to happen on the west coast of Luzon. Here, they mostly commence at North or N.W., and veer to West, S.W. or South, blowing strong from all these directions, with heavy rain, and a cross turbulent sea; but they seldom continue long.

In May, June, July, and August, severe gales are at times experienced in the north-western part of the China sea, particularly between lat. 14° N. and Haïnan island, with Tong King gulf open. These gales generally begin at N.N.W. or N.W., and blow with violence out of the gulf, accompanied by dark weather and a deluge of rain: from N.W. they veer to West and S.W., still blowing strong, and abate as they veer more southerly. When these N.W. gales are blowing in the vicinity of Haïnan and the coast of Cochin China, strong S.W. or southerly gales generally prevail at the same time, in the middle of the China Sea.

Squalls are common during both monsoons, the most dangerous are those known as the Arch squalls. When clouds are seen rising from the horizon in the shape of an arch, sail should at once be shortened as a heavy gust of wind may be expected; these squalls when the arch is near the zenith are accompanied by heavy rain.*

Winds on Coast of Palawan.†—The monsoons on this coast are so subject to interruption, being influenced by local circumstances and other causes, that it is difficult to say at what period either fairly sets in, and therefore we can only give our experience of the weather generally in each of the consecutive months of the year, except those of February and March, when the *Royalist* was in China.

The barometer is of little use in prognosticating the changes; the difference in the column of mercury for the whole year, except in cases where the condition of the atmosphere has been disturbed by some physical cause, such as the approach of a Typhoon, seldom exceeding two-tenths of an inch. In general the mercury rises to north-east and easterly winds, and falls to south-west and westerly; but in some instances we have known the reverse of this to occur, doubtless from some such disturbing cause as above mentioned, when the barometer by falling or rising indicates as usual the approach and recession of the vortex.

In January, when the north-east monsoon is blowing steadily, and sometimes with great violence, in the China sea, moderate north-east and

* Staff Commander T. H. Tizard, 1879.

† By the late Capt. W. T. Bate, R.N., who surveyed this coast in H.M.S. *Royalist*, in 1850–54.

easterly winds prevail on the coasts of Palawan, and in Luzon, and land and sea breezes have been experienced with considerable regularity.

In April, when light north-east and frequently south-east winds prevail in the China sea, north-east and easterly winds usually blow steadily on the coast of Palawan, freshening considerably after daylight, and dying away towards sunset.

May, and the early part of June, appear to be the finest period of the year on the coast of Palawan, when land and sea breezes prevail with tolerable regularity, the former coming from the south and south-east in the morning, and the latter from the north and north-west in the afternoon.

Towards the end of June, and throughout July, unsettled weather, generally commencing about the change of moon, may be expected. A slight depression of the mercury, after a succession of fine weather, frequently indicates the approach of strong squalls from the W.S.W., which are usually accompanied by dark cloudy weather and much rain, lasting for a week or ten days. These are generally succeeded by a period of fine weather, with north-west and south-west winds, which draw to the southward and eastward in the morning. If June or July have been unsettled, it may be expected that August generally will be fine, with moderate south-west, but more frequently westerly winds, particularly in the afternoon. If, on the contrary, June or July has been tolerably fine, very unsettled weather may be expected in August; in either of these months when strong south-west squalls have succeeded a period of fine weather, vessels will not unfrequently in the south-west part of the passage experience a weatherly set of the current.

In September and October the wind generally blows strong from the W.S.W., with dark cloudy weather; and off the south-west end of Palawan, squalls, which veer to W.N.W. and N.W., sometimes blowing with great violence, succeed each other rapidly, and are accompanied by rain. Between the squalls the wind frequently shifts to south-east.

In November and December the weather is variable; north-east and easterly winds, changing at times to south-east, more frequently prevail; but it is not unusual, especially in the former month, to have a south-westerly blow, with dark cloudy weather and rain. One of the heaviest gales experienced on the coast of Palawan, which shifted round to north-west, occurred in November, just before the change of moon, and lasted till the end of the quarter.

Currents in South-west Monsoon.—The currents in the China sea are very changeable, their direction and velocity depending much upon local circumstances. Late in April, or early in May, they generally begin to set to the northward, in the southern and middle parts of the sea, and continue to run in a north-easterly direction until September, while the south-west monsoon is strong; but they are not constant in this monsoon, for at times, when the wind is moderate or light, they are liable

that island extends fully 3 miles from its south-west side. Large vessels should not pass eastward of Haycock at night, as this locality is said to have hidden danger.

After passing Haycock there will be no difficulty in working up to the south-east point of the Great Natuna, as that island, when approached, from the south-west, shelters against the strong north-east current of the monsoon. Off its southern shore at night, in fine weather, the wind is off the land, which should not be approached nearer than 2 or 3 miles without a commanding breeze, as the water is deep close in shore, and no good anchorage can be obtained.

