UNITED STATES

EXPLORING EXPEDITION

BY AUTHORITY OF CONGRESS.

UNITED STATES

EXPLORING EXPEDITION.

DURING THE YEARS

1838, 1839, 1840, 1841, 1842.

UNDER THE COMMAND OF

CHARLES WILKES, U. S. N.

VOL. XXIII.

HYDROGRAPHY.

BY

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WITH ILLUSTRATIONS.

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HYDROGRAPHY.

CHAPTER I.

INSTRUMENTS.

THE manufacture of astronomical instruments at the time the Expedition was fitted out, had not attained that perfection that it had in Europe, and that it since has in this country. Confidence in our mechanics was wanting, as well as encouragement sufficient for them to compete with those of Europe, both in constructing and keeping for sale, those that were required for its use; of necessity, therefore, the instruments which were furnished the Expedition, were mostly procured from the best makers in Europe. For this purpose it was deemed necessary by the Government to send an officer to Europe, at the time the Expedition was organizing under Commodore Jones, to obtain such instruments as could not be had on this side of the Atlantic, and as would suffice for the results in the departments of science which the Expedition was intended to investigate. I was requested to submit a list, and subsequently directed to proceed to Europe, with positive instructions to return in six months, or by the end of January, 1837; this left me but about one hundred days to effect the object in: consequently, I could not expect to have any instruments constructed, and little time left to complete any that might be found unfinished. On my arrival, I found that all the principal instrument makers were fully occupied, and very unwilling to lay aside any of their engagements, and it was only by representing the great objects of the Expedition, and their becoming interested in them, that they were induced to furnish those I was in search of. Messrs. Troughton and Simms, Dolland, Jones of

Charing Cross, the Messrs. Molyneux, Parkinson and Frodsham, the Messrs. Dents, Charles Frodsham, Lloyd, and others, of England; Gambey and Chevalier, of Paris; and the Messrs. Ertel, Meyer and Fraunhofer, of Munich, all took a most lively interest in executing the orders; indeed, this interest was equally participated in by many gentlemen, who, although they had been a long time waiting for instruments which were then constructing, came forward, and desired that their orders might be postponed or laid aside until the instruments required for the Expedition should be completed. It was under these circumstances that I was enabled to execute the duties assigned me to the satisfaction of the Government, and which enabled the Expedition to go forth sufficiently well provided for the duties that devolved upon it.

The following is a list of the instruments procured, designating those in the several departments, as well as the names of those in whose establishments they were constructed, viz.:—

ASTRONOMICAL AND SURVEYING INSTRUMENTS.

1 Three and a half feet transit, iron stand, &c., Dolland.

1 Altitude and azimuth circle (eighteen inch) two feet telescope, with microscope readings, by Dolland.

1 Repeating circle, twelve inch, by Ertel.

1 Five feet refracting telescope, six inch aperture, with micrometers, &c., by Meyer and Fraunhofer.

1 Three and a half feet refractor. Three inch ap., by Troughton.

2 Six inch repeating reflecting circles. Ertel.

1 Twelve inch repeating reflecting circle, by Gambey, with depression mirror.

1 Variation transit. Dolland.

6 Sextants. Troughton and Simms.

2 Levels, staffs, &c. Troughton and Simms.

2 Plane tables.

6 Box sextants.

6 Schmalcalder's prismatic compasses.

2 Dip sectors.

6 Mercurial horizons.

1 Glass horizon.

2 Massey's patent logs.

6 Surveying chains.
6 Barlow's compensating plates.
1 Amici collamator.

MAGNETIC INSTRUMENTS.

1 Variation apparatus, by Gambey.
1 Variation apparatus, by Dolland.
1 Gauss's diurnal variation. Troughton and Simms.
1 Diurnal variation. Gambey.
1 Diurnal variation. Dolland.
2 Dipping needles, six inches, by Robinson.
2 Dipping needles, twelve inches, by Gambey.
2 Dipping needles, six inches. Dolland.
3 Intensity needles. Gambey.
2 Intensity needles. Dolland.

METEOROLOGICAL AND PHYSICAL INSTRUMENTS.

2 Standard barometers. Troughton and Simms.
6 Mountain barometers, with extra tubes.
1 Iron cistern. Jones.
2 Sympiesometers. Adie.
6 Daniell's hygrometers.
2 Pouillet's hygrometers, à capsule.
9 Standard thermometers, by Simms, Jones, and Dolland.
16 Six's self-registering thermometers, with copper cylinders for deep sea soundings.
2 Scopeloscopes.
3 Pluviometers.
1 Brass convertible axis experimental pendulum, by Jones.
1 Iron convertible axis experimental pendulum, by Jones.
1 Eight day astronomical clock, mercurial pendulum. Molyneux.
1 Eight day clock, steel bar pendulum, for pendulum experiments. Molyneux.
1 Journeyman clock. Molyneux.
Iron frame to support the agate planes and its fixtures; also clock frames and stands. Molyneux.

Telescopes for observing coincidences, &c., &c. Jones.

Two weekly chronometers, Nos. 1567 and 1503. Charles Frodsham.

One Siderial chronometer, No. 1615. Charles Frodsham.

Twenty-five 56hrs. Chronometers, viz.:—Nos. 2075, 2085, 2203, 1839, 2204, 2066, 2093, 2095, 1964, 2105, 2052, 2083, 2096, 2037, by Parkinson and Frodsham; Nos. 2088, 3001, 1826, 2067, 2042, 2057, by Molyneux; Nos. 972, 766, by Arnold and Dent; Nos. 169, 170, by Chas. Young; No. 850, by James Murray; and four Pocket chronometers, viz.: Nos. 2124, 733, by Parkinson and Frodsham; No. 22, by Molyneux, and No. 786, by Cotterel and Co.

We were likewise provided with suitable libraries for each of the larger vessels, and duplicate instruments of those which were liable to be broken or become injured. For the repairs, there was attached to the Expedition a competent instrument maker. Besides those above enumerated, each officer was required to furnish himself with a sextant, watch, &c. It will thus be seen that we were well provided for the performance of our duties. There were some instruments I regretted not being able to procure, and among them was Fox's magnetic dipping apparatus.

Convenient portable houses and tents, for the protection and use of the instruments, were also provided, which rendered us entirely independent of external circumstance or local aid, so much so, that if we had been obliged to occupy a bare sandbank, we should have wanted for nothing; and I trust that the labors performed will exhibit abundant proof that the opportunities enjoyed were improved with the utmost industry and all the energy we possessed.

The reliance to be placed on Hydrographical labors depends upon the accuracy of the modes employed in obtaining the results. It therefore seems necessary to give a statement of these, and to explain the combinations by which the positions that have been astronomically determined are brought to prove and bear upon each other, thereby affording strong evidence of the credit the combined results are entitled to, and the confidence that ought to be placed in the surveys and charts resulting from our labors.

SURVEYS.

The surveys made by the Expedition were numerous, amounting to 234, during the four years of our absence from the United States. It will readily be seen, that in order to accomplish this amount of work, that some expeditious method of surveying the numerous coral islands had to be adopted; indeed, it may almost seem incredible, situated so far asunder as the surveys were, for even a much larger force than was placed at my disposal to execute them; but as the mode of conducting them will be shown, I trust that all will be satisfied that it was quite possible not only to execute the work, but to do it with accuracy.

In surveying operations it is all-important that an easy and perspicuous method should be adopted, as well in taking the observations as in recording them, particularly where it would be impossible to regain an opportunity that might, from inattention or neglect, be suffered to escape; and any one who may have the direction of such duties, should be careful that the rough charts be at once drawn from the note-books, and that these latter should be kept in so clear a manner, and in a formula so well understood, as not to require explanations. In order to effect this object, I deemed it necessary that all the officers should have a thorough knowledge of the operations by which I intended to carry on the surveying duties, and for this purpose I prepared a short syllabus, to render them familiar with the operations, and to avoid the defects existing in all treatises on surveying that I have hitherto seen, which appear to me to omit the first and most essential explanation of the principles. Many things appear to be taken for granted which the learner does not know, nor where to look for information, and he is consequently apt to neglect their importance. In other words, he must acquire much practical experience before he can understand the performance of duties which they pretend to teach. This omission is a serious one, and prevents the works on surveying from being as useful as they ought to the learner.

I gave (in Appendix xli, vol. i) the manner of executing our surveys, by the squadron, under sail: it had not been practised before, although the method of measuring bases by sound has been extensively used. As it more properly belongs to this place, I shall tran-

scribe it here, so as to bring the method into notice, as well as to explain it more fully.

METHOD OF SURVEYING THE CORAL ISLANDS.

The basis of the method rested on the measure of distances by sound. For this we had ready means, by firing guns alternately from the different vessels, any three of which being stationary, the distances and positions of objects could be determined from them by direct angles, giving a double result, or by the angles between them, taken from the shore, or from boats, furnishing data for the problem of "the three points." When both methods can be applied at the same time, it is evident that the utmost accuracy may be obtained. Upon the land, by employing many observers, and occupying all the points of a trigonometric survey simultaneously, the whole work might evidently be completed in a very short space of time; and in like manner upon the water, creating by means of vessels and boats a number of artificial stations around an island, measuring angles simultaneously at them all, and base lines by sound, the rapidity with which a survey can be performed is equally as great.

By means of the system of signals prepared by me for the Exploring Expedition, I could direct the vessels to assume any position I might select as most fit for our purpose. When these were reached, general but minute instructions directed the observations that were to be taken at each, in doing which there was no difficulty. These observations were entered upon a deck-board, for which the following form was prescribed:

FORM OF DECK-BOARD.

DATE.	POSITION.	TIME.	AZIMUTH OF ⊙	LEFT-HAND OBJECT.	CENTRE OBJECT.	RIGHT-HAND OBJECT.	REMARKS.

On approaching the island to be surveyed, signal was made to prepare for surveying duty; if boats were to be used, the number of them and the vessels whence they were to be despatched was next indicated;

and finally, the position each vessel was to occupy was shown. The vessels having reached their assigned places hove-to, and the boats having been previously despatched, would about the same time have anchored in their assigned stations, at the points of reefs, and hoisted their appropriate signals. The vessel that is first to fire a gun then hoists an ensign at the foremast-head, which is answered by all, and the flag is in like manner displayed previous to each successive fire. The firing then goes on in quick succession from all the vessels; and at the time, all the officers being on deck for the purpose, angles are measured between the other vessels and objects on the shore, each by a different observer, as directed and indicated by the senior officer present; these angles, together with those made by the visual tangents to the shore, have always been found sufficient to plot from. During this operation the ensign is kept hoisted at the peak, so that all the angles may be taken simultaneously; and at the same time, the altitude and azimuth of the masts of the ships is observed from the boats, for the purpose of determining their position more accurately. Altitudes of the sun for time, and angles whence to calculate the azimuth of some one of the objects, are also taken immediately before or after the horizontal angles.

When the duties at the first station have been finished the vessels and boats change positions alternately, and at each change the same operations are repeated.

To illustrate still further the mode in which the whole squadron was made to concur in obtaining unity of action, a detail of a survey and a plot of the work are given on Plate 1, Fig. 1.

By these alternate changes in the stations of the several vessels and boats, continued until a circuit of the island has been made, the work is finished, and when it joins, it is proved by the last distance determined by azimuthal angles and base by sound, as for a base of verification. The deck-boards are then sent on board the flag-ship, where the work is calculated and plotted.

The survey of the island thus represented, which is about seven miles in length, was performed in three hours and thirty-five minutes. It began, as noted on the deck-boards, at 1·18 P. M., and the observations closed at 4·53 P. M.

The facility with which the operations are made can scarcely be conceived until they are witnessed, and I may add the accuracy, not less so when the proper steps are taken to carry all parts into operation.

The measurement of the bases being all taken within a short time of each other, and the observations made by many officers at all the angles of the triangles, it leaves little correction even for personal error or inaccuracy in measuring the distance by sound, and as the angles are simultaneously measured, there can be but little variation from the truth. The objects are generally so well defined as to make their selection an easy task to even the most uninitiated.

It may be thought that the movements of the vessels would be too great; but this is not of any great amount, indeed is very small during the actual time engaged. There can be no doubt of the first positions being occupied, when the original angles are "kept on;" besides, the proof of the whole work by the bases of verification, fully assures one of its accuracy as well as efficiency. Indeed, I do not know what is more to be desired or obtained, except it be the rise and fall of the tides, which the short time occupied does not admit. Having fully tested and satisfied myself of the accuracy of the method, and the celerity of execution, even by ships of any squadron, not expressly fitted for surveying operations, I cannot too strongly recommend its adoption whenever an opportunity offers, believing there are few things that would add more to our knowledge of the changes going on in the islands and shores, than the results would bring to light.

Although we had recourse to sound, in many cases, to obtain our bases on land, or rather the sides of the triangles, yet these were frequently proven by a measured base for verification, or one obtained by the subtension of a staff at a distance, where the ground did not admit of its being actually measured.

The methods which were employed in the more extended surveys of the groups of islands, as well as those of the rivers, that fell to our duties, require also some explanation, and for this purpose, and to illustrate the methods more clearly, a diagram of each triangulation is given on Plates 1 and 11.

The Feejee Group of Islands embraces an extent of sixty thousand square miles, in which are situated one hundred and eighty islands, reefs, and shoals, some having areas of six hundred miles, and coasts of three hundred miles, with well-sheltered and commodious harbors, formed by reefs which encircle them, besides a large number of anchorages and passages through the reefs. This group was, so far as any knowledge of its hydrography and topography, entirely unknown, and but few of its fine harbors had ever been visited. Its inhabi-

tants were numerous, and addicted to cannibalism, and of a warlike and inhospitable disposition. It was under these circumstances that our duties were to be performed; yet, discouraging as they were, I aimed at accomplishing all we could in the shortest possible time, and feel gratified that we succeeded in making a full and complete examination of the whole Group. It must be evident that little time was lost; and I trust I may be permitted to express here the admiration I felt for the ardor and zeal manifested by those under my command in this duty, and for the accuracy with which the greater part of the minute details were performed, when surrounded, as they oftentimes were, by numbers of savages, who were constantly upon the watch to surprise or overpower the parties.

On our approach, the Porpoise was left at the Eastern Islands, to carry the examination to the north; this duty, I supposed, would occupy her for a limited time, or until I was able to visit the Northern Islands, where I intended to meet her, and give further instructions. With the Vincennes, Peacock, and Tender, I sought the Harbor of Levuka, in the Island of Ovolau, as the most central position, to establish the observatory, and to begin the general survey. On my arrival, I found it admirably adapted to the object, and no time was lost in directing the operations. Had it been possible to visit the interior of the large or even smaller high islands, without jeopardy to the lives intrusted to my care, the task would have been an easy one, and attended with much less anxiety, as well as labor, to both the officers and men; but in the work to be performed it was necessary to keep near the shores, and remain under the protection of the boats, as much as possible, to avoid surprise and prevent accident; consequently, we all suffered from confinement in such limited accommodations as the boats afforded, and incurred unavoidably greater fatigue in our duties.

The plan adopted was, to determine the position of Ovolau (the centre of the Group), by a careful set of astronomical observations, and from it to obtain meridian distances to all points, as well as their latitude by observations, including the measurement of the angles in the triangles, with the azimuthal bearings of the sides: this gave a series of large triangles, connecting all the prominent peaks, points, &c., of the islands with each other, and constituted the primary work. The lesser triangulations embraced the minor surveys and hydrographic operations, and were often connected with the larger triangles

by an independent set of observations, including meridian distances, latitudes, bases by sound, and distances from heights, the whole proved and rectified by final observations, made when passing around the Group, and after the charts had been constructed; by this means I felt confident that few errors had escaped us, and that the work was complete.

The explanation of the manner of conducting the surveys of the rivers will also admit of a few remarks.

In the survey of a river, it is very important that the officers acting in boats should understand the part they are required to perform. The survey of a river by a regular and slow triangulation is a very simple affair. The skeleton charts are prepared from the triangulations, and the hydrographical part is filled in by a small force: this requires much time, and that, it is well known, was not at my disposal; therefore it became necessary that the duties should be conducted quickly, and, while the work was in progress, that it should be immediately plotted and compared, as each day's work was finished. A mistake or error was a loss not only of our time, but necessarily of much labor to rectify it: to avoid this, as far as possible, the operations were conducted so as to triplicate the results or observations; which operated as checks and proofs on all the work. In the survey of the Columbia we had eight boats, manned by the officers and men of the Peacock, after her wreck, and the Porpoise; six of the boats were divided into two divisions, one to take the starboard side of the river, and the other the port side, or what I termed the *alphabetical* and *numerical* sides, as distinguished by the signals so marked. The leading boats placed the signals and observed the back angles; the centre boats followed, and observed the forward and backward angles, and the rear boats observed the forward angles, and all fired guns for bases. The boats of either division never changed sides, consequently all the stations the one division occupied were numerical, while those of the other were alphabetical; thus, moving on almost simultaneously, being well aware of the character of the signals, and fully understanding their positions, no impediment was suffered to interfere with the progress of the work. The remaining two boats observed the astronomical bearings from one distant station to another, sketched in the shores, and, as frequently happened, engaged in the triangulation; and when about to pass a bend in the river, they occupied the necessary additional stations. Further facilities were afforded by the brigs

Porpoise and Oregon, being in company: they were brought into the triangulation, and were employed in carrying on an independent set of observations, through azimuthal bearings and distances by sound, when at their several anchorages, which went to prove the other operations. A series of stations were also occupied on the land, where the latitudes and meridian distances were determined by observation. The close agreement of all the results proved that the survey was entitled to great confidence.

The "sounding out" formed a distinct part of the work, and was made on the return down the river. Each officer engaged thereon was furnished with a diagram of the section of the river he was ordered to sound out, taken from the original plotted chart, and on it the lines to be "sounded out" were drawn to the signal-points, as well as to intermediate points between the signals: these latter were fixed by the three-point problem, or by measured distances from signal-points.

During the absence of the river party, the sounding out of the Bar at the mouth of the Columbia was effected, and the soundings placed upon the projection, which had been previously made and furnished the officer in charge of the Flying-Fish and two boats. After this manner the whole extent of the Columbia, from the sea to the highest point of navigation, together with its branches, was surveyed. The survey began on the 12th of August, and was finished on the 10th of October.

For the purpose of showing the triangulation, both primary and secondary, I have selected a part of the Columbia River, a diagram of which will be found on Plate 1, Fig. 2. As the character of the lines on it is given, it is not deemed necessary to offer any further remarks in explanation.

After this view of the surveying operations, I think it will be admitted that our duty was energetically performed, and that a greater amount of work could not have been executed in a shorter time, even under the most favorable circumstances.

The surveying and hydrographical duties, although so extensive, have been fully proved by navigators who have followed us. It would, however, be surprising if there were no errors: yet I am satisfied there are but few; and from the reports of those who have had an opportunity of using the charts, I am confident that nothing essential to navigation and the interests of commerce has been neglected or overlooked in them.

A few remarks are also necessary respecting the search made by the Expedition for the numerous reported shoals or vigias, embraced in my instructions and published in Congressional documents. The many positions assigned these shoals, from their situations being often determined by meridian distances from places whose longitudes are not well established, renders the search for them by one vessel extremely uncertain; indeed, the ineffectual search and various positions assigned these doubtful islands and shoals have increased the confusion, —the only result that can reasonably be expected from the imperfect manner in which the examinations have been made. It would save much time and trouble, and much of the difficulty would be avoided, if, when an island or shoal is discovered, the navigator would state the longitude of the place where the error of the chronometers had been ascertained, and the meridian distance from it. Any one at all acquainted with navigation is aware how doubtful the position of a vessel becomes, even after the lapse of a few hours from the last observations, however vigilant the officers may be. It is this which renders the search by a vessel of so little value; in fact, very few are warranted in the assertion, that the part of the ocean in question has actually been examined, and is free from danger. At a short distance from the vessel, the very danger sought for, may exist, and still remain unseen. But this can hardly occur in a search made by a squadron, which insures the utmost certainty, and can be performed in much less time. Aware of the discrepancies existing in the determination of the positions, creating a doubt as to their actual place, and that parts of the ocean have been examined where no dangers whatever existed, a mode of search was adopted to effectually guard against these mistakes, or to cover and stretch over a sufficient space to make full allowance for them. The longitude was considered as most doubtful, and liable to the greatest errors. Errors in latitude are of less amount; indeed, there are but few observers who are not able to determine the position with respect to latitude correctly. The errors which exist are for the most part occasioned by the position being deduced from the dead reckoning; but even this is seldom very remote from the truth in latitude. Taking these things into consideration, a course was pursued that has put to rest the question of the existence or non-existence of these islands, shoals, &c. On arriving at the parallel of the island, reef, or shoal, such a position was sought as would enable us to begin the search, either to the eastward or westward, as the prevailing winds

favored, and to examine as large an area as could be passed over by the squadron, which generally embraced half a degree of latitude, and from one to two degrees of longitude. The examinations were always made by daylight, and frequently during the most favorable weather, and all the precautions taken that nothing should escape us, by having many "look-outs" and the lead going. In this way we have been able to erase from the charts many islands and reefs, which have been a constant source of alarm to those passing near their assigned positions, not unfrequently causing great detention, from fear of coming in contact with them during the night; but in many cases, disasters have been brought about, by drift and current (not previously known) carrying vessels beyond their ports, and oftentimes into real dangers.

No search should be considered effective, unless a sufficient area is passed over, in which, taking all the probabilities of error, the reported shoal or danger is said to exist. It is due to the navigating interests of our country, that these searches should be continued, until the existence or non-existence of these dangers is clearly ascertained.

SOUND.

Sound has been referred to as the medium through which was obtained, oftentimes, bases for the surveys. In order to test the accuracy of this mode of measurement, I determined to make the experiment on an extended scale, by measuring the distance from Cape Frio to Rio de Janeiro; the ascertainment of the position of the former having been made a part of my instructions. This was a distance of about 76 miles. The diagram of this measurement, and its accuracy, as compared with the meridian distance taken by chronometers from the observatory, will be found in Appendix XXIII, Vol. I, although it more properly belongs to this treatise on Hydrography. The two methods, though very dissimilar, approximate closely in results; proving the accuracy of the method by sound, and the reliance that can be placed upon its employment for extended bases. Notwithstanding this apparent confirmation, I was not satisfied that the velocity of sound had been truly ascertained by experiment. The difference between that deduced by theory and experiment, respectively, equal to one-sixth, was, in my opinion, too great; and in looking for the reason of the discrepancy, I concluded it might arise from the

measurement of the time not being sufficiently minute, and this together with the personal error in observation would, most probably, be found the cause, rather than that assigned for it, viz., the evolvement of latent heat by its wave-like motion. On this account I became desirous of repeating the experiments under the most favorable circumstances. An opportunity was afforded by the erection of the Fire Alarm Apparatus recently in Boston, which gave me the opportunity of recording the time on a cylinder, making the second of time equal to about five inches in length, and therefore giving the time with a degree of accuracy that had never been heretofore obtained. The close agreement of the many distinguished experimenters on sound, had led me to believe that I should but verify the conclusions arrived at, yet I hoped so to vary the experiments as to enable full reliance to be placed in the results: these I have embodied in Appendix I, where I have placed them by the approbation of the Joint Committee of the Library of Congress,—in whose name I applied to the Mayor of Boston, the Hon. Benjamin Seaver, for permission to use the apparatus, which was readily and obligingly placed at my disposal.

The State House at Boston was occupied as the central position, and at other distant stations guns were placed; while the steeples in which the bells were situated were connected by triangles with the State House, all radiating from it in various directions. The distances were kindly furnished me by Mr. Boutelle, an able assistant on the Coast Survey, from the surveys in progress. After we had arranged this part, it became important that the record of the firing should be made, if possible, by the concussion, or by the same impulse which was given to the air by the discharge of the cannon, so that no personal error might affect the observation, except in the record of hearing the sound. In the case of the bells in the steeples, the magnetic circuit was broken by the hammer the moment it struck the bell; the personal error then was only to be looked for in the last record to be made, the differences between the two marks on the time-cylinder of course giving the time in seconds and parts of seconds, in lineal measurement, the sound had occupied in passing over the distance. The experiments were numerous,—in the greater distances by the report of cannons, and the lesser ones by the bells of the several churches connected with the Fire Alarm Apparatus, both marked by striking the magnetic key. The lines on which the sounds passed radiated in

all directions, and thus afforded the means of obtaining satisfactory results, in a measure independent of atmospheric influences. The state of the atmosphere, as to pressure, temperature, moisture, and wind, was carefully noted, and duly recorded during the continuance of the experiments.

Mr. W. C. Bond, and his son, Mr. George Bond, the distinguished astronomers of Harvard University, kindly offered their aid, and recorded the observations upon the time-cylinder connected with the observatory clock at Cambridge. To these gentlemen, and to Mr. Moses G. Farmer, Telegraphic Engineer, and his assistants, I feel greatly indebted for the aid they rendered me in operating with the Telegraphs. I would also make mention of the obliging manner in which the different Telegraph Companies placed their wires and apparatus at my disposal.

LATITUDES.

The latitudes of all the principal stations have been obtained by circummeridian observations of the sun and stars, with the repeating circle; at the minor stations generally by equal altitudes with the sextant and artificial horizon. The headlands, capes, &c., which have not been observed at, are deduced by triangulation from two or more stations where observations were made: these different determinations are distinguished by appropriate marks in the tables.

LONGITUDES.

The longitudes of the principal stations have been determined by a series of observations of moon-culminating stars, east and west of the moon. In order to carry out these views, application was made to the Hon. Secretary of the Navy, to appoint Wm. Cranch Bond, Esq.,* at Dorchester, near Boston, to make a regular series of observations on the moon-culminating stars, at his private observatory, during the absence of the Expedition. Directions were also given to Lieut. James M. Gillis, of the Navy, who succeeded me at the Naval Depot, to observe a similar series at Washington. From these arrangements, the Expedition derived most important aid in the determinations of the absolute longitudes where the observatories were established. Very

* Since the Astronomer of Harvard University.

many corresponding observations were obtained of moon-culminating stars with each of these places. The duties of these gentlemen continued through the period of four years, or during the absence of the Expedition, and from their untiring assiduity, perseverance, and attention, many comparative results were also obtained in magnetism and meteorology.

At some points they have been more numerous than at others, in consequence of the weather being more favorable. These points have been connected by meridian distances measured by chronometers, and a net of triangles, if I may so express it, has thus been spread over both the North and South Pacific, which include positions whose longitudes have been ascertained by others as well as by ourselves. In many cases the meridian distances have been measured several times. In this way I have not only been able to satisfy myself of the performance of our chronometers, but of the accuracy of the positions assigned these points, which in turn aided to prove those of the islands, reefs, and shoals, which were encountered on the route from one point to another. The correctness of the determinations of the meridian distances we have had frequent opportunities of proving, by different chronometers and observations, entirely independent of each other, increasing the dependence that may be placed on them.

Although we were well provided with instruments, but few opportunities offered for the observation of occultations, or the eclipses of Jupiter's satellites. A single eclipse of the sun was observed, and only the end, owing to the first contact being lost by obscuration. This gave the position of Peacock or Ahii Island (south side), within a few minutes of the chronometric measurement. As respects chronometric distances, I have preferred to place greater reliance upon the determinations of short intervals, confining each to its own limit, and not to allow, by an extension of the series, the accumulation of error by any change that the comparison of chronometers may have shown in longer periods. I have invariably preferred adopting the determinations by a chronometer whose rate had proved most uniform during our passage from port to port, instead of taking the mean of the whole. The reductions of meridian distances have been computed for all intermediate points, by the supposition of a gradual increase or decrease of rate; and for any intermediate point, where a rate was obtained, the correction has been applied by the usual formula, according to the time that had elapsed when the observations were made. The weekly rates of

the chronometers during the entire cruise are given in the table, which will show their performance and what confidence is to be placed in them.

MAGNETIC OBSERVATIONS.

At an early period of the cruise, Barlow's plates were adapted to the azimuth compasses, and the position kept throughout. These azimuth compasses were after Kater's construction, with prismatic eye-pieces. The greatest amount of local attraction in high latitudes, observed on board the Vincennes, was but 5°; in lower latitudes it was not perceptible. The situation of the compass was about half way between the mizzen-mast and taffrail amidship, and the stand was of sufficient height to enable an observation to be taken at all times without difficulty. The variation was observed at sea, when the chronometric sights were taken, both morning and evening. The result of the mean of ten observations is given. At the observatories, during the time they were established, once every day, with the variation transit. The results are embodied in tables under the proper heading. The dip and intensity were observed frequently throughout the cruise, at sea, but at times it was found impossible to obviate the motion so as to get any results that I deemed worthy of record, even by means of swinging-tables and other contrivances which were resorted to with the intensity needles. The Expedition was not furnished with the apparatus of Fox. The dipping-needles were used with more success at sea, and by noting the vibrations of the needle, and taking the mean, the result could be depended upon. I resorted to the plan of always putting the ship's head north or south during the time of making the observation: this brought the line of local attraction in the plane of the magnetic meridian, and obviated the necessity of any reductions for the effect on the needle caused by the local attractions on the various rhumbs of the compass,—an element constantly undergoing changes with the latitude, and also affected by any alterations of the iron in the vessel.

Although I experimented by changing the poles of the needles, I cannot but believe that it increases the liability to errors more than it obviates them. The manner of changing the poles should always be uniform, and, if possible, by the same person. Great care is necessary to avoid scratching the needles; and in order to prevent this,

they should be covered with paper. They are liable to be much injured by sand if this is neglected; and when scratched are soon liable to become corroded, permanent injury being the consequence. The magnets used to change the poles, if this course is adopted, should be sufficiently powerful to effect it with a small number of manipulations. It appears to me that the result of experiments with magnetic needles would be more satisfactory if this were omitted. Careful observations made on returning to the same points, would give the state of the needle, and although all the results would be rendered comparative, yet, with the changes known, they could be calculated, and must be of less amount and uncertainty than the usual mode of procuring the direct determination by changing the poles, in order to obviate the errors likely to arise from a defective axis.

TIDES.

Observations on the tides in connection with the surveys were made. Our attention was also directed to the flow of the tidal wave throughout the great Pacific, for the purpose of examining into the anomalies that it is said to exhibit. On arrival in port a station was established as soon as practicable, a position being chosen where the free action of the tide could be felt, and the tide-staffs erected, consisting of two stout poles, 3 inches square, with ratchets to receive the springs of a float 8 inches square, which caused the tide to register itself. One of these floats indicated the rise, the other the fall, —the feet, inches, and fractional parts being legibly marked on the staffs. It was noted hourly both night and day, and recorded. Floats were anchored in the stream, which gave the direction, and there the velocity of the tide was ascertained. These have been embodied in the charts and the general hydrographical information. On several islands, 60 to 80 miles apart, simultaneous observations were made, in order to mark more particularly the flow of the tidal wave. The tidal observations have been projected in the usual form in curves of ordinates, as well as the results given in tabular form, which will enable them to be readily understood and the anomalies to be perceived. I have to regret that, in some of the most interesting localities, particularly in the South Pacific,—where so great an interest has been manifested, for some years, relative to the appa-

rent anomaly from the Newtonian theory,—our time for observation was often too limited for full series; but this was unavoidable, as the duties required of the Expidition did not admit of longer delays. Notwithstanding, I hope our observations will tend to throw some satisfactory light upon the subject. They are given in the chapter on Tidal Observations.

HEIGHTS.

Heights, as connected with the surveying duties, were obtained by triangulation as well as by actual levelling, observations with the barometer, sympiesometer, and the thermometer, as marking the boiling-point. They are given in a column with the tables of latitudes and longitudes.

CURRENTS.

The velocity of the current experienced by the vessels, I have inserted in a column of the table of Magnetic Variations. The difference between the *true* place and that by Dead Reckoning may be the effect of current on the ship, or the result of local attraction, oftentimes entirely unsuspected. Though included in the variation, but without knowledge of its amount, half a point or even a few degrees of local attraction would be imputed to the effect of current. It is true, there is no great danger likely to arise from this omission, or want of knowledge, on a continuous route, when observations are made from day to day, as it is generally allowed for in giving the course to be steered, yet many serious accidents have happened to vessels from ignorance of this subject. This is the reason I consider currents so intimately connected with the magnetic variation to be allowed by all navigators, and why I have joined the tables. I am satisfied, that one of the causes why our American merchant fleet are generally so successfully navigated, is owing to the absence of local attraction in our ships.

CHAPTER II.

RATES OF CHRONOMETERS.

In giving the rates of the Chronometers of the Expedition in the table hereto annexed, I have adopted the true rates, as derived from the observations from time to time during the cruise. These have been established through a daily comparison with one chosen as a standard, and on which the astronomical time was immediately brought from the observatory. Although this chronometer, No. 1567, was selected for this purpose principally for its loud and distinct beat, as well as its being a weekly one, and therefore not liable to the daily winding which those of 56 hours require, yet throughout the voyage it proved itself admirably adapted, not only for the uses it had been selected for, but, as will be seen, maintained a very uniform rate. It was wound every third day, as I felt satisfied its motive power would exert a more uniform motion if confined within the limits of its greatest activity. The chronometers were compared daily on board all the vessels, and every *third* day, when the squadron was in company, through their standards, with that of the Vincennes, which was entered in the recording books for reference and future use. These were all reduced weekly to mean Greenwich time, from their established rate and errors, and the result of their performances tabulated, thus exhibiting at a glance any deviations which might have taken place. The standard has itself been farther corrected by the variation it underwent in each week, after it had become known, on the supposition that its rate had been uniformly increasing or decreasing between any two observations or establishments of rate. The *true* rate thus established has been compared with that of the others, as shown at the weekly comparison, from which has resulted their *true* rates given in the table, bringing them all to the same test as the

standard; the rates, which are given for each chronometer to the closest figure deemed necessary, being arranged in vertical columns, all discrepancies are easily seen, and show the reliance that is to be placed on their performance, and in our determination of longitudes through them.

By referring to the numbers in Chapter I, it will be seen by whom the instruments were made, and which have performed the best.

After such proofs, it might seem invidious were I to designate any particular instruments; yet I cannot deny, that greater confidence was felt in some, when navigating through the devious routes followed during the course of the Expedition, than in others. I must give the assurance, however, that all the chronometers were uniformly attended to with great care.

In the tables, I am aware that many discrepancies appear that cannot well be imputed to the instruments themselves; these may possibly have arisen with ourselves, but it is now beyond my power to determine: such the record books give, and they must stand. All those who are conversant with the use of chronometers well know the liability of error of a few seconds in the comparisons, and will make allowance therefore in places in which it is apparent that such may have been the case.

As the Table of Rates fully explains itself, I deem it unnecessary to offer any further explanatory remarks. It shows the changes and transfers of the chronometers, and their periods of absence from the ships; when they were returned, the comparisons and rates were again taken up, as before.

The capital letter of the name of the vessel on board of which the chronometer was, is placed over the head of the column, and when transferred to other vessels, is then noted in the column of remarks.

It is necessary to remark here, in reference to the Peacock's instruments, that the daily record of comparisons, for a part of her cruise, was lost at the time of her wreck; but I have endeavored to supply this, by the weekly and monthly returns which Captain Hudson made of their performance during the period.