Vessels fetching to leeward of Subi with a northerly wind should take the Koti passage, between Pulo Panjung and Sirhassen island. The Sirhassen passage is also safe when the south side of Sirhassen island is kept aboard. The currents among these islands are more regular; but not so in the Api passage, where they set in various directions, and with great velocity to the S.W. from 16 to 19 hours at a time; for large vessels any of the other passages are preferable to this, for great caution and perseverance are requisite in working through, as the Borneo coast (in 10 to 11 fathoms water) must be kept aboard to avoid the current and profit by the land winds.*

In taking the Koti passage, give Pulo Panjung a good berth to avoid the dangerous reef which surrounds it. The winds amongst these islands and as far eastward as the meridian of cape Sirik are generally from North to N.N.W. The passage cleared, proceed to the north-eastward; endeavouring, if not certain of the longitude, to make the Royal Charlotte or Louisa reef, whichever is the weathermost, by running on its parallel of latitude; and as the currents appear to be influenced by the prevailing winds, a set in the direction in which it is blowing should be anticipated, the velocity of the current being proportionate to the force of the wind.

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* For steam vessels of small power, proceeding to China by the Palawan passage against the north-east monsoon, the route by the Api passage and the coast of Borneo presents the following advantages: first, light, variable winds and mooth water will often be found close to the Borneo coast, when a strong monsoon is blowing a hundred miles off it; and next the Api passage route affords convenient landmarks to lead a vessel safely and expeditiously to the entrance of the Palawan; whereas by the ordinary route much difficulty and delay frequently occurs in making Low island, and in passing between the Royal Charlotte and Louisa shoals.

Such vessels leaving Singapore should pass southward of Victory island, then steer to sight the small island of St. Pierre (carefully observing and allowing for the set of the current), and afterwards for the Api passage, keeping towards Marundum island rather than Tanjong Api. Having passed Marundum and Tanjong Datu, the course is clear up to the entrance of the Palawan, passing between the south Luconia shoals and Barram point, and keeping as close to the Borneo coast until abreast of that point as circumstances may make convenient.—Navigating Lieutenant J. W. Reed, commanding H.M. surveying vessel *Rifleman*, 1866.

from a quarter of a mile from the reef until close to the end of the spit, when the water deepens rapidly from 9 to 17 fathoms, thence 67 fathoms, no bottom; while at a distance less than a third of a mile, no bottom was obtained with 220 fathoms of line. There is no danger on the ridge if vessels do not get into less than 4 fathoms, although from the clearness of the water the bottom appears close to the ship's keel; the ledges surrounding the islet are steep-to.

Anchorage on the ridge in 5 fathoms, in the south-west monsoon, was obtained by the *Rifleman*, fairly sheltered from the prevailing wind. Fish appeared to be abundant, but only a few were caught.

Tides.—By observations at Amboyna cay two days before neaps, the maximum rate of tide was 1·4 knots per hour, the flood stream setting about N. by W., the ebb West; flood commencing at 11 p.m., and the ebb at 6 a.m.; rise and fall doubtful.

Owen Shoal, in lat. 8° 8′ N., long. 111° 59′ E., was discovered in 1835, by Mr. Owen, commanding the ship *David Scott*, who had soundings of 6 to 4½, and one cast of 3¾ fathoms in passing over it, a little past noon, steering S.S.E., and at 1 p.m. cleared the shoal, having then no bottom. The shoal appeared to be about 2 miles in extent, consisting of black and white speckled coral, in a state of rapid accretion, apparently by the vitality and energy of the madrepores, observed in recent formations of large pieces of coral brought up by the lead. The patches of speckled coral were bright and alarming while on the shoal, and although no breakers were perceived, as the sea was then very smooth, yet with a heavy swell, the sea probably rises in rollers over the shoal patches, when a large vessel would be liable to strike on some of them.

Stags Shoal, the north end of which is said to be in lat. 8° 24′ N., long. 112° 57′ E., was seen by Mr. Trinder, in the brig *Amboyna*, 1802, and named by him from the resemblance of the rocks to the horns of a stag. No soundings were obtained at 80 fathoms, within a quarter of a mile of the north end of the shoal, which extended S.E. and S.S.W. in form of a triangle, with rocks above water, and breakers on various parts, the intermediate space apparently very shoal, and the southern extremity could not be discerned from the mast-head.*

The *Rifleman* in 1868, obtained 1085 fathoms, oaze, in the position assigned to Stags shoal.

* H.M.S. *Renard* got upon the position ascribed to the Stags, and steered a few miles East and West, but could not discover them. Commander Ward, R.N., found Amboyna cay to be 11 miles farther west than reported by Mr. Trinder, commanding the *Amboyna*, who discovered both dangers; and it is possible, therefore, that the position of the Stags given in the text may be 11 or 12 miles to the eastward of the truth.

Ladd Reef (Rob Roy reef), the eastern extreme of which is in lat. 8° 40¼′ N. long. 111° 41′½ E., is a coral bank 3 miles long E.N.E. an W.S.W., and a mile across its broadest part, which is at its eastern end. In the centre of the reef is a lagoon with a bottom of clear white sand, which shows with remarkable distinctness. The surrounding reef uncovers at half tide in many places, and at low water it is almost impossible for boats to cross over into the lagoon.