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 1567	V. 972	V. 2037	V. 2088	V. 766	V. 169	V. 3001	V. 2203	
1838.									
Aug. 10, .	+ 1·4	— 1·06	+ 4·24	+ 2·20	+ 0·22	+ 1·65	— 0·95	— 3·46	Rate by observations at Norfolk.
" 24, .	+ 1·39	— 0·09	+ 5·20	+ 5·72	+ 1·66	+ 2·13	+ 0·34	— 2·01	
" 31, .	+ 1·39	— 0·24	+ 4·61	+ 8·61	+ 1·83	+ 1·23	— 0·78	— 2·31	
Sept. 7, .	+ 1·38	+ 0·26	+ 5·19	+ 4·64	+ 2·11	+ 1·47	— 0·31	— 2·17	
" 14, .	+ 1·38	+ 0·71	+ 4·97	+ 0·61	+ 2·40	+ 1·19	— 0·31	— 2·31	
" 21, .	+ 1·37	+ 0·96	+ 5·18	+ 0·61	+ 2·61	On shore.	— 0·67	— 2·38	At Funchal.
" 28, .	+ 1·36	+ 0·61	+ 5·26	+ 0·47	+ 2·40	+ 1·82	— 0·81	— 2·67	
Oct. 5, .	+ 1·35	+ 0·54	+ 5·33	+ 0·68	+ 2·17	+ 1·04	— 0·60	— 2·46	
" 12, .	+ 1·35	+ 0·28	+ 5·68	+ 0·26	+ 2·13	+ 1·33	+ 0·04	— 2·78	
" 16, .	+ 1·34	+ 0·30	+ 5·15	+ 2·16	+ 2·14	+ 1·65	— 0·40	— 2·18	At Rio Janeiro.
" 26, .	+ 1·36	+ 0·23	+ 6·41	+ 0·77	+ 2·03	+ 0·71	— 0·08	— 3·31	
Nov. 2, .	+ 1·40	+ 0·94	+ 6·69	+ 1·01	+ 2·84	+ 1·41	+ 0·48	— 1·92	
" 9, .	+ 1·46	+ 1·19	+ 6·69	+ 1·12	+ 3·01	+ 0·84	+ 0·34	— 1·76	
" 16, .	+ 1·54	+ 1·41	+ 6·84	+ 1·15	+ 2·98	+ 0·69	+ 0·58	— 2·01	
" 23, .	+ 1·65	+ 1·45	+ 6·91	+ 1·45	+ 2·79	+ 1·55	+ 0·34	— 2·23	
" 30, .	+ 1·77	+ 1·54	+ 7·19	+ 1·02	+ 2·82	+ 1·38	+ 0·31	— 3·30	
Dec. 7, .	+ 1·91	+ 1·63	+ 7·30	+ 1·23	+ 2·74	+ 1·47	+ 0·37	— 3·00	
" 14, .	+ 2·07	+ 1·48	+ 7·34	+ 0·98	+ 2·37	On shore.	+ 0·24	— 3·42	
" 21, .	+ 2·26	+ 1·24	+ 6·81	+ 0·95	+ 2·17	. .	+ 0·71	— 3·44	
" 28, .	+ 2·46	+ 1·24	+ 7·45	+ 1·05	+ 2·12	+ 2·23	+ 1·08	— 3·14	
1839.									
Jan. 4, .	+ 2·69	+ 1·96	+ 7·79	+ 1·91	+ 3·00	+ 2·31	+ 1·82	— 2·17	
" 11, .	+ 2·93	+ 2·78	+ 9·11	+ 2·64	+ 3·83	+ 2·47	+ 2·85	— 1·83	On leaving Rio Janeiro.
" 18, .	+ 2·93	+ 2·83	+ 8·39	+ 2·47	+ 4·04	+ 2·17	+ 2·253	— 1·73	
" 25, .	+ 2·94	+ 2·96	+ 8·26	+ 2·79	+ 4·53	+ 2·40	+ 2·23	— 1·57	
Feb. 1, .	+ 2·94	+ 2·94	+ 8·57	+ 2·90	+ 4·46	+ 2·47	+ 2·84	— 1·61	
" 8, .	+ 2·95	+ 2·86	+ 8·76	+ 2·89	+ 4·97	+ 1·93	+ 2·00	— 1·67	
" 15, .	+ 2·96	+ 2·92	+ 8·89	+ 3·04	+ 5·54	+ 1·63	+ 1·69	— 1·83	
" 22, .	+ 2·97	+ 3·17	+ 11·22	+ 2·67	+ 5·53	+ 1·93	+ 2·29	— 1·99	
Mar. 1, .	+ 2·99	+ 3·67	+ 12·50	+ 3·22	+ 6·00	+ 1·97	+ 1·87	— 1·95	
" 8, .	+ 3·00	+ 3·62	+ 10·62	+ 2·79	+ 6·57	+ 2·00	+ 3·54	— 1·85	
" 10, .	+ 3·02	+ 3·65	+ 10·74	+ 2·99	+ 7·25	+ 2·12	+ 2·94	— 1·60	
" 22, .	+ 3·02	+ 3·77	+ 10·18	+ 2·96	+ 6·25	. .	+ 2·64	— 1·91	
" 29, .	+ 3·03	+ 3·66	+ 13·23	+ 2·88	+ 7·73	. .	+ 2·95	— 1·41	
April 5, .	+ 3·04	+ 3·59	+ 10·59	+ 2·95	+ 6·88	. .	+ 3·02	— 1·69	
" 12, .	+ 3·06	+ 3·59	+ 10·45	+ 3·09	+ 6·59	. .	+ 3·30	— 1·91	
" 20, .	+ 3·08	+ 3·67	+ 9·77	+ 3·12	+ 6·94	+ 2·06	+ 3·17	— 1·63	
" 27, .	+ 3·00	+ 3·38	+ 10·88	+ 2·62	+ 9·26	+ 1·88	+ 2·66	— 1·12	
May 4, .	+ 3·13	+ 3·38	+ 10·77	+ 2·83	+ 9·63	+ 1·85	+ 2·88	— 1·21	
" 11, .	+ 3·16	+ 3·28	+ 9·05	+ 3·28	+ 9·01	+ 2·12	+ 3·31	— 1·36	
" 18, .	+ 3·19	+ 3·09	+ 9·36	+ 3·12	+ 9·27	+ 1·92	+ 3·13	— 1·83	

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 1567	V. 972	V. 2037	V. 2088	V. 766	V. 169	V. 3001	V. 2203	
1839.									
May 26, .	+ 3·23	+ 3·16	+ 10·81	+ 3·42	+ 8·59	+ 1·89	+ 3·88	— 1·69	
June 1, .	+ 3·27	+ 3·02	+ 10·88	+ 2·95	+ 8·09	+ 1·95	+ 3·66	— 1·83	
" 9, .	+ 3·32	+ 4·00	+ 11·00	+ 3·62	+ 8·00	+ 2·00	+ 3·4	— 1·60	At Callao.
" 16, .	+ 3·32	+ 3·39	+ 11·51	+ 3·44	+ 7·89	+ 1·74	+ 3·95	— 1·49	
" 23, .	+ 3·32	+ 3·20	+ 10·89	+ 3·23	+ 7·66	+ 4·16	+ 3·82	— 2·01	
" 30, .	+ 3·32	+ 3·03	+ 11·66	+ 2·93	+ 6·96	+ 2·39	+ 3·48	— 2·32	
July 7, .	+ 3·33	+ 3·25	+ 11·72	+ 2·82	+ 7·22	+ 2·65	+ 3·63	— 2·28	
" 13, .	+ 3·33	+ 3·12	+ 10·85	+ 2·94	+ 7·03	+ 2·74	+ 3·85	— 1·79	
" 20, .	+ 3·34	+ 2·85	+ 6·32	+ 2·68	+ 6·85	+ 2·53	+ 3·69	— 2·28	
" 27, .	+ 3·34	+ 2·82	+ 10·89	+ 2·68	+ 6·18	+ 2·85	+ 3·59	— 2·16	
Aug. 3, .	+ 3·35	+ 2·75	+ 9·96	+ 2·51	+ 5·39	+ 2·93	+ 3·48	— 2·25	
" 10, .	+ 3·36	+ 2·46	+ 10·10	+ 2·25	+ 5·36	+ 2·93	+ 3·28	— 2·39	
" 17, .	+ 3·37	+ 2·51	+ 10·76	+ 2·71	+ 6·02	+ 2·95	+ 3·21	— 2·49	
" 24, .	+ 3·37	+ 2·35	+ 10·35	+ 2·46	+ 5·66	+ 2·89	+ 3·25	— 2·65	
" 31, .	+ 3·38	+ 2·19	+ 10·96	+ 2·29	+ 5·43	+ 3·01	+ 3·25	— 2·63	
Sept. 7, .	+ 3·40	+ 2·09	+ 10·11	+ 2·28	+ 5·68	+ 2·89	+ 3·10	— 2·54	Verified at Tahiti.
" 14, .	+ 3·42	+ 2·03	+ 10·95	+ 2·55	+ 5·85	+ 3·03	+ 3·36	— 2·72	
" 21, .	+ 3·43	+ 2·60	+ 10·76	+ 2·40	+ 6·00	+ 3·06	+ 3·25	— 2·42	
" 28, .	+ 3·45	+ 2·12	+ 10·63	+ 2·61	+ 5·96	+ 2·86	+ 3·35	— 2·92	
Oct. 5, .	+ 3·46	+ 1·85	+ 10·61	+ 2·33	+ 5·75	+ 2·68	+ 3·03	— 2·46	
" 12, .	+ 3·48	+ 1·78	+ 11·82	+ 2·31	+ 5·63	+ 2·80	+ 3·07	— 2·55	
" 19, .	+ 3·49	+ 2·10	+ 11·76	+ 2·33	+ 5·72	+ 2·98	+ 3·56	— 2·73	
" 26, .	+ 3·51	+ 2·10	+ 12·35	+ 2·52	+ 5·61	+ 2·88	+ 3·58	— 2·61	
Nov. 2, .	+ 3·53	+ 1·96	+ 12·85	+ 2·39	+ 6·18	+ 2·61	+ 3·61	— 2·48	
" 9, .	+ 3·55	+ 1·96	+ 12·72	+ 2·36	+ 6·28	+ 2·75	+ 3·72	— 2·11	
" 16, .	+ 3·57	+ 1·70	+ 10·77	+ 1·94	+ 5·27	+ 2·17	+ 2·99	— 2·14	
" 23, .	+ 3·59	+ 2·03	+ 11·99	+ 2·29	+ 6·46	+ 2·53	+ 3·42	— 2·82	
" 30, .	+ 3·61	+ 2·46	+ 12·10	+ 2·07	+ 11·22	+ 2·49	+ 3·15	— 1·83	
Dec. 7, .	+ 3·63	+ 2·79	+ 14·82	+ 2·09	+ 10·25	+ 2·82	+ 3·45	— 2·06	
" 14, .	+ 3·66	+ 2·46	+ 16·33	+ 2·10	+ 12·29	+ 2·62	+ 3·46	— 2·08	
" 21, .	+ 3·68	+ 2·18	+ 15·81	+ 1·72	+ 10·59	+ 2·61	+ 3·25	— 2·18	Verified at Sydney.
" 28, .	+ 3·71	+ 2·14	+ 12·96	+ 2·23	+ 11·00	+ 2·6	+ 3·25	— 2·42	
1840.									
Jan. 4, .	+ 3·73	+ 1·88	+ 14·95	+ 1·49	+ 11·89	+ 2·42	+ 3·39	— 2·30	
" 11, .	+ 3·76	+ 1·76	+ 16·43	+ 1·19	+ 12·32	+ 2·06	+ 2·28	— 1·21	
" 18, .	+ 3·79	+ 1·73	+ 16·42	+ 1·02	+ 20·73	+ 1·02	+ 1·86	— 1·05	
" 25, .	+ 3·81	+ 1·69	+ 18·19	+ 1·19	+ 17·52	+ 1·71	+ 2·18	— 1·22	
Feb. 1, .	+ 3·84	+ 1·78	+ 19·59	+ 1·31	+ 21·25	+ 2·29	+ 2·28	— 0·85	
" 8, .	+ 3·87	+ 1·39	+ 18·83	+ 0·89	+ 18·99	+ 2·13	+ 2·33	— 1·32	
" 15, .	+ 3·90	+ 1·29	+ 16·99	+ 0·79	+ 16·93	+ 1·96	+ 2·46	— 1·39	
" 22, .	+ 3·93	+ 1·75	+ 15·29	+ 1·17	+ 19·56	+ 2·15	+ 2·46	— 1·25	

RATES OF CHRONOMETERS.

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DATE.	CHRONOMETER RATES.								REMARKS.
	V. 1567	V. 972	V. 2037	V. 2088	V. 766	V. 169	V. 3001	V. 2203	
1840.									
Feb. 29, .	+ 3·97	+ 1·92	+ 14·88	+ 0·92	+ 19·29	+ 2·71	+ 2·16	— 0·65	
Mar. 7, .	+ 3·99	+ 1·75	+ 16·05	+ 1·05	+ 15·28	+ 2·49	+ 2·41	— 1·13	
" 14, .	+ 4·00	+ 4·5	+ 18·50	+ 2·87	+ 11·00	+ 3·97	+ 4·20	— 2·00	Arrival at Sydney.
" 21, .	+ 4·00	+ 2·29	+ 17·14	+ 0·86	+ 10·57	+ 3·86	+ 4·41	— 1·89	
" 28, .	+ 4·00	+ 1·79	+ 16·36	+ 1·89	+ 10·19	+ 3·36	+ 4·14	— 2·10	
April 4, .	+ 3·99	+ 1·93	+ 17·26	+ 1·96	+ 14·34	+ 3·43	+ 3·83	— 1·22	
" 11, .	+ 3·99	+ 2·53	+ 16·50	+ 2·00	+ 11·69	+ 3·46	+ 4·24	— 1·57	
" 18, .	+ 3·98	+ 2·14	+ 15·46	+ 1·94	+ 9·90	+ 3·43	+ 4·43	— 1·96	
" 25, .	+ 3·98	+ 1·87	+ 15·47	+ 2·10	+ 9·06	+ 3·51	+ 4·47	— 2·37	
May 2, .	+ 3·97	+ 1·74	+ 16·50	+ 2·43	+ 8·54	+ 3·74	+ 4·88	— 2·24	
" 9, .	+ 3·96	+ 1·61	+ 15·36	+ 2·26	+ 8·53	+ 3·40	+ 4·57	— 2·26	
" 16, .	+ 3·95	In boat.	In boat.	+ 2·46	+ 8·61	In boat.	+ 4·83	— 2·24	
" 23, .	+ 3·94	. .	. .	+ 2·36	+ 9·00	. .	+ 4·78	— 2·14	
" 30, .	+ 3·93	. .	. .	+ 2·28	+ 9·46	. .	+ 4·67	— 1·54	
June 6, .	+ 3·91	. .	. .	+ 2·24	+ 9·58	. .	+ 4·73	— 1·81	
" 13, .	+ 3·90	. .	. .	+ 2·90	+ 9·98	. .	+ 5·31	— 1·21	
" 20, .	+ 3·89	. .	. .	+ 2·68	+ 9·68	. .	+ 5·00	— 1·26	
" 27, .	+ 3·863	. .	. .	+ 2·389	+ 9·50	. .	+ 4·79	— 1·60	At Ovolau.
July 4, .	+ 3·866	. .	. .	+ 1·96	+ 8·06	. .	+ 4·59	— 1·68	
" 11, .	+ 3·873	. .	. .	+ 2·36	+ 9·92	. .	+ 4·55	— 0·92	
" 18, .	+ 3·883	+ 1·366	. .	+ 2·13	+ 9·12	. .	+ 4·53	— 1·66	
" 25, .	+ 3·896	+ 1·96	. .	+ 2·58	+ 9·08	. .	+ 4·86	— 1·18	
Aug. 1, .	+ 3·913	+ 2·25	. .	+ 2·65	. .	. .	+ 4·72	— 1·23	
" 8, .	+ 3·932	+ 2·47	. .	+ 2·43	. .	. .	+ 4·83	— 1·18	
" 15, .	+ 3·955	+ 2·24	+ 12·15	+ 2·12	+ 9·50	+ 3·01	+ 4·70	— 1·45	
" 22, .	+ 3·981	+ 1·96	+ 15·23	+ 2·06	+ 10·82	+ 3·16	+ 4·55	— 1·38	
" 29, .	+ 4·011	+ 1·88	+ 13·85	+ 1·65	+ 7·51	+ 3·22	+ 4·41	— 1·63	
Sept. 5, .	+ 4·944	+ 1·93	+ 13·09	+ 1·66	+ 8·38	+ 3·28	+ 4·43	— 1·42	
" 12, .	+ 4·080	+ 2·06	+ 13·28	+ 1·58	+ 8·93	+ 3·19	+ 4·49	— 1·38	
" 19, .	+ 4·120	+ 2·08	+ 13·83	+ 1·53	+ 8·85	+ 2·98	+ 4·43	— 1·32	
" 26, .	+ 4·163	+ 2·15	+ 13·22	+ 1·52	+ 10·01	+ 2·99	+ 4·31	— 1·08	
Oct. 3, .	+ 4·209	+ 2·59	+ 15·53	+ 2·01	+ 10·43	+ 3·43	+ 4·63	— 0·43	
" 10, .	+ 4·259	+ 2·42	+ 14·93	+ 1·85	+ 10·45	+ 3·29	+ 4·23	— 0·78	
" 17, .	+ 4·311	+ 2·62	+ 15·19	+ 1·88	+ 9·71	+ 3·62	+ 4·29	— 0·65	
" 24, .	+ 4·367	+ 2·22	+ 14·58	+ 1·39	+ 8·12	+ 3·18	+ 4·18	— 1·16*	* Transferred to Flying-Fish.
" 31, .	+ 4·427	+ 2·72	+ 13·93	+ 1·79	+ 8·36	+ 3·83	+ 4·36	— 1·06	
Nov. 7, .	+ 4·490	+ 2·36	+ 14·25	+ 1·73	+ 8·68	+ 3·46	+ 3·96	— 1·02	
" 14, .	+ 4·556	+ 2·65	+ 15·36	+ 2·23	+ 9·22	+ 3·83	+ 4·16	— 0·76	
" 21, .	+ 4.625	+ 2·79	+ 14·87	+ 1·96	+ 9·55	+ 3·96	+ 4·28	— 0·26	
" 28, .	+ 4·71	+ 3·16	+ 15·40	+ 2·47	+ 10·00	+ 4·20	+ 4·863	— 0·07	At Oahu.
Dec. 5, .	+ 4·72	+ 3·34	+ 15·55	+ 2·49	+ 11·35	+ 4·41	+ 4·64	+ 0·27	