Spratly Island, bearing E. ½ S. distant 14 miles from Ladd reef, is evidently identical with the Storm island of Horsburgh, as no other island exists in this vicinity. It is a flat islet, about 8 feet high, 500 yards long and 300 yards broad, with a margin of bright white sand and broken coral, which, when the sun is shining on it, is conspicuous from the mast-head at a considerable distance. It was described by Mr. Spratly, commanding the *Cyrus*, whaler, as "a low sandy island, the top appearing to be covered with bushes."* Commander Ward says that not a bush or even a blade of grass is to be found upon it, and the appearance described by Mr. Spratly was no doubt the effect of the mirage, which exaggerates the size and distorts the appearance of the drift-wood on the beach and the sea birds which throng it. At a distance of 3 or 4 miles, the birds standing erect look very like small bushes.

Spratly island † is on the west side of a coral bank, which is 1⅓ miles long N.E. and S.W., and three-quarters of a mile broad. Northward of the island at three-quarters of a mile distant, there are 3½ fathoms close to the edge of the bank decreasing towards the shore. North-eastward there are 7 or 8 fathoms not quite half a mile from the island. Rocky ledges, dry at low water, surround this island, rendering it necessary to be cautious when landing, which during the south-west monsoon may be effected on the lee side. The bank is steep-to, the sea breaking heavily upon it in the south-west monsoon, except in very fine weather.

The *Rifleman* anchored in about 6 fathoms on the north-east point of the bank, fairly sheltered from the S.W.; with the extremes of the island bearing S.W. ½ S., and S.W. by W. ½ W., and the extreme of the breakers on the western edge W. ¾ S.

In the months of June and July the islet swarmed with turtle of a very fine description, and they may possibly frequent it at other seasons. Large numbers were taken, being easily turned over by two or three men on the beach, in the evening or night, and occasionally in

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* Nautical Magazine, 1843, p. 697.

† A square beacon was erected by Commander Ward on this islet. It is formed with four uprights of rough drift-wood spars, 27 feet high and 15 feet apart. The uprights are shored up, and the centre space solidly filled in and built up to a height of 15 feet with drift-wood, rubble, &c.

the daytime: they are apparently identical with the green turtle of Ascension. Immense quantities of their eggs were found on the south-west side of the islet. Fish were numerous, but few were caught. Sea birds' eggs literally covered the ground.

Tides.—Observations at Spratly island in the south-west monsoon showed but one tide during the 24 hours, and in the early part of July it was found to be high water at 9 h. a.m., the rise and fall being 5¼ feet. No observations up to the present time have been obtained during the north-east monsoon, which probably creates a great change. The direction of the stream at the north-east corner of the bank was S.W. during the rising tide, and S.E. to E.N.E. during the falling tide.

WEST LONDON REEF, bearing E. by N. ¾ N. distant 31 miles from Ladd reef, is 4½ miles long, N.E. by E. and S.W. by W., 3¼ miles broad; several of the coral heads surrounding this reef dry at low water. On the centre of the reef there are 6 to 10 fathoms water, with several shoal spots. The only approach to the centre is from the south-east side, but so many coral patches exist that the navigation is extremely hazardous. On the east side of the bank, in lat. 8° 52′ 51″ N., long. 112° 15′ 28″ E., is a sandy cay, a quarter of a mile in extent N.E. and S.W., 26 yards broad, and 2 feet above high water.

CENTRAL LONDON REEF, the centre of which is in lat. 8° 55½′ N., long. 112° 20′ E., was discovered by the *Rifleman* whilst sounding between the East and West London reefs. It is a coral patch, awash, half a mile in extent, with a shallow lagoon inside the belt of coral. On the south-west extreme of the reef is a sandy cay, 60 or 70 yards in circumference, which is probably covered at high-water springs.

This is a dangerous reef, and lies directly in the track of vessels working up or down the China sea. Being small, it is not marked by breakers, like those which so readily point out the positions of East and West London reefs.

Caution.—Like most dangers in the China sea, the Central London reef is surrounded by deep water, thus rendering the lead useless; great caution is therefore necessary when navigating in their vicinity, and not to stand towards them with the sun shining ahead, as under these circumstances it becomes almost impossible to distinguish shoal water or breakers.

EAST LONDON REEF is 7 miles long, east and west, from one to 2 miles broad, and its east end is in lat. 8° 49′ 38″ N., long. 112° 38′ 16″ E. The coral round it edges encloses a lagoon, having 4 to 8 fathoms water. No entrance into the lagoon could be discovered, but there are apparently numerous shoal patches inside. The sea breaks heavily on the reef, and

on its western extreme are one or two rocks which seldom cover. No soundings could be obtained with 100 fathoms of line at one mile from where the coral dries, nor with 500 fathoms at 2 miles north of it.

Cuarteron Reef, named after the Spaniard who discovered it, is awash, crescent shaped, curved to the southward, the distance between the horns being 3 miles E. by S. and W. by N. Its eastern extreme is in lat. 8° 50′ 54″ N., long. 112° 50′ 8″ E.

The reef was found steeper-to than any yet visited, for although deep water is found close to all of them, there was generally some slope from the rocks awash, on which the *Rifleman* could anchor with safety for a short period, to enable the position to be fixed; here, however, although she anchored in 5 fathoms, with the jib-boom over the rocks awash, the reef was so steep as to cause the anchor to roll down the incline, and run the cable out to the cliuch. Captain Ward is opinion that no vessel should ever venture to sight this reef.

The Fiery Cross or N.W. Investigator Reef is an extensive coral reef having several dry patches, upon most of which the sea breaks even in light winds, or with a slight swell. It is 14 miles in length N.E. by E. and S.W. by W., and 4 miles in breadth. Its south-west end is in lat. 9° 32′ N., long. 112° 50° E., and its north-east end in lat. 9° 41′ N., long. 113° 2′ E. The largest dry patch is at its south-west end, and here were found the wrecks of two vessels, supposed to have been those of the *Fiery Cross* and *Meerschaum*, both of which are known to have been lost upon this reef.*

Discovery Great Reef, the south end of which is in lat. 10° 0′ 42″ N., long. 113° 51½′ E., is a long narrow coral shoal, the greater part of which dries at low tides, with several large rocks upon it which always show above water; in the centre is a lagoon, which appeared to be shallow, and to have no passage leading into it. From the south

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* The schooner *Dhaulle*, 1826, anchored at night on a shoal of 3 fathoms, which, on the following morning, appeared to be about one or 2 miles in circumference. At noon of the preceding day, the *Dhaulle* had passed a mile to the westward of what was supposed to be West London reef, and thence had steered N. by E. ½ E., 42 miles, until she anchored in 3 fathoms on the shoal; this run would place it in 9° 32′ N., and 112° 24′ E.

The *Rifleman* was employed a whole day in searching over and about that locality, with a heavy swell and light breeze, circumstances favourable for the discovery of shoals in deep water, but no shoal could be found; on the presumed locality bottom of dark ooze was brought up from a depth of 1,060 fathoms.

The London reefs, were, until the *Rifleman's* survey, 1868, placed upon the charts very much out of their correct positions, and it seems probable that the reef passed to the westward by the *Dhaulle* was either the East London or the Cuarteron, and that the shoal anchored on was one of the shoal patches of the Fiery Cross reef, in the same latitude as that ascribed to the Dhaulle shoal.

point the reef trends North, 5 miles, then N. by E., 5 miles, it is a mile broad at the south end and half a mile at the north. No bottom was found with 100 fathoms line within a short distance of any part of the reef except off its north end, where the *Rifleman* anchored in 42 fathoms, nearly half a mile from the rocks; a third of a mile off its south-west point a sounding of 192 fathoms, sand and coral, was obtained.

The Haïnan fishermen report a reef or shoal lying 10 miles north-eastward of Discovery Great reef, but that locality, not having been examined, should be avoided.

Discovery Small Reef, in lat. 10° 1½′ N., long. 114° 1½′ E., is a small round coral patch, a third of a mile in diameter, dry in places at low tides, with very deep water all round. Soundings of 174 and 180 fathoms, sand and coral, were obtained very close to its eastern side, and no bottom at 210 fathoms the same distance off the opposite side.

Western or Flora Temple Reef, the centre of which is in lat. 10° 15′ N., long. 113° 37′ E., is the westernmost reef in this part of the China sea, and very dangerous, having patches of rock just under water at the south-west part, and but one to 3 fathoms in other places. It is 1½ miles long N.E. and S.W., and rather more than half a mile broad at the southern part, decreasing to half that breadth at the opposite end. The *Rifleman*, for the purposes of the survey, anchored in 5 fathoms on its north-eastern extreme, which had to be approached with great caution, as shoal water was seen at a very short distance inside the edge; soundings of 18 to 74 fathoms were obtained close to, but at a short distance off, no bottom at 100 fathoms.

TIZARD BANK, with REEFS and ISLANDS.—From Discovery Small reef the nearest part of this bank bears N.E. by E., 16 miles. It, like the generality of the large coral banks in the China sea, consists of a lagoon bordered by shoal patches, several of which are dangerous reefs, dry at low water, two with islands on them, and a third a sand cay. The bank lies in an E.N.E. and W.S.W. direction, and extends nearly 31 miles, its breadth at the north-east part being 11 miles, and at the opposite end 3½ miles.

Itu-Aba, the larger of the two islands, lies at the north-west corner of the bank, and is three-quarters of a mile long, E. by N. and W. by S., and a quarter of a mile broad. The reef surrounding it extends in some places nearly half a mile, and in others not so far; its limits, however, are generally defined by a line of breakers. The island is covered with small trees and high bushes, with numerous nests of sea birds. There are two or three cocoa-nut and a few plantain trees near a small well, but the most conspicuous object is a single black clump tree, on the north side of

the island, which may be distinctly seen 10 miles off; this tree is in lat. 10° 22′ 42″ N., long. 114° 21′ 11″ E.

A little more than 6 miles, East, from Itu-Aba island is a small sand cay, nearly in the centre of a round-shaped reef three-quarters of a mile in diameter. The island and cay are connected by a line of shoal patches, which form the north-east part of the bank; and nearly midway between, but nearer the island, is a dangerous reef, entirely covered at half-tide, about the same size as that surrounding the cay. Elsewhere on the northern edge of the bank there are not less than 4 fathoms, and vessels may safely anchor in 7 to 11 fathoms about 1½ miles westward of the sand cay, midway between it and the reef last described.

Petley Reef, an oval-shaped patch a little over a mile in extent, lies E. by N. ¾ N. 5¼ miles from Sand cay; it forms the extremity of a remarkable strip of coral, 1¼ miles wide, projecting in a N.N.E. direction from the main body of the bank, the edge of which trends E.S.E. from the cay; not less than 6 fathoms was found upon the strip, except within a mile of the southern part of the reef above mentioned, where it shoals to 4 and 3 fathoms, and no bottom could be obtained with 100 fathoms at a short distance on either side of it.