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 1567	V. 972	V. 2037	V. 2088	V. 766	V. 169	V. 3001	F. F. 2203	
1840.									
Dec. 12, .	+ 4·73	+ 2·97	+ 16·54	+ 2·28	+ 11·02	+ 3·97	+ 3·63	+ 0·27	
" 19, .	+ 4·75	On	+ 16·75	On	+ 11·64	+ 3·89	+ 4·27	+ 0·27	
" 26, .	+ 4·77	shore.	+ 15·64	shore.	+ 11·52	+ 3·99	+ 4·51	+ 0·27	
1841.									
Jan. 2, .	+ 4·81	. .	+ 15·98	. .	+ 10·97	+ 3·66	+ 4·02	+ 0·27	
" 9, .	+ 4·84	. .	+ 16·32	. .	+ 11·61	+ 3·82	+ 4·09	+ 0·27	
" 16, .	+ 4·86	. .	+ 17·17	. .	+ 12·38	+ 3·88	+ 4·18	+ 0·27	
" 23, .	+ 4·89	. .	+ 16·75	. .	+ 11·81	+ 3·74	+ 3·92	+ 0·27	
" 30, .	+ 4·94	— 0·17	+ 16·92	+ 3·17	+ 11·54	+ 3·61	+ 3·89	+ 0·27	
Feb. 6, .	+ 5·00	— 0·15	+ 16·90	+ 3·714	+ 11·91	+ 4·19	+ 4·50	+ 0·27	At Oahu.
" 13, .	+ 5·01	+ 0·51	+ 17·92	+ 3·36	+ 11·84	+ 3·89	+ 4·21	+ 0·27	
" 20, .	+ 5·03	+ 1·03	+ 17·57	+ 3·43	+ 10·90	+ 4·11	+ 4·36	+ 0·27	
" 27, .	+ 5·05	+ 1·04	+ 16·41	+ 4·71	+ 11·60	+ 3·81	+ 4·06	+ 0·27	
Mar. 6, .	+ 5·09	+ 1·20	+ 17·86	+ 4·71	+ 11·97	+ 3·90	+ 4·07	+ 0·27	
" 13, .	+ 5·13	+ 1·37	+ 18·58	+ 3·46	+ 11·74	+ 3·91	+ 4·07	+ 0·27	
" 20, .	+ 5·18	+ 1·24	+ 18·57	+ 3·26	+ 11·74	+ 4·07	+ 4·04	+ 0·27	
" 27, .	+ 5·24	+ 1·81	+ 18·24	+ 3·63	+ 11·49	+ 4·51	+ 4·31	+ 0·27	
April 3, .	+ 5·31	+ 3·53	+ 15·92	+ 4·70	+ 11·93	+ 4·35	+ 4·55	+ 0·27	
" 10, .	+ 5·32	+ 1·84	+ 17·69	+ 3·81	+ 11·57	+ 4·24	+ 4·48	+ 0·27	
" 17, .	+ 5·35	+ 1·42	+ 18·24	+ 3·52	+ 12·44	+ 4·18	+ 4·47	+ 0·27	
" 24, .	+ 5·38	+ 1·84	+ 18·96	+ 3·66	+ 14·96	+ 4·02	+ 4·59	+ 0·27	
May 1, .	+ 5·43	+ 1·81	+ 18·22	+ 3·74	+ 18·55	+ 3·72	+ 4·38	+ 0·27	
" 8, .	+ 5·49	+ 1·42	+ 20·28	+ 3·15	+ 17·38	+ 3·42	+ 3·98	+ 0·27	
" 15, .	+ 5·56	+ 1·19	+ 18·48	+ 3·59	+ 15·41	+ 3·69	+ 4·41	+ 0·27	
" 22, .	+ 5·64	In Boat.	+ 18·17	+ 3·68	+ 15·07	+ 4·24	+ 4·89	+ 0·27	
" 29, .	+ 5·74	. .	+ 17·17	+ 3·67	+ 13·09	+ 4·24	+ 5·16	+ 0·27	
June 5, .	+ 5·85	. .	+ 15·02	+ 3·22	+ 13·88	+ 3·87	+ 4·77	+ 0·27	
" 12, .	+ 5·97	. .	+ 14·85	+ 3·14	+ 14·78	+ 3·92	+ 4·77	+ 0·27	
" 19, .	+ 6·10	. .	+ 15·84	+ 3·42	+ 15·62	+ 4·38	+ 5·24	+ 0·27	
" 26, .	+ 6·24	. .	+ 17·85	+ 3·72	+ 17·14	+ 4·41	+ 5·38	+ 0·27	
July 3, .	+ 6·40	. .	+ 16·69	+ 3·18	+ 16·55	+ 3·85	+ 4·61	+ 0·27	
" 10, .	+ 6·57	. .	+ 16·38	+ 3·17	+ 14·87	+ 3·92	+ 4·74	+ 0·27	
" 17, .	+ 6·80	+ 1·70	+ 17·90	+ 3·65	+ 15·70	+ 4·75	+ 5·78	+ 0·27	At Nisqually.
" 24, .	+ 6·80	+ 3·04	+ 18·46	+ 5·24	+ 15·30	+ 5·54	+ 6·40	+ 0·27	
" 31, .	+ 6·79	+ 2·98	+ 18·90	+ 4·94	+ 17·08	+ 5·06	+ 6·08	+ 0·67	
Aug. 7, .	+ 6·78	+ 2·90	+ 19·51	+ 5·11	+ 17·66	+ 4·94	+ 6·13	+ 0·72	
" 14, .	+ 6·77	+ 2·81	+ 19·73	+ 5·23	+ 15·28	+ 5·08	+ 6·30	+ 0·61	
" 21, .	+ 6·76	In Boat.	+ 21·30	+ 5·23	+ 14·51	In boat.	+ 6·21	+ 0·58	
" 28, .	+ 6·74	. .	+ 20·70	+ 5·47	+ 14·70	. .	+ 6·67	+ 0·92	
Sept. 4, .	+ 6·72	. .	+ 21·08	+ 5·17	+ 15·64	. .	+ 6·56	+ 0·86	
" 11, .	+ 6·70	. .	+ 20·73	+ 5·11	+ 16·91	. .	+ 6·60	+ 0·69	

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 1567	V. 972	V. 2037	V. 2088	V. 766	V. 169	V. 3001	F. F. 2203	
1841.									
Sept. 18, .	+ 6·67	+ 2·13	+ 21·28	+ 5·33	+ 17·16	. .	+ 6·70	+ 0·82	
" 25, .	+ 6·65	+ 1·74	+ 20·94	+ 5·16	+ 14·77	. .	+ 6·37	+ 1·11	
Oct. 2, .	+ 6·62	+ 1·86	+ 21·51	+ 5·16	+ 14·33	. .	+ 6·73	+ 0·97	
" 9, .	+ 6·58	+ 2·01	+ 22·01	+ 5·24	+ 14·67	. .	+ 6·61	+ 1·23	
" 16, .	+ 6·55	+ 1·76	+ 21·94	+ 5·23	+ 14·73	. .	+ 6·66	+ 1·60	
" 23, .	+ 6·50	+ 1·26	+ 21·43	+ 4·70	+ 14·93	. .	+ 6·43	+ 1·52	
" 30, .	+ 6·50	+ 1·28	+ 21·47	+ 4·33	+ 14·39	. .	+ 5·61	+ 1·74	
Nov. 7, .	+ 6·50	+ 1·47	+ 20·57	+ 4·91	+ 15·37	+ 4·86	+ 6·11	+ 1·67	
" 14, .	+ 6·50	+ 0·57	+ 20·93	+ 4·43	+ 13·14	+ 4·78	+ 5·78	+ 1·96	
" 21, .	+ 6·50	+ 0·43	+ 21·43	+ 4·50	+ 12·64	+ 4·93	+ 5·64	+ 2·01	
" 28, .	+ 6·50	+ 0·50	+ 21·55	+ 4·83	+ 12·50	+ 4 81	+ 5·62	+ 2·32*	* Transferred to Vincennes.
Dec. 5, .	+ 6·50	. .	+ 22·14	+ 3·93	+ 12·71	+ 5·07	+ 5·57	+ 2·60	
" 12, .	+ 6·50	. .	+ 19·79	+ 3·43	+ 9·93	+ 4·14	+ 4·57	+ 2·00	
" 19, .	+ 6·50	. .	+ 22·07	+ 4·00	+ 11·04	+ 4·86	+ 5·36	+ 1·29	
" 26, .	+ 6·50	. .	+ 22·21	+ 4·07	+ 11·50	+ 4·86	+ 5·43	+ 4·14	
1842.									
Jan. 2, .	+ 6·50	. .	+ 22·00	+ 3·78	+ 11·00	+ 4·78	+ 5·28	+ 4·07	
" 9, .	+ 6·50	. .	+ 21·71	+ 3·86	+ 12·14	+ 4·79	+ 5·64	+ 1·43	
" 17, .	+ 6·50	. .	+ 23·18	+ 4·00	+ 19·56	+ 4·44	+ 5·44	+ 2·94	
" 23, .	+ 6·50	. .	+ 21·99	+ 4·00	+ 11·69	+ 4·80	+ 5·52	+ 2·80	
" 30, .	+ 6·50	. .	+ 22·60	+ 3·98	+ 12·35	+ 4·55	+ 4·73	+ 2·65	
Feb. 6, .	+ 6·50	. .	+ 22·93	+ 4·21	+ 12·21	+ 4·57	+ 5·78	+ 3·14	
" 13, .	+ 6·50	. .	+ 22·78	+ 4·00	+ 12·71	+ 4·36	+ 5·64	+ 2·21	
" 20, .	+ 6·50	. .	+ 22·43	+ 4·14	+ 13·43	+ 4·21	+ 5·36	+ 2·21	
" 27, .	+ 6·50	. .	+ 22·14	+ 4·28	+ 13·16	+ 4·28	+ 5·00	+ 2·57	
Mar. 6, .	+ 6·50	. .	+ 21·50	+ 4·07	+ 12·86	+ 4·36	+ 4·93	+ 2·64	
" 13, .	+ 6·50	. .	+ 23·21	+ 3·79	+ 15·07	+ 4·36	+ 4·71	+ 2·71	
" 20, .	+ 6·50	. .	+ 22·50	+ 3·57	+ 14·36	+ 4·28	+ 4·86	+ 2·78	
" 27, .	+ 6·50	. .	+ 22·64	+ 3·43	+ 14·93	+ 4·36	+ 4·64	+ 1 50	
April 3, .	+ 6·50	. .	+ 21·71	+ 3·36	+ 13·78	+ 4·43	+ 5·07	+ 1·57	
" 10, .	+ 6·50	. .	+ 21·71	+ 3·50	+ 13·86	+ 4·21	+ 5·14	+ 3·14	
" 17, .	+ 6·50	. .	+ 21·86	+ 3·55	+ 12·94	+ 4·14	+ 4·75	+ 2·39	
" 24, .	+ 6·50	. .	+ 22·14	+ 3·64	+ 13·36	+ 4·00	+ 5·28	+ 2·93	
May 1, .	+ 6·50	. .	+ 22 28	+ 3·64	Stopp'd.	+ 4·07	+ 5·28	+ 2·50	
" 8, .	+ 6·50	. .	+ 22·93	+ 3·50	. .	+ 4·43	+ 4·64	+ 2·43	
" 15, .	+ 6·50	. .	+ 23·67	+ 3·07	. .	+ 4·21	+ 4·57	+ 1·86	
" 22, .	+ 6 50	. .	+ 22·61	+ 3·57	. .	+ 4·14	+ 6·71	+ 2·21	
" 29, .	+ 6·50	. .	+ 22·57	+ 3·50	. .	+ 3·93	+ 5·07	+ 2·28	
June 3, .	+ 6·50	. .	+ 22·57	+ 3·56	. .	+ 4·00	+ 5·07	+ 2·28	
" 10, .	+ 6·50	. .	+ 22·80	+ 3·50	. .	+ 3·90	+ 4·90	+ 2·70	

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 170	V. 2083	V. 2096	F. F. 2204	Por. 2095	Por. 2042	Por. 2052	Por. 773	
1838.									
Aug. 10, .	+ 3·50	+ 2·184	— 3·022	+ 4·41	+ 5·87	+ 4·10	+ 4·22	— 6·17	
" 24, .	+ 5·08	+ 2·34	— 0·68	+ 4·40	+ 6·10	+ 4·13	+ 4·27		
" 31, .	+ 3·97	+ 2·59	+ 0·09	+ 4·39	+ 5·92	+ 3·98	+ 4·31		
Sept. 7, .	+ 3·90	+ 3·11	— 2·03	+ 4·36	+ 6·17	+ 3·97	+ 4·42		
" 14, .	+ 3·83	+ 3·46	— 1·43	+ 4·33	+ 6·43	+ 3·64	+ 4·49		
" 21, .	+ 3·90	+ 3·18	— 1·27	+ 4·29	+ 6·69	+ 3·72	+ 4·40		
" 28, .	+ 4·16	+ 3·26	— 1·38	+ 4·24	+ 6·69	+ 3·28	+ 4·35		
Oct. 5, .	+ 3·78	+ 3·33	— 1·31	+ 4·19	+ 6·84	+ 2·47	+ 3·69		
" 12, .	+ 4·61	+ 3·61	— 2·17	+ 4·13	+ 7·13	+ 2·12	+ 3·54		
" 16, .	+ 4·35	+ 2·95	— 1·96	+ 4·06	+ 7·57	+ 3·19	+ 3·69		
" 26, .	+ 4·81	+ 4·62	— 2·00	+ 4·00	+ 8·16	+ 2·58	+ 4·88		
Nov. 2, .	+ 4·08	+ 4·45	— 2·02	+ 4·00	+ 8·90	+ 3·35	+ 6·49	— 5·56	
" 9, .	+ 3·98	+ 4·65	— 0·59	+ 4·00	+ 8·87	+ 2·47	+ 6·04	— 5·46	
" 16, .	+ 3·57	+ 4·41	— 0·36	+ 4·00	+ 8·81	+ 3·93	+ 6·07	— 5·22	
" 23, .	+ 3·89	+ 4·52	+ 0·25	+ 4·01	+ 8·73	+ 3·47	+ 5·97	— 5·67	
" 30, .	+ 3·33	+ 4·57	+ 2·51	+ 4·01	+ 8·61	+ 3·54	+ 6·33	— 5·60	
Dec. 7, .	+ 4·06	+ 4·86	+ 1·61	+ 4·01	+ 8·47	+ 3·47	+ 6·54		
" 14, .	+ 3·91	+ 4·32	— 0·63	+ 4·02	+ 8·30	+ 1·56	+ 4·56		
" 21, .	+ 4·77	+ 4·48	— 0·02	+ 4·03	+ 8·47	+ 2·52	+ 6·44	— 10·44	
" 28, .	+ 4·94	+ 4·67	+ 0·64	+ 4·03	+ 8·80	+ 2·59	+ 5·59	— 7·07	
1839.									
Jan. 4, .	+ 5·36	+ 5·72	— 0·59	+ 4·04	+ 8·81	+ 2·82	+ 5·96	— 7·09	
" 11, .	+ 6·17	+ 6·35	+ 3·60	+ 4 05	+ 8·83	+ 2·29	+ 5·29	— 7·13	
" 18, .	+ 5·02	+ 5·72	+ 5·00	+ 4·05	+ 8 85	+ 2·66	+ 5·02	— 7·26	
" 25, .	+ 4·64	+ 5·43	+ 7·66	+ 4·06	+ 8·89	+ 3·16	+ 5·80	— 7·20	
Feb. 1, .	+ 5·19	+ 5·50	+ 7·70	+ 4·07	+ 8·93	+ 2·52	+ 4·94	— 7·63	
" 8, .	+ 3·53	+ 4·36	+ 6·69	+ 4·08	+ 8·99	+ 2·30	+ 4·94	— 7·49	
" 15, .	+ 3·12	+ 3·93	+ 9·26	+ 4·10	+ 9·05	+ 2·60	+ 5·05	— 6·70	
" 22, .	+ 3·86	+ 4·14	+ 7·70	+ 4·11	+ 9·12	+ 2·49	. .	— 7·66	
Mar. 1, .	+ 3·64	+ 4·14	+ 10·54	+ 4·12	+ 9·21	+ 2·47	. .	— 6·46	
" 8, .	+ 3·36	+ 3·89	+ 11·74	+ 4·13	+ 9·29	+ 3·09	+ 3·76	— 7·65	
" 10, .	+ 2·95	+ 4·49	+ 11·15	+ 4·15	+ 9·39				
" 22, .	+ 2·41	+ 4·40	+ 11·39	+ 4·16	+ 9·50	+ 3·13	+ 3·20	— 9·94	
" 29, .	+ 3·31	+ 4·52	+ 11·02	+ 4·18	+ 9·62	+ 2·23	+ 5·30	— 8·20	
April 5, .	+ 3·59	+ 4·27	+ 11·95	+ 4·19	+ 9·75	+ 0·66	+ 4·01	— 9·13	
" 12, .	+ 2·77	+ 4·99	+ 9·88	+ 4·21	+ 9·88	+ 0·44	+ 3·80	— 9·13	
" 20, .	+ 3·11	+ 4·74	+ 12·16	+ 4·23	+ 10·02	+ 0·91	+ 4·63	— 10·09	
" 27, .	+ 2·13	+ 4·15	+ 13·09	+ 4·24	+ 10·18	+ 1·30	+ 3·66	— 9·06	
May 4, .	+ 2·55	+ 3·85	+ 14·19	+ 4·26	+ 10·34	+ 1·09	+ 3·66	— 9·06	
" 11, .	+ 2·99	+ 4·33	+ 8·71	+ 4·24	+ 10·51	+ 1·23	+ 4·37	— 9·06	
" 18, .	. .	+ 4·13	+ 7·23	+ 4·22	+ 10·69	+ 0·51	+ 3·73	— 10 06	