Eldad Reef, the north-east end of which is in latitude 10° 23′ N., longitude 114° 42′ E., forms the eastern extreme of Tizard bank. It is 4½ miles long, N.N.E. ½ E. and S.S.W. ½ W., the southern and middle parts being about 1½ miles wide, but of irregular outline; and the northern part tapering away in the form of a long narrow tongue, on either side of which no bottom could be obtained with 100 fathoms of line. A few large rocks are visible at high water, and at low water many smaller ones uncover. Shoal patches extend nearly three-quarters of a mile to the westward of the reef.

Nam-yit Island, lying South 11¼ miles from Itu-Aba, is 600 yards long East and West, 200 yards broad, and surrounded by a reef which projects more than a mile to the westward, and about a third of a mile in other directions.

Gaven Reefs are two dangerous reefs, covered at high water, lying westward of Nam-yit; the easternmost is three-quarters of a mile long, N.N.W. and S.S.E., Nam-yit island bearing from it E. ⅜ N., distant 6 miles; the westernmost is a mile long North and South, and nearly three quarters of a mile broad at its northern end, narrowing to a point at the opposite end; its outer edge is in lat. 10° 13′ 20″ N., long. 114° 13′ 7″ E.

Anchorage.—The above comprise the whole of the dangers found on Tizard bank, and with the exception of a 3-fathoms patch about a mile north-east of Nam-yit, nothing less than 4 fathoms was discovered on any of the shoal patches surrounding the lagoon; so that vessels of moderate draught

point the reef trends North, 5 miles, then N. by E., 5 miles, it is a mile broad at the south end and half a mile at the north. No bottom was found with 100 fathoms line within a short distance of any part of the reef except off its north end, where the *Rifleman* anchored in 42 fathoms, nearly half a mile from the rocks; a third of a mile off its south-west point a sounding of 192 fathoms, sand and coral, was obtained.

The Haïnan fishermen report a reef or shoal lying 10 miles north-eastward of Discovery Great reef, but that locality, not having been examined, should be avoided.

Discovery Small Reef, in lat. 10° 1½′ N., long. 114° 1½′ E., is a small round coral patch, a third of a mile in diameter, dry in places at low tides, with very deep water all round. Soundings of 174 and 180 fathoms, sand and coral, were obtained very close to its eastern side, and no bottom at 210 fathoms the same distance off the opposite side.

Western or Flora Temple Reef, the centre of which is in lat. 10° 15′ N., long. 113° 37′ E., is the westernmost reef in this part of the China sea, and very dangerous, having patches of rock just under water at the south-west part, and but one to 3 fathoms in other places. It is 1½ miles long N.E. and S.W., and rather more than half a mile broad at the southern part, decreasing to half that breadth at the opposite end. The *Rifleman*, for the purposes of the survey, anchored in 5 fathoms on its north-eastern extreme, which had to be approached with great caution, as shoal water was seen at a very short distance inside the edge; soundings of 18 to 74 fathoms were obtained close to, but at a short distance off, no bottom at 100 fathoms.

TIZARD BANK, with REEFS and ISLANDS.—From Discovery Small reef the nearest part of this bank bears N.E. by E., 16 miles. It, like the generality of the large coral banks in the China sea, consists of a lagoon bordered by shoal patches, several of which are dangerous reefs, dry at low water, two with islands on them, and a third a sand cay. The bank lies in an E.N.E. and W.S.W. direction, and extends nearly 31 miles, its breadth at the north-east part being 11 miles, and at the opposite end 3½ miles.

Itu-Aba, the larger of the two islands, lies at the north-west corner of the bank, and is three-quarters of a mile long, E. by N. and W. by S., and a quarter of a mile broad. The reef surrounding it extends in some places nearly half a mile, and in others not so far; its limits, however, are generally defined by a line of breakers. The island is covered with small trees and high bushes, with numerous nests of sea birds. There are two or three cocoa-nut and a few plantain trees near a small well, but the most conspicuous object is a single black clump tree, on the north side of

the island, which may be distinctly seen 10 miles off; this tree is in lat. 10° 22′ 42″ N., long. 114° 21′ 11″ E.

A little more than 6 miles, East, from Itu-Aba island is a small sand cay, nearly in the centre of a round-shaped reef three-quarters of a mile in diameter. The island and cay are connected by a line of shoal patches, which form the north-east part of the bank; and nearly midway between, but nearer the island, is a dangerous reef, entirely covered at half-tide, about the same size as that surrounding the cay. Elsewhere on the northern edge of the bank there are not less than 4 fathoms, and vessels may safely anchor in 7 to 11 fathoms about 1½ miles westward of the sand cay, midway between it and the reef last described.

Petley Reef, an oval-shaped patch a little over a mile in extent, lies E. by N. ¾ N. 5¼ miles from Sand cay; it forms the extremity of a remarkable strip of coral, 1¼ miles wide, projecting in a N.N.E. direction from the main body of the bank, the edge of which trends E.S.E. from the cay; not less than 6 fathoms was found upon the strip, except within a mile of the southern part of the reef above mentioned, where it shoals to 4 and 3 fathoms, and no bottom could be obtained with 100 fathoms at a short distance on either side of it.

Eldad Reef, the north-east end of which is in latitude 10° 23′ N., longitude 114° 42′ E., forms the eastern extreme of Tizard bank. It is 4½ miles long, N.N.E. ½ E. and S.S.W. ½ W., the southern and middle parts being about 1½ miles wide, but of irregular outline; and the northern part tapering away in the form of a long narrow tongue, on either side of which no bottom could be obtained with 100 fathoms of line. A few large rocks are visible at high water, and at low water many smaller ones uncover. Shoal patches extend nearly three-quarters of a mile to the westward of the reef.

Nam-yit Island, lying South 11¼ miles from Itu-Aba, is 600 yards long East and West, 200 yards broad, and surrounded by a reef which projects more than a mile to the westward, and about a third of a mile in other directions.

Gaven Reefs are two dangerous reefs, covered at high water, lying westward of Nam-yit; the easternmost is three-quarters of a mile long, N.N.W. and S.S E., Nam-yit island bearing from it E. ⅞ N., distant 6 miles; the westernmost is a mile long North and South, and nearly three quarters of a mile broad at its northern end, narrowing to a point at the opposite end; its outer edge is in lat. 10° 13′ 20″ N., long. 114° 13′ 7″ E.

Anchorage.—The above comprise the whole of the dangers found on Tizard bank, and with the exception of a 3-fathoms patch about a mile north-east of Nam-yit, nothing less than 4 fathoms was discovered on any of the shoal patches surrounding the lagoon; so that vessels of moderate draught

can, in cases of necessity, and in fine weather, find convenient anchorage, observing always due care and caution in approaching them, so as to guard against possible danger from some shoal spot having escaped detection by the lead.*

LOAI-TA BANK extends 21 miles N.E. and S.W.; its southern part is 5½ miles wide, and its centre 7 miles; from thence it gradually narrows to a point at its north-east extreme.

Loai-ta Island (South island of Horsburgh) lies N. ¾ E., distant 18 miles from Itu-Aba, its north-west entrance being in latitude 10° 40′ 45″ N., longitude 114° 24′ 54″ E. It is a low sand island, 300 yards in diameter, covered with bushes, and surrounded by a reef extending in some places nearly half a mile.

A reef, about 1½ miles in extent, dry at low water, and having a small sand cay near the centre, lies 5 miles north-westward of Loai-ta island. Another and larger reef lies three-quarters of a mile to the south-westward of the one just mentioned, extending in that direction 1¾ miles, its width being about a mile. The south-west extreme of this last reef, which is also the south-west extreme of Loai-ta bank, is in 10° 42′ N., and 114° 19′ E.; the sand cay bearing N.E. distant nearly 3 miles, and Laoi-ta island E. by S. 6 miles.

From the sand cay above mentioned, the north-western edge of the bank trends away E.N.E. 5 miles, and then N.E. 13 miles; no less than 4 fathoms was found anywhere upon this part of the bank.

Lan-keeam Cay and adjacent Reefs.—A coral patch, half a mile in extent, which partly dries at low water, lies E. by N. 2 miles from Loai-ta island; and E.N.E. 6¼ miles from the same island is a larger reef, three quarters of a mile in diameter, having a sand cay near its centre: this cay, known to the Haïnan fishermen as Lan-keeam, is in lat. 10° 43′ 20″ N., long. 114° 31′ E.

At 3 miles N.E. by E. ½ E. from Lan-keeam, is a small dry patch which forms the south-east angle of the great Loai-ta bank, and N.E. ¼ N. 4¼ miles from that cay is another small reef; this is the northernmost patch which dries.

From the reef just mentioned, the south-eastern edge of the bank

* Haïnan fishermen, who subsist by collecting trepang and tortoise-shell, were found upon most of these islands, some of whom remain for years amongst the reefs. Junks from Haïnan annually visit the islands and reefs of the China sea with supplies of rice and other necessaries, for which the fishermen give trepang and other articles in exchange, and remit their profits home; the junks leave Haïnan in December or January, and return with the first of the south-west monsoon. The fishermen upon Itu-Aba island were more comfortably established than the others, and the water found in the well on that island was better than elsewhere.

trends N. by E. about 9 miles, when it meets the north-western edge: nothing less than 4 fathoms was obtained on this part of the bank.

Soubie reef, the south-west end of which is in lat. 10° 53½′ N., long. 114° 3′ 40″ E., is the westernmost danger in this locality. It is an irregular-shaped coral reef, nearly 3½ miles long, N.E. and S.W., and 2 miles broad, is dry at low water, and has a lagoon, into which there appears to be no passage.

THI-TU REEFS and ISLAND (the N.W. Dangers of Horsburgh), consist of the several very dangerous patches grouped upon two coral banks, separated by a narrow deep channel. Thi-tu is a low sand island, not quite half a mile in diameter, situated near the centre of the dangers on the southern part of a reef, which dries at low water, and which extends three quarters of a mile eastward of the island, forming in that direction the extreme of the western bank. Near its south-west end is a dark clump tree in lat. 11° 3′ 9″ N., long. 114° 16′ 25″ E.; in addition to this clump tree the island has upon it some low bushes and two stunted cocoa-nut trees, near to which is a small well and a few plantain trees. (1867).