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 170	V. 2083	V. 2096	F. F. 2204	Por. 2095	Por. 2042	Por. 2052	Por. 773	
1839.									
May 26, .	. .	+ 4·38	+ 10·59	+ 4·16	+ 10·88	+ 0·54	+ 3·11		
June 1, .	. .	+ 3·52	+ 10·16	+ 4·10	+ 11·08	+ 0·76	+ 3·73	— 35·02	
" 9, .	+ 3·80	+ 4·50	+ 9·00	+ 4·11	+ 11·28	+ 0 83	+ 4·04	— 18·03	
" 16, .	+ 6·69	+ 4·50	+ 7·78	+ 4·13	+ 11·50	+ 1·22	+ 3·80	— 9·53	
" 23, .	+ 3·46	+ 4·03	+ 9·02	+ 4·16	+ 11·73	+ 0·20	+ 3·53	— 9·35	
" 30, .	+ 2·96	+ 4·15	+ 9·18	+ 4·21	+ 11·96	+ 1·77	+ 4·21	— 9·73	
July 7, .	+ 3·01	+ 4·17	+ 9·01	+ 4·26	+ 12·11	+ 3·615	+ 6·80	— 10·01	
" 13, .	+ 3·69	+ 5·18	+ 10·48	+ 4·33	+ 12·07	+ 3·82	+ 7·23	— 9·89	
" 20, .	+ 3·44	+ 4·68	+ 10·02	+ 4·41	+ 12 00	+ 4·21	+ 7·54	— 10·13	
" 27, .	+ 3·73	+ 3·96	+ 9·75	+ 4·50	+ 11·90	+ 4·40	+ 8·00	— 10·36	
Aug. 3, .	+ 4·08	+ 4·72	+ 11·92	. .	+ 11·91	+ 4·43	+ 7·69	— 6·36	
" 10, .	+ 4·29	+ 4·93	+ 10·61	. .	+ 11·92	+ 4·68	+ 7·97		
" 17, .	+ 4·38	+ 4·99	+ 11·25	. .	+ 11·93	+ 4·40	+ 7·61	— 7·17	
" 24, .	+ 4·61	+ 4·39	+ 10·25	. .	+ 11·95	+ 4·76	+ 8·04	— 5·19	
" 31, .	+ 4·86	+ 4·28	+ 5·79	. .	+ 11·98	+ 4·68	+ 8·11	— 5·38	
Sept. 7, .	+ 5·18	+ 5·36	+ 5·96	. .	+ 12·01	+ 4·61	+ 8·28	— 6·13	
" 14, .	+ 4·99	+ 6·93	On	. .	+ 12·05	+ 4·26	+ 8·58	— 5·97	
" 21, .	+ 3·72	+ 3·80	shore.	. .	+ 12·09	+ 4·50	+ 8·21		
" 28, .	+ 4·31	+ 5·38	+ 8·41	. .	— 12·10	+ 4·37	+ 8·20		
Oct. 5, .	+ 4·93	+ 5·72	+ 7·11	. .	+ 12·11	+ 4·59	+ 7·97		
" 12, .	+ 5·35	+ 4·49	+ 8·19	. .	+ 12·13	+ 4·66	+ 8·21		
" 19, .	+ 5·25	+ 5·61	+ 8·13	. .	+ 12·16	+ 4·44	+ 8·09		
" 26, .	+ 5·15	+ 5·60	+ 5·61	. .	+ 12·19	+ 4·23	+ 7·66		
Nov. 2, .	+ 4·93	+ 5·56	+ 6·72	. .	+ 12·23	+ 4·04	+ 7·09		
" 9, .	+ 5·06	+ 5·82	+ 5·49	. .	+ 12·28	+ 3·92	+ 7·47		
" 16, .	+ 4·06	+ 4·49	+ 5·20	. .	+ 12·33	+ 4·10	+ 7·32		
" 23, .	+ 4·22	+ 5·01	+ 6·83	. .	+ 12·40	+ 3·66	+ 7·59		
" 30, .	+ 3·61	+ 4·85	+ 8·03	. .	+ 12·46	+ 3·52	+ 5·73		
Dec. 7, .	+ 3·59	+ 4·71	On	. .	+ 12·52	+ 3·09	+ 6·37		
" 14, .	+ 4·10	+ 5·36	shore.	. .	+ 12·60	+ 2·59	+ 5·66		
" 21, .	+ 3·55	+ 4·93	. .	. .	+ 12·70	+ 3·70	+ 5·20		
" 28, .	+ 4·38	+ 5·25	+ 6·00	. .	+ 12·68	+ 2·74	+ 5·10		
1840.									
Jan. 4, .	+ 3·35	+ 4·17	+ 6·86	. .	+ 12·64	+ 3·94	+ 7·30	— 9·13	
" 11, .	+ 1·25	+ 3·82	+ 11·82	. .	+ 12·58	+ 4·13	+ 6·42	— 8·37	
" 18, .	+ 0·61	+ 2·98	+ 16·39	. .	+ 12·50	+ 0·70	+ 3·42	— 8·92	
" 25, .	+ 2·18	+ 3·71	+ 16·75	. .	+ 12·40	+ 0·114	+ 2·70	— 10·90	
Feb. 1, .	+ 0·95	+ 3·82	+ 19·46	. .	+ 12·41	— 0·59	+ 1·44	— 12·68	
" 8, .	+ 2·55	+ 1·85	+ 14·68	. .	+ 12·42	+ 0·54	+ 2·76	— 11·31	
" 15, .	+ 2·35	+ 3·29	+ 14·49	. .	+ 12·44	— 2·21	+ 0·33	— 13·96	
" 22, .	+ 2·01	+ 3·56	+ 13·95	. .	+ 12·47	+ 0·36	+ 2·54	— 11·31	

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 170	V. 2083	V. 2096	F. F. 2204	Por. 2095	Por. 2042	Por. 2052	Por. 773	
1840.									
Feb. 29, .	+ 1·52	+ 3·82	+ 13·01	. .	+ 12·51	+ 1·15	+ 3·26	— 10·67	
Mar. 7, .	+ 2·41	+ 3·83	+ 20·61	. .	+ 12·55	+ 2·61	+ 5·04	— 8·96	
" 14, .	+ 3·88	+ 5·45	+ 13·3	. .	+ 12·60	+ 2·43	+ 5·19		
" 21, .	+ 5·00	+ 5·61	+ 9·55	. .	+ 12·66	+ 3·11	+ 5·00		
" 28, .	+ 4·64	+ 5·26	+ 7·71	. .	+ 12·72	+ 2·20	+ 4·56		
April 4, .	+ 3·86	+ 4·93	+ 10·28	. .	+ 12·80	+ 3·50	+ 5·90		
" 11, .	+ 3·97	+ 5·10	+ 11·43	. .	+ 12·87	+ 3·62	+ 5·93		
" 18, .	+ 4·88	+ 4·86	+ 9·21	. .	+ 13·79	+ 3·86	+ 5·57		
" 25, .	+ 5·18	+ 5·47	+ 7·83	. .	+ 13·71	+ 4·22	+ 5·46		
May 2, .	+ 5·67	+ 6·21	+ 7·78	. .	+ 14·50	+ 4·70	+ 7·00		
" 9, .	+ 5·64	+ 5·57	+ 7·31	. .	+ 15·39	+ 4·70	+ 7·41		
" 16, .	In boat.	In boat.	+ 8·50	. .	+ 15·45	+ 4·71	+ 8·36		
" 23, .	. .	. .	+ 8·28	. .	+ 14·03	+ 4·72	+ 6·71		
" 30, .	. .	. .	+ 9·03	. .	+ 13·70	+ 4·74	+ 7·34		
June 6, .	. .	. .	+ 8·78	. .	+ 13·66	+ 4·75	+ 7·59		
" 13, .	. .	. .	+ 9·50	. .	+ 13·66	+ 4·77	+ 7·53		
" 20, .	. .	. .	+ 8·36	. .	+ 14·99	+ 4·80	+ 7·56		
" 27, .	. .	. .	. .	. .	+ 14·84	+ 4·83	+ 7·99		
July 4, .	. .	. .	. .	. .	+ 14·66	+ 4·86	+ 7·56		
" 11, .	+ 4·54	. .	+ 11·65	. .	+ 13·74	+ 4·89	+ 7·37		
" 18, .	+ 5·26	+ 6·22	+ 11·36	. .	+ 13·91	+ 4·93	+ 7·24		
" 25, .	+ 6·02	+ 6·06	+ 12·01	. .	+ 13·41	+ 4·97	+ 7·09		
Aug. 1, .	+ 5·85	+ 6·22	+ 10·86	. .	+ 13·34	+ 5·02	+ 7·24		
" 8, .	+ 6·01	+ 7·33	+ 11·22	. .	+ 13·27	+ 5·07	+ 7·13		
" 15, .	+ 5·94	+ 7·38	+ 10·17	. .	+ 13·86	+ 5·115	+ 7·61		
" 22, .	+ 6·15	+ 7·62	+ 9·08	. .	+ 13·84	+ 5·12	+ 7·41		
" 29, .	+ 5·62	+ 7·51	+ 9·69	. .	+ 14·11	+ 5·14	+ 7·61		
Sept. 5, .	+ 5·61	+ 7·75	+ 7·82	. .	+ 14·61	+ 5·16	+ 7·62		
" 12, .	+ 5·26	+ 7·62	+ 10·89	. .	+ 13·62	+ 5·19	+ 7·21		
" 19, .	+ 5·33	+ 7·32	+ 11·55	. .	+ 14·52	+ 5·23	+ 7·25		
" 26, .	+ 5·03	+ 6·38	+ 11·52	. .	+ 14·11	+ 5·27	+ 7·11		
Oct. 3, .	+ 6·18	+ 6·71	+ 12·95	. .	+ 14·12	+ 5·33	+ 7·21		
" 10, .	+ 6·23	+ 6·29	+ 13·93	. .	+ 14·32	+ 5·39	+ 7·92		
" 17, .	+ 6·39	+ 7·26	+ 11·91	. .	+ 14·11	+ 5·46	+ 7·64		
" 24, .	+ 5·65	+ 7·01	+ 9·51	. .	+ 14·21	+ 5·54	+ 7·82		
" 31, .	+ 5·75	+ 7·18	+ 10·51	. .	+ 14·62	+ 5·62	+ 7·97		
Nov. 7, .	+ 5·52	+ 6·86	+ 11·46	. .	+ 14·56	+ 5·71	+ 7·82		
" 14, .	+ 5·58	+ 6·16	+ 11·81	. .	+ 14·91	+ 5·82	+ 8·16		
" 21, .	+ 5·61	+ 6·01	+ 12·10	. .	+ 15·11	+ 5·82	+ 8·01		
" 28, .	+ 6·40	+ 7·40	+ 12·44	. .	+ 15·53	+ 5·83	+ 7·61		

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 170	V. 2083	V. 2096	F. F. 2204	Por. 2095	Por. 2042	Por. 2052	Por. 773	
1840.									
Dec. 5, .	+ 5·61	+ 6·84	+ 12·35	. .	+ 15·32	+ 5·83	+ 7·89		
" 12, .	+ 5·91	+ 6·51	+ 11·14	. .	+ 15·18	+ 5·84	+ 7·75		
" 19, .	+ 5·75	+ 6·38	+ 11·78	. .	+ 15·03	+ 5·85	+ 7·89		
" 26, .	+ 6·28	+ 6·81	+ 12·38	+ 6·00	+ 15·25	+ 5·86	+ 7·92		
1841.									
Jan. 2, .	+ 5·74	+ 6·15	+ 12·71	+ 6·02	+ 15·32	+ 5·88	+ 7·65		
" 9, .	+ 5·57	+ 6·05	+ 12·08	+ 6·12	+ 15·25	+ 5·89	+ 7·68		
" 16, .	+ 5·47	+ 7·18	+ 13·45	+ 5·97	+ 15·25	+ 6·91	+ 7·68		
" 23, .	+ 5·35	+ 4·59	+ 12·92	+ 5·65	+ 16·03	+ 5·93	+ 8·03		
" 30, .	+ 5·49	— 2·32	+ 12·92	+ 5·81	+ 15·75	+ 5·95	+ 8·18		
Feb. 6, .	+ 6·09	+ 6·70	+ 12·72	+ 5·73	+ 15·53	+ 5·98	+ 7·61		
" 13, .	+ 6·32	+ 6·92	+ 13·18	+ 4·24	+ 16·11	+ 6·00	+ 7·46		
" 20, .	+ 6·73	+ 6·47	+ 13·61	+ 4·53	+ 15·39	+ 6·03	+ 7·61		
" 27, .	+ 5·76	+ 6·24	+ 12·99	+ 3·59	+ 15·77	+ 6·06	+ 8·10		
Mar. 6, .	+ 5·07	+ 6·16	+ 14·33	+ 4·07	+ 15·65	+ 6·09	+ 7·53		
" 13, .	+ 5·73	+ 6·63	+ 14·46	On shore.	+ 15·82	+ 6·13	+ 7·82		
" 20, .	+ 5·77	+ 6·47	+ 15·58	+ 5·31	+ 15·77	+ 6·17	+ 8·03		
" 27, .	+ 5·37	+ 11·21	+ 16·20	+ 10·36	+ 16·36	+ 6·22	+ 8·11		
April 3, .	+ 6·08	+ 6·80	+ 13·70	+ 7·60	+ 16·88	+ 6·30	+ 8·93		
" 10, .	+ 4·45	+ 6·39	+ 12·95	+ 7·78	+ 17·42	+ 6·35	+ 9·18		
" 17, .	+ 4·32	+ 6·08	+ 13·21	+ 5·41	+ 18·66	+ 6·46	+ 9·23		
" 24, .	+ 3·45	+ 5·42	+ 13·05	+ 6·76	+ 15·66	+ 6·61	+ 9·37		
May 1, .	+ 2·37	+ 5·14	+ 14·38	+ 8·25	+ 16·94	+ 6·82	+ 9·51		
" 8, .	+ 2·91	+ 4·79	+ 16·16	+ 6·29	+ 16·87	+ 7·08	+ 9·73		
" 15, .	+ 3·64	+ 5·39	+ 14·48	+ 5·45	+ 18·35	+ 7·40	+ 10·49		
" 22, .	+ 3·55	+ 5·72	+ 16·85	+ 7·14	+ 18·06	+ 7·40	+ 10·32		
" 29, .	+ 3·68	+ 5·85	+ 14·54	+ 7·12	+ 18·32	+ 7·40	+ 10·36		
June 5, .	+ 2·48	+ 5·09	+ 17·86	+ 4·54	. .	+ 7·40	+ 11·28		
" 12, .	+ 2·52	+ 4·99	+ 20·57	+ 4·84	+ 18·55	+ 7·40	+ 10·33		
" 19, .	+ 3·74	+ 5·55	+ 19·88	+ 5·07	+ 18·40	+ 7·40	+ 10·26		
" 26, .	+ 3·98	+ 5·91	+ 20·48	+ 5·94	+ 18·14	+ 7·39	+ 10·19		
July 3, .	+ 3·18	+ 5·35	+ 20·75	+ 7·24	+ 18·37	+ 7·39	+ 10·33		
" 10, .	. .	+ 5·66	+ 20·41	+ 4·82	+ 18·18	+ 7·39	+ 10·04		
" 17, .	+ 4·03	+ 6·09	+ 17·00	+ 6·78	+ 18·04	+ 7·39	+ 10·26		
" 24, .	+ 6·47	+ 7·06	+ 26·63	+ 6·81	+ 17·35	+ 7·38	+ 9·78		
" 31, .	+ 5·77	+ 6·76	+ 14·84	+ 5·66	+ 18·87	+ 7·38	+ 10·26		
Aug. 7, .	+ 6·43	+ 6·84	+ 16·21	+ 6·18	+ 18·14	+ 7·38	+ 11·04		
" 14, .	+ 6·17	+ 6·71	+ 16·66	+ 6·48	+ 18·44	+ 7·37	+ 9·83		
" 21, .	+ 5·67	+ 6·38	+ 15·37	+ 7·94	+ 18·47	+ 7·37	+ 10·04		
" 28, .	+ 6·36	+ 7·07	+ 16·37	+ 5·11	+ 18·90	+ 7·36	+ 9·76		

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 170	V. 2083	V. 2096	F. F. 2204	Por. 2095	Por. 2042	Por. 2052	Por. 773	
1841.									
Sept. 4, .	+ 5·74	+ 6·40	+ 18·57	+ 4·96	+ 18·65	+ 7·36	+ 10·01		
" 11, .	+ 5·76	+ 6·50	+ 17·68	+ 4·96	+ 18·82	+ 7·35	+ 9·76		
" 18, .	+ 6·13	+ 6·33	+ 16·64	+ 6·96	+ 18·74	+ 7·35	+ 9·93		
" 25, .	+ 6·18	+ 6·11	+ 15·44	+ 5·97	+ 18·76	+ 7·34	+ 9·83		
Oct. 2, .	+ 6·18	+ 6·31	+ 17·13	+ 7·47	+ 18·43	+ 7·34	+ 9·71		
" 9, .	+ 5·87	+ 6·30	+ 14·51	+ 6·03	+ 18·73	+ 7·33	+ 9·69		
" 16, .	+ 5·41	+ 6·01	+ 13·30	+ 8·30	+ 17·18	+ 7·32	+ 8·11		
" 23, .	+ 5·36	+ 5·77	+ 14·47	+ 6·84	+ 20·54	+ 7·32	+ 11·33		
" 30, .	+ 4·36	+ 4·90	+ 15·06	+ 6·57	+ 19·47	+ 7·31	+ 10·18		
Nov. 7, .	+ 4·77	+ 6·11	+ 16·36	+ 6·29	+ 18·98	+ 7·30	+ 9·98		
" 14, .	+ 5·07	+ 5·78	+ 14·71	+ 9·86	+ 19·11	+ 7·29	+ 9·61		
" 21, .	+ 5·93	+ 6·21	+ 12·59	+ 12·57	+ 18·83	+ 7·29	+ 9·26		
" 28, .	+ 5·60	+ 6·10	+ 12·71	+ *7·62	+ 18·28	+ 7·28	+ 9·03		* Transferred to Porpoise.
Dec. 5, .	+ 6·21	+ 5·93	+ 10·86	Stopp'd.	+ 18·28	+ 7·29	+ 8·99		
" 12, .	+ 5·07	+ 4·79	+ 10·00	. .	+ 18·29	+ 7·30	+ 9·06		
" 19, .	+ 4·64	+ 5·36	+ 11·78	. .	+ 16·38	+ 7·32	+ 8·59		
" 26, .	+ 5·86	+ 5·28	+ 11·57	. .	+ 18·49	+ 7·34	+ 9·63		
1842.									
Jan. 2, .	+ 5·57	+ 5·14	+ 12·70	. .	+ 18·35	+ 7·37	+ 9·31		
" 9, .	+ 5·28	+ 4·64	+ 12·21	. .	+ 18·56	+ 7·40	+ 9·32		
" 17, .	+ 6·12	+ 5·02	+ 12·87	. .	+ 18·35	+ 7·45	+ 9·21		
" 23, .	+ 5·92	+ 5·30	+ 12·11	. .	+ 18·32	+ 7·50	+ 9·61		
" 30, .	+ 6·45	+ 5·08	+ 13·53	. .	+ 18·66	+ 7·55	+ 9·66		
Feb. 6, .	+ 7·00	+ 5·36	+ 13·00	. .	+ 18·63	+ 7·61	+ 9·71		
" 13, .	+ 6·57	+ 5·07	+ 11·64	. .	+ 18·58	+ 7·68	+ 9·21		
" 20, .	+ 6·57	+ 5·07	+ 9·64	. .	+ 18·83	+ 7·75	+ 9·71		
" 27, .	+ 7·43	+ 4·93	+ 9·43	. .	+ 19·41	+ 7·83	+ 10·56		
Mar. 6, .	+ 6·57	+ 5·50	+ 10·93	. .	+ 19·33	+ 7·92	+ 10·74		
" 13, .	+ 5·57	+ 4·71	+ 11·14	. .	+ 19·40	+ 7·81	+ 10·43		
" 20, .	+ 6·57	+ 4·36	+ 11·36	. .	+ 19·61	+ 7·79	+ 10·72		
" 27, .	+ 5·36	+ 4·28	+ 10·36	. .	+ 19·52	+ 7·76	+ 10·79		
April 3, .	+ 5·43	+ 4·21	+ 12·07	. .	+ 20·08	+ 7·73	+ 10·95		
" 10, .	+ 5·07	+ 4·07	+ 12·07	. .	+ 19·83	+ 7·69	+ 11·04		
" 17, .	+ 5·70	+ 4·22	+ 11·04	. .	+ 19·80	+ 7·64	+ 10·83		
" 24, .	+ 5·07	+ 4·50	+ 11·71	. .	+ 20·36	+ 7·58	+ 10·97		
May 1, .	+ 4·78	+ 3·64	+ 11·64	. .	+ 20·33	+ 7·52	+ 10·47		
" 8, .	+ 5·43	+ 3·86	+ 11·57	. .	+ 20·73	+ 7·47	+ 11·33		
" 14, .	+ 5·71	+ 4·43	+ 10 86	. .	+ 19·85	+ 7·40	+ 10·20		
" 21, .	+ 5·86	+ 4·64	+ 10·71	. .	+ 19·11	+ 7·40	+ 10·40		
" 28, .	+ 5·86	+ 4·21	+ 12·07	. .	+ 19·83	+ 7·40	+ 10·11		