From the island the western bank widens out in directions N.W. and S.W. for a distance each way of 2½ miles; the north side of this part of the bank is marked by a round coral reef, three-quarters of a mile in diameter, between which and the reef surrounding the island are soundings of 2½ to 7 fathoms, the deep water being nearer the island. The south edge of the bank is also marked by a reef, but this is much smaller than the one just described, and the depths between it and the island are more favourable for anchoring upon than the opposite side of the bank, being in no place less than 4½ fathoms. From these two reefs the bank gradually narrows, and terminates in a point in lat. 11° 2′ 30″ N., long. 114° 10′ 30″ E. the island bearing E. ¾ N., distant 6 miles.

On the north edge of the bank is a sand cay which bears from the island W. ⅓ N., nearly 3½ miles. This is also on a large patch of reef, dry at low water, and between it and the western extreme of the bank are dangerous reefs, nearly always marked by breakers. There is a passage into the lagoon between the sand cay reef and the one 2½ miles N.W. of the island, with depths of 5 to 12 fathoms.

The south side of the bank is not nearly so dangerous as the north side, and vessels may anchor upon it with the sand cay bearing between N.E. by N. and N.W. by N., or to the eastward of the patch which lies S.W. 2½ miles from the island, with the cay bearing N.W. by W. ½ W., and the island N.E. ½ E. In the lagoon the depths are 17 to 19 fathoms.

The eastern bank is a mass of dangerous reefs and patches; its western extreme is more than a mile eastward of Thi-tu island, extending

from thence 1½ miles East and 3½ miles N.E., with an average breadth of 2 miles.

Trident Shoal, lying E. by N. 16 miles from North Danger, is composed of coral 7½ miles long and 6 miles broad; there are many patches on this shoal with less than 10 fathoms water over them, two of which are dangerous. These patches lie round the edges of the shoal, forming a lagoon, the depths in which are 26 to 37 fathoms; close outside of them, there is no bottom at 100 fathoms.

The most dangerous patch, situated at the northern extreme of the shoal, extends 1¾ miles East and West, and half a mile North and South, having near its centre, in lat. 11° 31′ 30″ N., long. 114° 39′ 15″ E., a small spot which dries at low water springs; the depths on other parts of the patch vary from 1¼ to 6 fathoms. The other patch is at the eastern extreme of the shoal, and is distant 3½ miles S.E. ½ S. from that just described; it is a small spot of 2¼ fathoms, with depths of 3 to 5 fathoms at half a mile around it; depths of 4 fathoms were obtained about a mile W. by S. from the dry spot, but not less than 5 fathoms on any of the other patches.

Lys Shoal lies 2 miles southward of Trident shoal, and like the latter is formed of a number of patches under 10 fathoms, with a lagoon in the centre; only one danger, a small spot of 17 feet, was found, and this lies near the south-west extreme of the bank, in lat. 11° 19′ 40″ N., long. 114° 34′ 24″ E.; around it the depths are 5 fathoms. Some 5-fathom patches were also discovered near the north-east end of the bank, but nothing under 6 fathoms was met with elsewhere, the general depths on the patches being 7 to 10 fathoms, and a short distance outside of them bottom was not reached with 100 fathoms of line.

North Danger Reef, of coral formation, is about 8½ miles long, N.E. and S.W., and 4½ miles broad. On its north-west side are two sandy cays, the north-eastern of which is half a mile long, one quarter of a mile broad, and 10 feet high; the south-western cay is nearly half a mile long, 300 yards broad, and 15 feet high. Between the cays is a passage one mile wide, with 4 to 9 fathoms water, leading into the lagoon of the reef, where the depth is 20 to 25 fathoms.

Shoal water exists all round the edge of North Danger reef, and there are heavy breakers over the coral, awash at its north-east and south-west extremes. No soundings could be obtained close to the edge of the reef with upwards of 100 fathoms of line, but there is a depth of 380 fathoms at 1½ miles north-east of the breakers on its north-east extreme. On the eastern side of the reef no bottom could be obtained with 450 fathoms of line.

Both cays are covered with coarse grass, and on the north-eastern

of the two is a stunted tree in lat. 11° 28′ N., long. 114° 20¾′ E. The cays are frequented by Chinese fishermen from Haïnan, who collect beche-de-mer, turtle-shell, &c., and supply themselves with water from a well in the centre of the north-eastern cay.

Caution.—Vessels should not attempt to pass through the reefs in this part of the China sea, as a line of dangerous shoals, extending many miles, is known to exist eastward of the dangers just described.

Currents and Tides.—Whilst the *Rifleman* was at anchor on the reefs, during both monsoons, careful observations were taken of the set of the current, which, for 16 hours out of the 24, invariably set to windward, generally with the greatest force when the monsoon was strongest.

The rise of tide at springs was about 5 feet, and at neaps one to 2 feet one tidal steam in 24 hours.

WESTERN SIDE OF MAIN ROUTE.