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 170	V. 2083	V. 2096	F. F. 2204	Por. 2095	Por. 2042	Por. 2052	Por. 773	
1842.									
June 4, .	+ 5·50	+ 4·14	+ 12·86	. .	+ 19·80	+ 7·40	+ 10·11		
" 10, .	+ 4·80	+ 4·20	+ 12·10						Vincennes arrived.
" 11, .	. .	. .	. .	. .	+ 20·00	+ 7·40	+ 10·47		
" 18, .	. .	. .	. .	. .	+ 20·16	+ 7·40	+ 10·47		
" 25, .	. .	. .	. .	. .	+ 20·43	+ 7·40	+ 10·40		
July 2, .	. .	. .	. .	. .	+ 20·17	+ 7·40	+ 10·47		Porpoise arrived.
	CHRONOMETERS ON BOARD THE PEACOCK.								
	P. 1964	P. 2085	P. 1503	P. 1826	P. 22	P. 2093	P. 2057	P. 972	
1838.									
Aug. 10, .	+ 0·723	+ 2·244	— 1·40	— 3·956	— 11·278	+ 0·27	+ 9·024	— 1·106	Records of the rates of the chronometers, except the standard, were lost at the time of the wreck of the U. S. S. Peacock, from August 10th, 1838, to July 21st, 1839.
" 24, .			— 1·40						
" 31, .			— 1·38						
Sept. 7, .			— 1·39						
" 14, .			— 1·57						
" 21, .			— 2·01						
Oct. 5, .			— 2·42						
Nov. 30, .			— 2·36						
Dec. 7, .			— 2·35						
" 14, .			— 2·34						
" 21, .			— 2·36						
" 28, .			— 2·38						
1839.									
Jan. 4, .			— 3·31						
" 11, .			— 2·99						
" 18, .			— 2·76						
" 25, .			— 2·95						
Feb. 1, .			— 2·93						
" 8, .			— 2·48						
" 15, .			— 2·62						
" 22, .			— 2·77						
Mar. 1, .			— 2·75						
" 8, .			— 2·54						
April 5, .			— 2·40						
" 12, .			— 2·25						
May 4, .			— 2·10						

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	P. 1964	P. 2085	P. 1503	P. 1826	P. 22	P. 2093	P. 2057	P. 972	
1839.									
May 11, .			— 1·97						
" 18, .			— 1·67						
" 25, .			— 1·28						
June 2, .			— 1·05						
" 9, .			— 1·15						
" 16, .			— 1·25						
" 23, .			— 1·15						
" 30, .			— 0·996						
July 7, .			— 1·20						
" 14, .			— 1·20						
" 21, .			— 1·20						
" 28, .	+ 3·10	+ 3·00	— 1·20	+ 0·50	+ 3·60	+ 4·70	+ 9·40		
Aug. 4, .	+ 4·23	+ 4·40	— 1·20	+ 0·44	+ 5·94	+ 8·01	+ 12·23		
" 11, .	+ 3·58	+ 4·38	— 1·21	+ 0·30	+ 5·80	+ 7·01	+ 12·30		
" 18, .	+ 3·80	+ 4·70	— 1·22	+ 0·44	+ 6·44	+ 7·66	+ 12·66		
" 25, .	+ 3·51	+ 4·76	— 1·23	+ 0·87	+ 6·30	+ 7·62	+ 12·73		
Sept. 1, .	+ 3·45	+ 4·67	— 1·24	+ 1·23	+ 6·08	+ 7·66	+ 12·80		
" 8, .	+ 3·15	+ 5·23	— 1·25	+ 1·23	+ 6·56	+ 8·44	+ 13·58		
" 15, .	+ 3·30	+ 5·13	— 1·27	+ 1·13	+ 6·75	+ 8·63	+ 13·96		
" 22, .			— 1·26						
" 29, .			— 1·31						Between Sept. 21st and Oct. 19th, record lost.
Oct. 6, .			— 1·34						
" 13, .			— 1·37						
" 20, .	+ 3·02	+ 5·10	— 1·40	+ 0·92	+ 6·80	+ 8·91	+ 13·74		
" 27, .			— 1·46						October 19th to Nov. 9, record lost.
Nov. 3, .			— 1·57						
" 10, .	+ 2·24	+ 4·85	— 1·75	+ 0·27	+ 6·90	+ 8·71	+ 13·39		
" 17, .	+ 2·53	+ 3·82	— 1·77	+ 1·32	On shore.	+ 8·18	+ 12·25		
" 24, .	+ 3·53	+ 4·61	— 1·80	+ 1·18	+ 7·82	+ 9·61	+ 13·96		
Dec. 1, .	+ 5·25	+ 4·68	— 1·85	— 0·68	+ 7·68	+ 9·11	+ 13·39		
" 8, .			— 1·91						
" 15, .			— 2·00						Record lost.
" 22, .			— 2·09						
" 29, .	+ 8·76	+ 4·40	— 2·21	— 3·52	+ 6·90	+ 6·84	+ 13·79		
1840.									Between January 1st and March 14th, record lost. * Record lost within these dates.
Mar. 21,* .	+ 4·87	+ 4·37	— 2·00	— 3·00	+ 8·00	+ 8·57	+ 14·00		
May 2,* .	+ 4·30	+ 4·55	— 2·40	+ 2·44	+ 8·00	+ 10·30	+ 15·00		
" 9, .	+ 4·16	+ 4·62	— 2·41	+ 1·12	+ 8·17	+ 10·62	+ 15·03		
" 16, .	+ 4·27	+ 4·45	— 2·42	+ 0·97	+ 8·00	+ 11·67	+ 15·87		

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	P. 1964	P. 2085	P. 1503	P. 1826	P. 22	P. 2093	P. 2057	P. 972	
1840.									
May 23, .	+ 4·21	+ 4·97	— 2·44	+ 0·32	+ 8·56	+ 12·08	+ 16·01		Records from 5th December, 1840, till the 17th July, 1841, were lost at the time of the wreck. Afterwards the chronometers were transferred to the Vincennes, Oregon, and Flying-Fish.
" 30, .	+ 4·39	+ 5·06	— 2·47	+ 0·48	+ 8·32	+ 12·32	+ 16·27		
June 6, .	+ 4·28	+ 4·87	— 2·51	On shore.	+ 8·00	On shore.	+ 15·53		
" 13, .	+ 4·17	+ 4·80	— 2·54	+ 0·31	+ 7·73	. .	+ 14·80		
" 20, .	+ 4·03	+ 4·60	— 2·58	+ 4·00	+ 8·17	. .	+ 15·81		
" 27, .	+ 4·31	+ 4·96	— 2·65	. .	On shore.	+ 11·73	+ 16·17		
July 4, .	+ 4·66	+ 5·03	— 2·69	. .	. .	+ 12·96	+ 15·58		
" 11, .	+ 4·53	+ 4·80	— 2·76	. .	. .	+ 12·51	+ 14·89		
" 18, .	+ 4·04	+ 4·76	— 2·83	— 0·47	. .	On shore.	+ 15·26		
" 25, .	+ 4·23	+ 4·94	— 2·91	+ 0·80	. .	+ 12·53	+ 15·30		
Aug. 1, .	+ 4·31	+ 5·24	— 2·99	+ 0·81	. .	+ 13·03	+ 15·39		
" 8, .	+ 4·53	+ 5·24	— 3·089	+ 0·96	. .	On shore.	+ 15·31		
" 15, .	+ 4·26	+ 5·20	— 3·17	+ 0·87	+ 8·15	+ 13·00	+ 15·43		
" 22, .	+ 4·10	+ 5·09	— 3·20	+ 0·85	+ 8·50	+ 13·05	+ 15·40		
" 29, .	+ 4·05	+ 5·12	— 3·25	+ 0·53	+ 8·31	+ 13·29	+ 15·43		
Sept. 5, .	+ 4·15	+ 5·06	— 3·47	+ 0·25	+ 8·47	+ 13·51	+ 15·43		
" 12, .	+ 4·17	+ 5·02	— 3·56	+ 0·20	+ 8·47	+ 13·56	+ 15·45		
" 19, .	+ 4·12	+ 4·90	— 4·00	+ 0·16	+ 8·50	+ 14·17	+ 15·50		
" 26, .	+ 4·00	+ 4·80	— 4·06	— 0·15	+ 8·60	+ 14·50	+ 15·55		
Oct. 3, .	+ 4·51	+ 4·11	— 4·06	— 0·17	+ 8·36	+ 13·79	+ 14·25		
" 10, .	+ 4·88	+ 3·38	— 4·04	— 0·24	+ 8·11	+ 12·75	+ 13·63		
" 17, .	+ 4·94	+ 3·79	— 4·03	— 0·20	+ 7·86	+ 12·48	+ 13·79		
" 24, .	+ 4·26	+ 4·53	— 4·02	— 0·25	+ 7·15	+ 12·81	+ 16·03		
" 31, .	+ 3·92	+ 3·57	— 3·42	+ 0·21	+ 7·89	+ 11·39	+ 12·49		
Nov. 7, .	+ 3·23	+ 3·01	— 3·91	— 0·55	+ 8·06	+ 11·02	+ 12·23		
" 14, .	+ 3·73	+ 3·67	— 3·66	+ 0·62	+ 8·05	+ 14·27	+ 15·41		
" 21, .	+ 3·75	+ 3·53	— 3·61	+ 0·39	+ 8·96	+ 12·89	+ 14·18		
" 28, .	+ 3·65	+ 3·22	— 4·21	+ 0·36	+ 8·22	+ 12·58	+ 13·58		
1841.									
Aug. 7, .	+ 17·82	+ 3·31	— 6·28	. .	. .	+ 14·71	+ 12·73		
" 14, .	+ 17·12	+ 3·28	— 6·28	. .	. .	+ 14·69	+ 12·98		
" 21, .	+ 17·67	+ 3·40	— 6·28	. .	. .	+ 11·98	+ 12·83		
" 28, .	+ 18·91	+ 3·69	— 6·28	. .	. .	+ 12·63	+ 18·60		
Sept. 4, .	+ 13·33	+ 3·55	— 6·28	. .	. .	+ 11·12	+ 18·72		
" 11, .	+ 17·05	+ 2·55	— 6·28	. .	. .	+ 13·55	+ 18·05		
" 18, .	+ 16·97	+ 2·48	— 6·28	. .	. .	+ 13·76	+ 19·05		
" 25, .	+ 17·62	+ 2·83	— 6·28	. .	. .	+ 14·19	+ 18·62		
Oct. 1, .	+ 18·35	+ 2·77	— 6·28	. .	. .	+ 13·93	+ 17·02		
" 9, .	. .	+ 2·69	— 6·28	. .	. .	+ 14·26	+ 18·66		
" 16, .	+ 3·08	+ 3·25	— 6·28	. .	. .	+ 14·26	+ 18·92		

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.								REMARKS.
	V. 1964	O. 2085	O. 1503	O. 1826	22	O. 2093	O. 2057	972	
1841.									
Oct. 23, .	Repairing.	+ 3·62	— 6·28	+ 1·42	. .	+ 14·40	+ 19·67		
" 30, .		+ 4·12	— 6·28	+ 1·30	. .	+ 14·42	+ 19·77		
Nov. 7, .		+ 4·65	— 6·20	+ 1·29	. .	+ 14·42	+ 19·77	+ 1·47	
" 14, .		+ 3·97	— 6·03	+ 1·22	. .	+ 16·37	+ 22·08	+ 1·47	
" 21, .		On shore.	— 5·70	+ 1·90	. .	+ 17·76	+ 21·69	+ 1·23	
" 28, .	+ 2·00	+ 3·18	— 5·44	+ 1·85	. .	+ 14·226	+ 21·94	+ 0·50	
Dec. 5, .	+ 3·64	+ 3·13	— 5·47	+ 1·96	. .	+ 18·07	+ 22·82	*	* Transferred to Flying-Fish.
" 12, .	+ 4·14	+ 3·21	— 5·51	+ 2·07	. .	+ 18·21	+ 21·78		
" 19, .	+ 4·00	+ 3·07	— 5·60	+ 2·07	. .	+ 18·23	+ 22·32		
" 26, .	+ 4·11	+ 3·09	— 5·71	+ 1·36	. .	+ 18·14	+ 22·57		
1842.									
Jan. 2, .	+ 3·71	+ 3·42	— 5·84	+ 1·66	. .	+ 19·16	+ 22·94		
" 9, .	+ 3·36	+ 2·84	— 6 00	+ 1·50	. .	+ 18·21	+ 22·29		
" 17, .	+ 3·87	+ 3·11	— 6·20	+ 1·44	. .	+ 18·09	+ 22·76		
" 23, .	+ 4·10	+ 2·92	— 6·41	+ 1·73	. .	+ 19·46	+ 21·94		
" 30, .	+ 3·40	+ 3·16	— 6·65	+ 1·78	. .	+ 18·21	+ 21·71		
Feb. 5, .	+ 2·36	+ 3·21	— 6·92	+ 1·66	. .	+ 17·99	+ 22·58		
" 12, .	+ 2·28	+ 3·42	— 7·22	+ 1·42	. .	+ 18·42	+ 21·92		
" 19, .	+ 2·00	+ 3·21	— 7·54	+ 1·17	. .	+ 18·03	+ 22·54		
" 26, .	+ 1·86	+ 3·61	— 7·89	+ 0·61	. .	+ 18·04	+ 22·18	— 0·50	
Mar. 5, .	+ 1·64	+ 3·34	— 8·33	— 1·86	. .	+ 15·38	+ 20·43	— 0·50	
" 12, .	+ 1·21	+ 2·81	— 8·33	— 0·68	. .	+ 16·57	+ 21·61	+ 0·65	
" 19, .	+ 0·86	+ 3·01	— 8·34	— 0·54	. .	+ 15·67	+ 20·74	+ 0·95	
" 26, .	+ 0·64	+ 2·96	— 8·32	+ 0·67	. .	+ 16·88	+ 22·95	+ 1·02	
April 2, .	+ 0·57	+ 3·95	— 8·27	+ 0·38	. .	+ 17·35	+ 20·81	+ 0·81	
" 9, .	+ 0·14	+ 4·47	— 8·33	+ 2·31	. .	+ 17·19	+ 20·24	+ 0·59	
" 16, .	— 0·34	+ 4·71	— 8·33	+ 1·02	. .	+ 17·02	+ 19·74	+ 0·31	
" 23, .	+ 0·14	+ 4·51	— 8·36	+ 1·17	. .	+ 17·24	+ 20·31	+ 0·81	
" 30, .	— 1·64	+ 4·61	— 8·35	+ 1·31	. .	+ 17·52	+ 20·24	+ 0·95	
May 7, .	+ 1·93	+ 3·76	— 8·34	+ 1·67	. .	+ 18·31	+ 20·67	+ 0·83	
" 14, .	— 0·36	+ 3·43	— 8·33	+ 1·52	. .	+ 18·01	+ 21·72	+ 0·96	
" 21, .	— 0·64	. * .	— 8·34	+ 1·98	. .	+ 18·13	+ 21·83	+ 0·95	* Transferred to U. S. Ship Delaware
" 28, .	— 0·36	. .	— 8·346	+ 2·15	. .	+ 17·95	+ 21·65	+ 0·95	
June 4, .	— 0·21	. .	— 8·35	+ 1·74	. .	+ 18·78	+ 21·44	+ 1·01	
" 10, .	— 0·28								Vincennes arrived.
" 11, .	. .	. .	— 8·35	+ 2·29	. .	+ 19·23	+ 22·01	+ 1·24	
" 18, .	. .	. .	— 8·35	+ 2·23	. .	+ 19 08	+ 21·29	+ 1·51	
" 25, .	. .	. .	— 8·35	+ 2·65	. .	+ 18·51	+ 22·01	+ 1·72	
July 2, .	. .								Oregon arrived.

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETERS ON BOARD THE RELIEF.				REMARKS.
	R. 2066	R. 656	R. 1839	R. 2075	
1838.					
Aug. 16, ...	— 1·723	+ 9·255	— 4·133	+ 7·974	At Norfolk.
" 24, ...	— 1·723	+ 8·73	— 4·89	+ 7·19	
" 31, ...	— 1·579	+ 9·36	— 4·65	+ 7·42	
Sept. 7, ...	— 1·572	+ 9·06	— 4·65	+ 7·21	
" 14, ...	— 1·243	+ 9·35	— 4·58	+ 7·35	
" 21, ...	— 1·160	+ 9·71	— 4·51	+ 7·49	
" 28, ...	— 1·145	+ 9·77	— 4·58	+ 7·35	
Oct. 5, ...	— 1·136	+ 9·63	— 4·51	+ 7·38	
" 12, ...	— 1·075	+ 9·92	— 4·43	+ 7 68	
" 19, ...	— 1·010	+ 10·13	— 4·51	+ 8·13	
" 26, ...	— 0·923	+ 10·85	— 4·36	+ 8·49	
Nov. 2, ...	— 0·87	+ 10·92	— 4·21	+ 8·42	
" 9, ...	— 0·81	+ 11·27	— 3·93	+ 8·71	
" 16, ...	— 0·72	+ 11·42	— 3·60	+ 8·28	
" 23, ...	— 0·67	+ 11·42	— 3·36	+ 8·42	
" 30, ...	— 0·61	+ 11·06	— 3·03	+ 8·13	
Dec. 7, ...	— 0·53	+ 10·63	— 2·91	+ 7·92	
" 14, ...	— 0·48	+ 11·49	— 2·87	+ 8·28	
" 21, ...	— 0·49	+ 12·41	— 2·89	+ 9·81	At Rio Janeiro.
" 28, ...	— 0·48	+ 12·81	— 3·36	+ 9·54	
1839.					
Jan. 4, ...	— 0·46	+ 12·01	— 3·63	+ 8·51	
" 11, ...	— 0·43	+ 12·01	— 3·34	+ 8·72	
" 18, ...	— 0·43	+ 11·51	— 3·77	+ 8·22	
" 25, ...	— 0·43	+ 11·29	— 3·92	+ 7·94	
Feb. 1, ...	— 0·42	+ 11·08	— 4·36	+ 7·58	
" 8, ...	— 0 41	+ 11·29	— 4·24	+ 7·58	
" 15, ...	— 0·40	+ 11·22	— 4·28	+ 7·51	
" 22, ...	— 0·41	+ 11·65	— 4·06	+ 7·79	
Mar. 1, ...	+ 0·53	+ 12·41	— 4·01	+ 8·03	At Orange Harbor.
" 8, ...	+ 0·56	+ 12·43	— 3·47	+ 8·60	
" 15, ...	+ 0·63	+ 13·00	— 3·11	+ 9·06	
" 22, ...	+ 0·81	+ 12·39	— 3·39	+ 8·57	
" 29, ...	+ 0·81	+ 12·74	— 3·04	+ 8·92	
April 5, ...	+ 0·94	+ 13·39	— 2·47	+ 9·71	
" 12, ...	+ 1·17	+ 13·96	— 2·47	+ 10·03	
" 20, ...	+ 1·27	+ 13·84	— 2·53	+ 10·15	
" 27, ...	+ 1·35	+ 14·21	— 2·02	+ 10·57	
May 4, ...	+ 1·37	+ 14·81	— 1·45	+ 11·24	
" 11, ...	+ 1·26	+ 15·51	— 1·13	+ 11·87	
" 18, ...	+ 0·97	+ 15·55	— 1·34	+ 11·99	
" 25, ...	+ 0·84	+ 15·15	— 1·41	+ 11·51	
June 2, ...	+ 0 84	+ 15·79	— 2·05	+ 11·59	At Callao.

RATES OF CHRONOMETERS.

UNITED STATES EXPLORING EXPEDITION.

DATE.	CHRONOMETER RATES.				REMARKS.
	R. 2066	R. 656	R. 1839	R. 2075	
1839.					
June 9,	+ 0·82	+ 15·03	— 2·46	+ 11·30	
" 16,	+ 0·61	+ 15·12	— 2·26	+ 11·17	
" 23,	+ 0·57	+ 14·94	— 2·42	+ 11·08	
" 30,	+ 0·42	+ 14·91	— 2·40	+ 11·02	
July 7,	+ 0·40	+ 14·97	— 2·43	+ 10·71	
" 14,	+ 0·43	+ 14·84	— 2·21	+ 11·11	
" 21,	+ 0·46	+ 15·62	*	+ 11·71	* Transferred to Vincennes.
" 28,	+ 0·41	+ 16·77		+ 12·17	
Aug. 4,	+ 0·37	+ 17·09		+ 12·38	
" 11,	+ 0·39	+ 17·10		+ 12·82	
" 18,	+ 0·41	+ 16·46		+ 12·96	
" 25,	+ 0·33	+ 16·08		+ 12·54	
Sept. 1,	+ 0·25	+ 15·96		+ 12·01	
" 8,	+ 0·12	+ 15·74		+ 11·82	At Sandwich Islands.
" 15,	+ 0·25	+ 15·63		+ 12·04	
" 22,	+ 0·37	+ 15·82		+ 12·09	
" 29,	+ 0·54	+ 16·05		+ 12·26	
Oct. 6,	+ 0·87	+ 15·91		+ 12·17	
" 13,	+ 1·10	+ 16·12		+ 12·92	
" 20,	+ 1·22	+ 16·78		+ 13·01	
" 27,	+ 1·33	+ 16·21		+ 12·72	
Nov. 3,	+ 1·36	+ 16·47		+ 12·57	
" 10,	+ 1·37	+ 16·67		+ 12·73	At Sydney, N. S. W.
" 17,	+ 1·45	+ 16·82		+ 12·66	
" 24,	+ 1·50	+ 16·83		+ 12·83	
Dec. 1,	+ 1·57	+ 16·75		+ 12·46	
" 8,	+ 1·63	+ 16·31		+ 12·37	
" 15,	+ 1·69	+ 16·59		+ 12·46	
" 22,	+ 1·83	+ 16·52		+ 11·69	
" 29,	+ 2·10	+ 16·72		+ 12·01	
1840.					
Jan. 4,	+ 2·0	+ 16·33		+ 12·19	
" 11,	+ 2·12	+ 16·47		+ 12·34	
" 18,	+ 2·3	+ 16·29		+ 12·29	
" 25,	+ 2·2	+ 16·36		+ 12·81	
Feb. 1,	+ 2·1	+ 16·42		+ 13·06	
" 8,	+ 2·21	+ 16·81		+ 12·67	
" 15,	+ 2·3	+ 16·69		+ 12·43	
" 22,	+ 2·4	+ 16·35		+ 12·21	
" 29,	+ 2·5	+ 16·66		+ 12·39	
Mar. 7,	+ 2·6	+ 16·87		+ 12·65	
" 14,	+ 2·7	+ 16·71		+ 12·42	
" 21,	+ 2·5	+ 16·67		+ 12·26	
" 28,					Arrived in United States.

CHAPTER III.

PASSAGES.

It was found necessary to insert in the Narrative some general remarks connected with the Hydrography of the Expedition: the detailed information belongs to this volume. In treating of the passages from port to port, I shall follow the order of the cruise, believing it to be the most useful as well as the most convenient for reference. At this day it may seem superfluous, or be deemed a work of supererogation, to make any remarks on the passage across the Atlantic, a sea so much frequented: yet, strange as it may appear, there is no part of the ocean where so many vigias are laid down on the charts, and of which the accounts that have been published are so contradictory, or in which there appears to be so great a necessity for a thorough examination, to set at rest the doubtful points, as the Atlantic. This state of things seems to be tolerated by nautical men, who appear averse to record or publish any observations that might tend to illumine the paths of those who may pass after them, so that almost all navigators are left to derive their knowledge from their own, oftentimes dear-bought, experience.

The recent publication of charts, by the Hydrographical Bureau, on which are laid down the tracks of vessels, has had the effect to direct attention to this subject. It would have been desirable if the "dead reckoning" as well as the true daily positions had been laid down on the charts, to show the currents, as well as the errors arising from bad steering, &c. The tracks may give the approximate route of a vessel, but all navigators are aware how great are the daily and unaccountable discrepancies, and how many causes combine to render the courses and position of a vessel uncertain on the ocean.

CAPES OF VIRGINIA TO THE CAPE DE VERDE ISLANDS.

From the 18th of August to the 7th of October, 1838.

The passage first in order is that from the Capes of Virginia to the Cape de Verde Islands. It was remarkable as illustrating the length of passage caused by a difference of routes across the Atlantic.

It was my intention to pass into the Gulf Stream, and continue in it as long as it lay in my power, but the winds not permitting us to pursue that course, we were compelled to pass outside of it. I feel satisfied that it would have expedited our passage to Madeira, had we kept within it, but the temptation of steering within a few points of our course, which the wind permitted, prevailed, and we continued our route without it, though nearly parallel to its direction, receiving but little aid from it, and experiencing variable currents and light winds, but, at the same time avoiding exposure to the heavy August gales, which were to be expected, and from the experience of many are believed to be much more severely felt within its limits, and are extremely dangerous from the effect of the current, which renders the sea higher and shorter.

The Relief parted company when four days out, with orders to make the best of her way to the Cape de Verde Islands. Lieutenant-Commander Long chose a direct route across the Atlantic, between the parallels of 32° and 34°, and continued it until he reached the longitude of 37° west, after being out 37 days. During all this time they were scarcely able to steer their course, but were constantly annoyed by light and head winds with opposing currents; after this, easterly winds prevailed, until within a few days sail of the port, preventing her from reaching her destination until after a lapse of 60 days.

The Relief was not to be classed among fast sailers, but it is believed will bear a fair comparison with ordinary merchant vessels that carry a large cargo. At any other season, it is probable she would have made better time; but when the sun is approaching the northern tropic, there is little doubt in my mind that the result must be the same, by pursuing a similar route; light and variable winds will always then be found to prevail, and as far as this passage serves, it proves that they generally prevail from the east instead of the western quarter. The log-book of the Relief only mentions her having set studding-sails on 13 days.

The route which I took with the squadron was between the 37th and 38th parallels, to the Azores, some 200 miles to the northward of that of the Relief. Here we find a totally different state of things. The wind was fair 16 days out of the 28, and we only encountered adverse winds during 6 days; and I am under the impression that, had our passage been made on a more northern parallel, we should have shortened it by having more wind and deriving greater assistance from the Gulf Stream; indeed, as a proof of it, the Peacock, after parting company, kept about a degree to the northward of the Vincennes's track, and reached the Azores two days before us, but was detained longer in consequence of passing between the islands of this group.

On this passage the position assigned St. Anne's Shoal, as well as a vigia in lat. 38° 8′ north, long. 34° 3′ west, was visited, and no appearance of either found. I have mentioned in the Narrative my belief that many of these shoals and vigias, which have obtained a place on our charts, result from encountering large trees in boisterous and thick weather, or during the night. It would appear likely that they should be met with hereabouts, having been brought by the currents or Gulf Stream, and for a time remain floating in this part of the ocean. In this longitude (42° west), we encountered many pieces of drift-wood, as well as large trees, which were of a deceptive appearance until closely approached.

The course to be pursued in passing the Azores bound to the eastward, is to give them a wide berth, to the northward or southward; the former in the winter months, the latter in the summer months, when the winds incline mostly from those quarters, by which a steady breeze will be secured in the neighborhood of these islands, when it is often interrupted and variable nearer them; the strong currents would also be avoided by keeping at a distance.

The position of the Tulloch Reef was passed near to, reported in the neighborhood of the Formigas Rocks as long ago as 1808, and said to have been seen several times since. In 1829, it was diligently sought for by H. M. S. Ariadne, expressly sent for that purpose, without success. We also have to report its non-existence.

The approach to Madeira is generally shaped for the purpose of doubling its eastern end, and thus taking advantage of the prevailing winds to reach the roadstead of Funchal with the least delay. There are seasons when the winds permit an approach from the westward: this being the case at the time of our visit, I took advantage

of it, in order to save time, and by standing close along the southern shore of the island, favored with a gentle breeze from the southwest, we were wafted by sunset to our anchorage in the roadstead. Ordinarily this is not an advisable course to pursue, as a large vessel may be sometimes becalmed, or meet with baffling and light airs, in passing under the high land, and be unable to reach an anchorage. It is better to approach from the eastward when the northeast winds prevail. During June, July, and August, a day and upwards may be saved in reaching the port. Captain Hudson, in the Peacock, took the eastern route, anticipating a leading wind to the anchorage: on the north side of the island he found the wind northwest, and as he proceeded round the east end it became southwest, which caused him to stand well over towards the Deserters, where the wind was baffling and squally, with a current setting to the south and east.

It may be as well here to notice that the best anchorage in the roadstead is limited to the range of the Loo Rock with the Castle on the Hill; you then avoid the declivity of the bank to the eastward, which deepens suddenly, and have a good depth of water to anchor in, from a half to one mile out. Not having been aware of this, I anchored further to the eastward than this range, and was obliged to change to a place of more safety the next morning. I mention this circumstance in order that others, on their first visit to this port, may not fall into a like error.

The Peacock and Flying-Fish both came east about, and reached the roadstead the next day. The current which prevailed in the roadstead during our stay, was from east to southeast, varying from half to one mile per hour; the winds were light and variable, generally from the southward and westward.

At Madeira it is scarcely requisite to inform the navigator that all kinds of provisions may be had to recruit, but it is a bad place to effect repairs in.

From Madeira we steered to the southward, with the intention of passing over the positions of several reported shoals. The winds, in our passage from Madeira to the Cape de Verdes, were light, though favorable. We did not obtain the trades until we had reached the latitude of 26° north. They had previously been found to prevail in veins, generally springing up fresh for a few hours, and then dying away to nearly calm. There appears to me great necessity for taking advantage of all these spirts or cat's-paws; the greatest atten-

tion is required in keeping the ship on her course, to secure all the progress possible, as a mile, or even a smaller distance, in position, may make a great difference in time when a favorable breeze is taken, and the voyage is accelerated or retarded accordingly.

The winds on this route, from latitude 29° to 27°, are no doubt somewhat influenced by the proximity of the Canary Islands, and the approach to the trade winds. I am satisfied that attention to the trimming of the sails and sailing of the vessel, whilst passing through these latitudes, will greatly expedite a voyage.

We encountered on this passage, between latitude 24° 30′ and 18° 25′ north, on the meridian of 20° 40′ west, an extent of 360 miles of water as green as that of but 50 fathoms in depth. In passing through it, we repeatedly sounded in from 150 to 300 fathoms, without obtaining bottom.

The width of this discolored water I have ascertained to be about 150 miles, on the parallel of 21° north latitude. In passing into it the temperature fell 2° of Fahrenheit, and rose the same amount on passing out. The line of demarcation was very well defined, the sea on either side being of a deep blue. It was noticed in the voyage of Frazer, in 1712, but, considering the great number of navigators who have since traversed that part of the ocean, it does not seem to have been often observed. There seems to be an impression by those who have noticed it that soundings could be had, but the lead has been often tried, as was the case with us, to various depths, without success. Many have imputed the discoloration to animalcula, but I am confident that this was not the case at the time we passed through it, for careful examination failed to discover any in water taken from the surface as well as that from a depth of fifty fathoms; and I would also urge against its being the effect of animalcula, the long continuance of it in the same place. Whether it is the reflection of the bottom, as some suppose, or a peculiarity of the surface waters, emanating from the rivers of Africa, I leave for others to decide; it is a phenomenon well worthy of investigation. While in it we saw no phosphorescence of the water, but on passing out, it was very evident. To determine its actual limits, both in breadth and width, is a work of no great difficulty, and if observations were repeated, in a few years the question would be settled as to its being permanent.

In the Pacific as well as Atlantic Ocean there are many places of discolored waters, betokening banks of large extent, which have served

useful purposes in navigation. The discolored water to windward of Barbadoes and that of the False Brazil Bank are well-known examples.

The deep sea temperature at the depth of 350 fathoms was 23° less than that of the surface.

The reputed shoals, on which it is said the Maria and Bon Felix struck, are on this route; the former is said to be in latitude 19° 45′ north, longitude 20° 50′ west, and the latter in latitude 19° 20′ north, longitude 20° 37′ west. Both of these situations were passed over, by the squadron, in the manner I have before described, and the examination of the localities fully satisfied us that no such shoals exist where they are laid down. It is to be hoped that this evidence will have the effect to erase these supposed dangers from the charts.

On this passage we found the current trending to the northward and eastward, from one-half to five-eighths of a knot per hour, but there was none most of the time. Many navigators give it as setting to the southwest. The set of the ship by current in the whole passage was found to be north 57° east, 42 miles in 13 days.

The Bonetta Rocks, in latitude 16° 32′ north, longitude 20° 57′ west, said to lie to the eastward of Bonavista, and nearly in our track, I determined to make search for. Although the account given in Purdy's Atlantic Memoirs appeared so well authenticated, and the failure to find them after so diligent a search as that made by H. B. M. Ship Leven, Captain Bartholemew, left but little hope of our being more successful, yet I considered the sweeping over the locality with the squadron would be, as I have before stated, still more satisfactory; we therefore passed over this locality, as well as an area of ocean of from 40 to 50 miles in extent in the neighborhood, with the lead continually going to the depth of from 60 to 70 fathoms, and good look-outs both below and aloft, the sea being quite smooth; we also, after having passed over the position assigned them, continued to steer on their reported bearing, towards the island of Bonavista, but saw nothing of them. It appears that in the year 1841, the British Ship Charlotte was wrecked on a shoal which was reported in latitude 16° 17′ north, longitude 22° 21′ west; the nearest we approached this position was eighty-two miles, on a bearing of north 79° west. I am still inclined to doubt the accuracy of this position, as it appears to have been passed over by H. B. M. Ship Leven in her search. Should the rocks be hereafter seen, I have little doubt that their true position will correspond to that of the Hartwell Reef, on which a ship of that name, and the Madelaine, were both lost.

In this neighborhood we encountered many tide rips, and found the current, on trial, to set northeast by north three-quarters of a mile per hour.

Formerly it was deemed equally feasible as well as more advantageous to pass to the eastward of the Cape de Verdes, to be enabled to cross the equator on a more eastern meridian. Vessels now seldom pursue this route, unless they have similar intentions with ourselves, viz., to touch at St. Jago.

Experience has proved that the best course for vessels to take that are bound across the line, is to pass some distance to the westward of San Antonio; some, however, still prefer sighting this island, to ascertain that the rates of their chronometers have not altered.

Before leaving the Cape de Verdes, and as somewhat connected with the interests of navigators, I may call attention to the remarkable dry haze that frequently envelopes these islands, which renders all objects indistinct, and at times entirely obscures the horizon, so as to make it impossible to get observations with accuracy. Our observations place the fort at Porto Praya in latitude 14° 53′ 45″ north, longitude 23° 30′ 55″ west.

The supplies for ships at Porto Praya are not to be depended upon, if required in a short time; indeed, they are, at times, very difficult to be had, the cultivation of late years having been much neglected, in consequence of the few vessels visiting it, and the small demand in comparison to what it was formerly.

The magnetic variations decreased with regularity from Madeira to the Cape de Verdes, viz., from 24° to 17° westwardly.

FROM THE CAPE DE VERDES TO RIO DE JANEIRO.

From October 8th to November 20th, 1838.

On leaving Porto Praya, my intention was to pass over the position of several shoals, which were embraced in my orders, and which lie on the route of ships in the part of the ocean we were to traverse. I was, therefore, not particularly anxious to cross the equator on any particular meridian, but to be governed more by the opportunities I might have of making our search as effectual as possible, without losing too much time.

We lost the northeast trade winds the day after we left Porto

Praya, when we were in 12° 24′ north latitude, and 23° 45′ west longitude, and experienced squalls, with much rain and lightning. On the 23d of October, the Relief lost the trades in 11° north, and on the meridian of 22° west. The Danish Brig Lion, which vessel we spoke, had lost the southeast trades in 6° 30′ north, and the Ship Crusader likewise informed us that she had lost the trades in 7° 30′ north, both having crossed the line between 22° and 27° west longitude.

Patty's Overfalls was the first supposed danger we steered for, in longitude 24° 30′ west, and latitude 11° 02′ 18″ north. On the 11th of October, we reached this position, and we were in its neighborhood for forty-eight hours. Various tide rips were encountered, trending east and west, but no current was found to exist, either by our observations, or by the trial with the current log; so that I feel satisfied that Patty's Overfalls does not proceed from reefs or shoals. At other seasons there may be an appearance of broken water, but there are no dangers existing.