Scawfell Shoal.—Mr. Thompson, commanding the ship *Scawfell*, reports as follows:—"On the 13th of May 1865, on my passage up the China sea, just before noon I observed an unusual quantity of fish around the ship, and while taking noon observations, rocks were reported under the bottom. I immediately got a cast of the lead, and had 9 fathoms, the lead tumbling off the coral gave half a fathom more. The water was very smooth at the time, the vessel having just steerage way, with a very light air from the north-east. Other casts of the lead gave 7½ fathoms until about the middle of the shoal, when the lead got fast between the coral rocks and was lost; this part appeared as shoal as any that was visible round the ship. Got another lead ready as soon as possible, when we had 17 fathoms, then losing sight of the bottom the ship drifting to the N.N.W. with a slight northerly current about a knot an hour. On sounding an hour later, the ship going in the same direction at the same rate, had 22 fathoms; one hour afterwards 29 fathoms, this last being 5 or 6 miles north-westward of the shoal.

"The noon observations taken on the shoal gave lat. 7° 19′ N., and by mean of forenoon and afternoon sights for chronometer, made the longitude of the shoal to be 106° 51′ E. Made Pulo Condore next day, and by that island, together with observations taken in Sunda and Gaspar straits, the chronometers appeared to be quite correct."

It will be seen that the position of this shoal is about as far to the westward of the usual track of shipping proceeding up or down the China sea before a fair monsoon as the Charlotte bank is to the eastward of it. Lying so near the fairway, it appears extraordinary that it has not been before observed.

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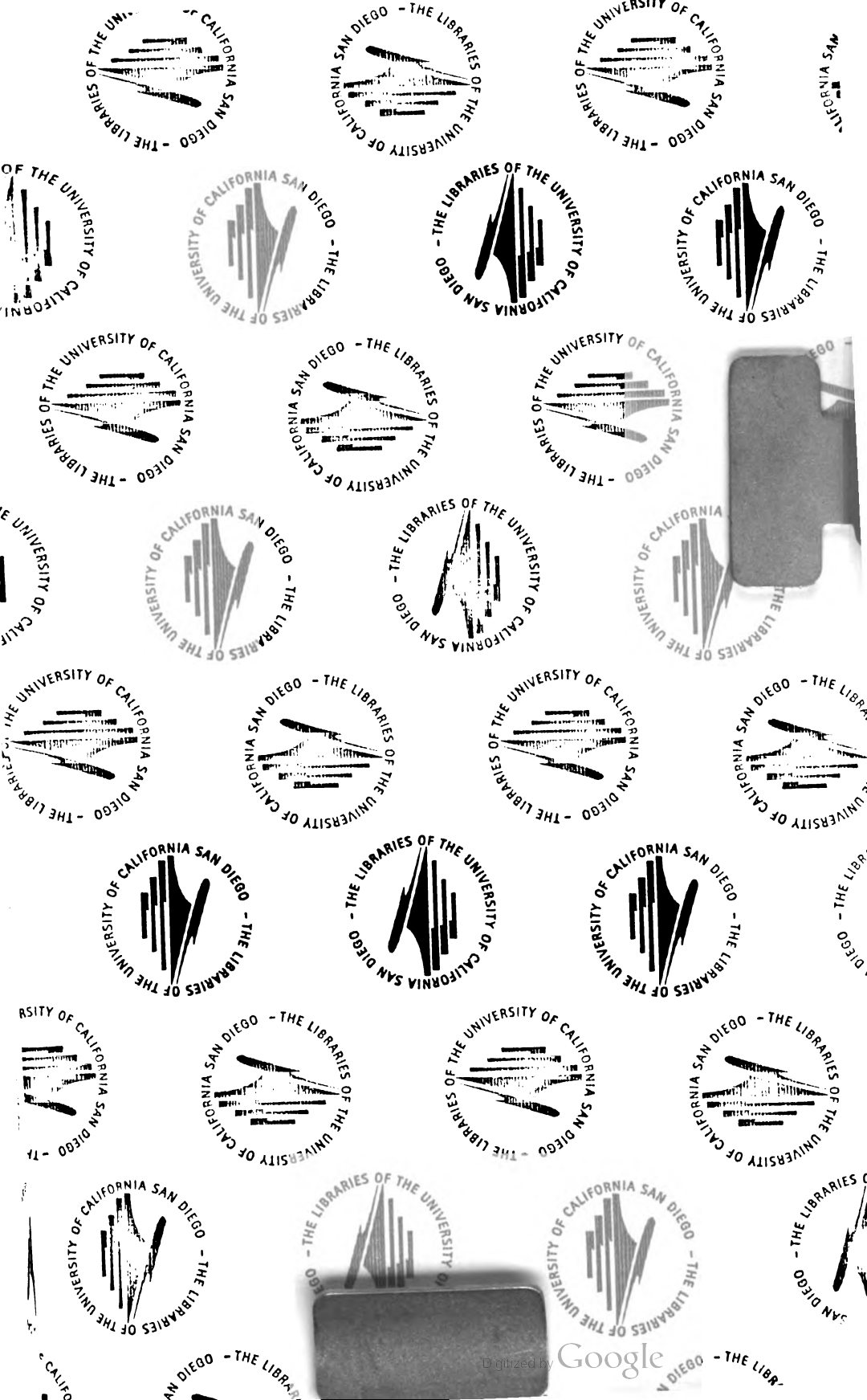
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