It was with some difficulty we reached the position of Warley's Shoal, in latitude 5° 04′ north, and longitude 21° 35′ west. We examined this locality thoroughly, but without success. From the manner of our search, I am well satisfied it does not exist in the position assigned it.

The westerly wind which we found in this latitude enabled us to run to the eastward as far as longitude 13° 53′ west, to look for the French Shoal. The positions assigned it by both French and English hydrographers were passed over, the first in latitude 4° 05′ north, longitude 20° 35′ west, and the second in latitude 4° 15′ north, longitude 19° 20′ west.

When we had reached 5° north latitude, we passed out of the sultry and damp weather that we had been subjected to for twenty days. Since we had lost the northeast trades, in 12° north latitude, we had comparatively little rain, and the expectation of filling our water-casks were not realized. I mention this circumstance, as I find from investigation, that there appears to be less rain in October and November, than other months of the year; therefore, those who pass at one season, and obtain a supply, may be disappointed in another. About the equinoxes, particularly the vernal, more rain falls than at other times. The quantity of rain that fell during this passage, was only 6·15 inches, and the greatest fall in 24 hours was 1·95.

As we approached the southeast trades we had a long swell from

the south-southeast, which gradually grew more perceptible until we reached them. We crossed the equator in 17° west, and sounded for the Triton Bank, under the longitude of 17° 46′ west, and latitude 0° 32′ south, keeping the lead constantly going; but no appearances of a shoal, either in the color of the water, tide rips, or soundings, were perceptible. The current setting to the northward had influenced us very considerably for the last few days before reaching the equator.

In passing through this space between the north and south trades, we observed the upper strata of clouds passing rapidly from the eastward.

From the number of rips encountered, and the variation of the temperature of the water from 3° to 5° between them, I suspected that a current of some magnitude existed; but after making frequent trials, it was found of very little strength, and running to the east-northeast.

The winds, until we reached the equator, prevailed from south-southwest to south-southeast, generally light, inclining to calm; those experienced by the Relief were very similar 15 days later.

The set by current of the squadron from Porto Praya to the line, in 24 days, was north 25° east 132 miles. The Peacock experienced it north 56° east 144 miles in 23 days, and the Relief north 48° east, 203 miles in 25 days.

A variety of opinions have always been held on the subject of the best meridian on which to cross the equator; I propose to say a few words upon it, having found it almost impossible to arrive, after examining all of them, at any satisfactory result. In my opinion, the season of the year ought alone to be the guide; that which controls more than anything else, being the monsoons of the coast of Brazil. During the prevalence of the southerly monsoon, it is extremely disadvantageous to cross the line too far to the westward, for after being so fortunate as to pass Cape St. Roque, the prevailing winds may be found to the southeast, and sometimes as far as south, thereby driving a vessel upon the coast, and subjecting her to tack to the eastward again, and consequently to a very long and tedious passage. On the other hand, during the northerly monsoon, a vessel pursuing a more westerly route would meet with no detention, but, on the contrary, having the wind to the northward and eastward, at times as far as north-northeast, she would be enabled to make rapid progress, with a free wind on a line parallel with the coast. It is thus evident that the equator may be

passed well to the westward, if the sun is advancing to the southward, but, on the contrary, it is always safer to navigate well to the eastward during the advance of the sun to northern declination. These directions are intended for all kinds of vessels, as well the slow as the fast, and notwithstanding the latter may pass with less difficulty, yet it is beyond a question that even with them a much quicker passage would be the result of taking the most favorable route. Another reason is to be found in the necessity there seems to be to avoid entering the great Equatorial Stream before reaching the equator. We found it cutting the equator about the meridian of 18° west, at an angle of fifty degrees; and although our experience may not determine its actual northern boundaries at all times, yet it is probable it does not vary very much from that here given; consequently, vessels passing the equator in a more western longitude, would enter it before reaching the equator, and be subject to its influence much sooner. By taking a course to the eastward, it would be entered later; but it is to be considered whether the opposing northern current, in a more eastern longitude, is not as disadvantageous. On the other hand, by crossing at the meridian of 18°, it is evident that the Equatorial Stream would not be encountered until the winds from the southeast had become so well established, that its influence would be less felt, and it would have but comparatively little effect on a vessel, until she had the means of quickly passing beyond its influence, and therefore be subject to it the shortest possible time; on this account I am decidedly of opinion, that, taking the winds and currents into consideration, the nearer a vessel, bound to the south across the equator, can cut the meridian of 18°, the better, at all seasons of the year, though during the favorable monsoon I would myself try, and even recommend, a more western meridian.

Much has been said about "*Great Circle Sailing*," and it has been recommended particularly on this route. Although I do not wish to dispel the illusion, or to detract from the merits of the officer to whom is assigned the origin of "Great Circle Sailing," I cannot but do justice to the prior right of Mr. John Garnett,* a distinguished mathematician, of New Brunswick, New Jersey, whose devotion to nautical science was well known, and who edited and published the first edition

* In the Tran. Am. Phil. Society, vol. vi, p. 303 (Old Series), August 25th, 1807, is a notice by Mr. Garnett, of the "Principle of Sailing in the Arc of a Great Circle," with a Chart, for which he was awarded the Magellanic Gold Medal.

of the American Nautical Almanac in 1815, and a set of highly useful nautical tables in 1816, and also a large chart, showing the projection of the "Great Circle Sailing," under the title of "Loxodromic Curve," copies of which I had the honor of presenting to the Honorable Secretary of the Navy from the author, on my first entrance into the navy. By claiming a prior right for a distinguished mathematician, a friend and associate of Adrain, Vateck, Fulton, and other distinguished mathematicians and mechanicians of our country, I only desire to restore to one, and to claim for him the original investigation of this subject, and publication of the chart. I am well satisfied there are few parts of any ocean in which the loxodromic curve can or ought to be attempted; and although the route from the United States to the Brazils is one of those on which it is strongly recommended, I think there are sufficient reasons why vessels should not attempt it. Many have failed entirely, others have but partially succeeded, whilst others, again, have made quick passages. Those voyages which I have examined have derived all their advantages from gaining the line at the most favorable time to take the northeast monsoon of the coast of Brazil, which is fallen in with sometimes as far as 5° to the north of the equator, and at times the wind veers as far to the northward as north-northwest; thus giving vessels, though close to the coast of Brazil, a favorable opportunity to make the passage the whole distance almost on a loxodromic curve, or the shortest distance between two points,—evidently the most desirable to be sought for, or taken, if possible; yet there are few routes across the ocean where the winds will permit its being taken to advantage at all seasons, except within the trades: these passed, the variables succeed, and change so rapidly, that it is next to impossible to pursue, for any length of time, a course on any loxodromic curve.

From the equator to 3° south, the set by the Equatorial Stream was south 69° west 75 miles, while from latitude 3° south, longitude 20° west, to latitude 13° south, longitude 30° west, its set was north 80° west, 100 miles; thence to the latitude of Cape Frio it was to the southward and westward. The amount of current between the equator and Rio was north 82° west 300 miles. The greatest set we experienced between latitude 10° north and 13° south, was on the meridian of 26° 30′ west, 30 miles a day, nearly west.

The position of Bouvet's Sandy Isle was passed over, but nothing whatever was seen of it. As it was my intention to examine the posi-

tion of Krusenstern's Volcano, I limited the search under the equator to the twentieth degree of west longitude, as I was apprehensive the Equatorial Current might render it impossible to reach its assigned position in longitude 20° 41′ west, and latitude 2° 53′ south. The squadron passed over the locality three times, in different directions, but saw no indications of a shoal.

We were 25 days in reaching the equator, and 20 days from the equator to Rio de Janeiro.

Very great differences occur in estimating the latitude to which the southeast and northeast trades extend, arising no doubt from sailing to or from them; in both cases great allowance is to be made for the want of accurate observation, and disappointment often experienced in losing or meeting them. As respects my own experience on this voyage, and from information obtained, navigators give the latitude where they lost the southeast trades, too far to the north, and in sailing in an opposite direction, too far to the south; therefore, we find several degrees of difference assigned the trades at the same period, when they could not have altered to any extent. The condensed table which Horsburgh gives as the result of his examination of 238 voyages shows this fact; without this explanation his long list would be of little use, but with it, it becomes perfectly intelligible. Although many of his sailing directions have been superseded, yet the debt that all seamen owe to this great navigator is not to be measured. Few men have done so much for the commerce of the world; and his industry in obtaining nautical information and compiling sailing directions, has been the cause of preserving many lives, and a vast amount of property.

In crossing the space between the northeast and southeast trades, the changes of wind are at times sudden, and require constant attention; sometimes severe and rapidly shifting squalls are experienced: one of them happened to us in latitude 9° 30′ north. The squadron was sailing in close order, with a fresh breeze from the southeast, when the vessels were taken suddenly aback by a squall from the southwest; in a few minutes we had the wind from different quarters, so that it required during the time it lasted, good management of the vessels to avoid running into each other.

The approach to Cape Frio may be said to be safe at all times, the lighthouse now established affording all necessary facilities to the navigator to advance without fear or apprehension at night. When

the light cannot be seen from haze or thick weather, the soundings, as well as a fall in the temperature of the water, will indicate a proximity to the land. The soundings extend some 25 miles, and are of ooze and shells. The lighthouse on Cape Frio we found to be 1285 feet above the level of the sea, placed on the highest peak of the island, and often enveloped in mists and clouds. Its position appears to have been chosen that it might be seen from as many points as possible. It is a revolving light, and can be seen distinctly from 30 to 35 miles in clear weather. As this is a point which is always made by our ships, and from whence their departure is usually measured, it was deemed important that its correct position should be ascertained: this was effected by connecting it with the observatory on Enxados Island, the position of which had been determined by a series of moon-culminating stars. Sound was employed as the most convenient and expeditious mode to measure the meridian difference: the result placed the lighthouse on Cape Frio in longitude 42° 00′ 13″ 87‴ west.

It has been generally supposed that it was necessary for vessels to await a favorable wind to enter and depart from Rio Janeiro, but this is a mistake; there is no difficulty whatever in vessels departing or entering, at any hour and with any wind and favorable tide: the best time, however, to enter is during the day, when the sea-breeze is fresh: it ordinarily dies away at sunset, and then remains calm until an early hour in the morning, when a gentle land-breeze prevails until about 9 o'clock.

So safe and free from danger is this harbor, that pilots are unnecessary, but it is requisite to pay attention to the tides, which at times run with great velocity. There are times, too, when heavy squalls prevail, from the southwest to northwest, which sometimes blow with violence, and I have been informed that a heavy sea has been experienced at the anchorage in the harbor, so much so as to prevent any landing at the Great Quay, and rendering it necessary for boats to seek the upper or mercantile harbor to land, where it is practicable at all times. Vessels lie at anchor, and lighters are employed to land all goods, thereby causing a detention, as well as expense, in discharging the cargoes.

The situation of the upper harbor is well adapted for the erection of wharves, and they might be constructed with little expense, and

would be entirely protected from the influence of the winds and sea by the small islands of Enxados and Cobra.

The tide in the harbor of Rio ebbs and flows 4½ feet, and it is high water at 2^h 15^m P. M. full and change. A tide-staff was kept during the time of our stay, and marked hourly, night and day. The ebb often runs very nearly the whole day, and is always represented as much stronger than the flood.

Vessels after leaving the harbor of Rio would do well to follow the example of the coasters, and stand down along the northern shore towards Cape Frio, for they would thereby not only preserve the land-breeze, but also be assisted by the counter current which sets along the shore, and save much of the time that is frequently lost by standing off to the southward and eastward, when not only contrary winds are met with, but frequently calms of some duration. The coast is free from dangers, and a vessel of any size may approach it within a short distance. The light on Raza Island we found to be a brilliant revolving light, showing alternately a deep-red and white light.

The port regulations of Rio are somewhat unfavorable to trade, and the number of holidays interfere with the desirable despatch in the loading and unloading of vessels, but as the commerce of this region is rapidly on the increase, it is believed that a better system will ultimately prevail.

Every kind of supplies may be had here, and generally at reasonable prices.

FROM RIO DE JANEIRO TO THE RIO NEGRO.

Between the 6th and 25th of January, 1839.

On the 6th of January, 1839, we got under way and dropped down the bay, but the breeze in a short time left us, and we were obliged to drop our anchor until the sea-breeze set in, which we were favored with at about 10 o'clock, when we made sail and beat out of the harbor with the last of the ebb tide. In the afternoon we anchored outside the bar, in 20 fathoms, white sand, owing to the breeze failing, as well as to await the return of one of the tenders, which I had despatched back to Rio on business: the time was, however, usefully employed in measuring the altitude of the Sugar Loaf. It continued calm until the next afternoon, when the sea-breeze was so light, that

I determined to await the land-breeze, which came off at an early hour in the night, when we made sail, and stood to the southward. On the 9th we had heavy showers, with lightning, but no thunder, succeeded by a southeasterly wind, and a reduction of temperature, which gave us great relief, as we had been suffering from the heat for the last eight months. On the 11th, when we had reached the latitude of 30° south, the air had assumed a very perceptible change in respect to its hygrometric state, being now much drier, and giving a feeling of more elasticity than we had experienced for some months. We had fine weather, with the wind from the northward and eastward, increasing towards evening. On the 15th, we had reached the latitude of 34° south and longitude 51° west, just to the northward of the Rio de la Plata. The current previous to this time had been experienced to the southward and westward, and as we were now on soundings in 80 fathoms, of ooze, the current was tried by anchoring a boat, and was found to be setting north-by-west 6 fathoms.

On the 18th January, the twelfth day from Rio, in latitude 37° south, longitude 52° 40′ west, we passed into the discolored water of the Rio de la Plata. The line of demarcation on entering it was very distinct, and its temperature 4° less than the surrounding ocean. We continued in it until after passing to the southward of the latitude of the La Plata, being about 80 miles in width. To the northward of latitude 40° we again struck soundings, in 55 fathoms, which proved to be sand. From this it is probable that the ooze deposit of the river has spread over an area of great extent north and south.

The great fall of temperature, both in the water and air, which we experienced in latitude 40° south (some ten degrees), with thick fog, led me strongly to believe that we were in the immediate vicinity of icebergs, which have often been seen in this latitude, and longitude 50° west. Commodore Wadsworth, in the Vincennes, on a former cruise, encountered them in latitude 39°, and longitude 54°, and had great difficulty in escaping from them; on this point navigators should be cautious at this season of the year (January). The best course to pursue in order to avoid the ice, I am satisfied, is to keep near the Patagonia coast. Ice has been seen in great quantities to the east of the Falkland Islands, and although commonly in the form of field ice, yet it is dangerous, requiring the greatest care on the part of the navigator. By taking the open sea to the eastward, instead of getting out of it, the probability is it would be encountered in much greater quan-

tities. As far as my inquiries went, I satisfied myself that when met with on the edge of soundings it will be found to interrupt the navigation more seriously to the eastward than along the coast.

Our run towards the Rio Negro was attended with fine weather, and after reaching the parallel on which the Ariel Rocks were believed to exist, and to the eastward of the longitude, we sailed two degrees to the west, but saw nothing of them; and from our search and that of others we feel satisfied that they have no existence. The position in which they were supposed to lie was in latitude 40° south, longitude 57° 33′ west.

As we approached the coast, we found the soundings extremely regular, varying about a fathom for every three miles. The coast at the mouth of the Rio Negro presents a low line of sand-hills. To the south of the river is a bluff 100 feet in height, of tertiary limestone, regularly stratified; to the north of Point de Maine, there is a remarkable sand-hill, called the Barrancas; and beyond are seen others, which terminate in extensive pampas.

We dropped anchor off the Rio Negro on the eighteenth day from Rio de Janeiro.

The Rio Negro is barred, and from the examinations we made and the reports of the pilots, it proved to be a shifting bar. In endeavoring to enter the former channel, without pilots, with the tenders, we grounded on the sand-bar that had recently formed, rendering it no longer practicable for the entrance of vessels. A vessel drawing more than 10 feet water cannot safely enter the Rio Negro. The best position to anchor in the roadstead is with the flag-staff on Point de Maine north 65° west, in about 9 or 10 fathoms water, within a mile and a half of the breakers, which extend in a northeast and southwest direction.

Pilots are usually found here, but in case they should not come off immediately, it is better to wait for them than to attempt to follow the directions for entering, which, from the shifting of the sands, are not to be relied upon after a flood or freshet. At the time of our visit, two poles were placed on Point de Maine, one on the hill and another near the beach; the first had several pieces nailed across it, that served for the purpose of ascending, for a look-out; these poles, kept in range, were intended as guides to lead a vessel in the deepest water over the bar, and until within half a cable's length of the point, which must then be turned short round to pass into the river. The course

by compass is northwest ¾ west. The depth of water on the bar will be found to be 13 feet, and the passage never should be attempted but at or nearly high water. The rise of the tide, at full and change, is 11 feet, and the current at the mouth of the river runs 5 knots; at the anchorage in the roadstead it was 2 knots. The tide in the river usually runs ebb 10 hours, and the flood 2 hours, but during the freshets it runs ebb the whole time. Large quantities of sand and mud are brought down, and on meeting with the ocean water, is deposited, forming extensive bars.

The roadstead may be considered at all times dangerous, but particularly so during the winter months. From May till October, southeast gales frequently blow, which are directly on shore, accompanied by a heavy sea. They are preceded by a heavy swell and thick weather, and are indicated by the barometer, which we found exceedingly sensitive to change to the south of 30° latitude. The holding-ground, composed of coarse sand, gravel, and shells, with clay, is good; and there is no great difficulty in getting off shore, provided advantage be taken of the flood tide, which sets to the windward, casting on the starboard tack.

The tide off the Rio Negro sets strong (the flood) to the southwest 5½, the ebb to the northeast 6½ hours. This is opposite to what Captain King gives it in his Patagonia directions, between Cape Blanco and Cape Virgins.

During the prevalence of northerly and westerly winds the weather is fine and the sea smooth.

Water may be obtained about a mile within Point de Maine, and after settling is considered wholesome. Supplies may also be had, but only in limited quantities; the lack of industry of the inhabitants being the cause of the scarcity, for the soil is capable of raising vegetables and fruit in abundance.

Vessels intending to visit this part of the coast would do well to seek the fine harbor of San Antonio, at the head of the bay of San Mathias, where supplies, I was informed, can be as readily obtained as at the Rio Negro. It is but about 30 miles from the town of Paula del Carmen. The charge on vessels in these ports is half a rial per ton; whale ships are admitted free for less than twenty days.

RIO NEGRO TOWARDS ORANGE HARBOR, TIERRA DEL FUEGO.

From the 3d to 17th February, 1839.

We made this passage in 13 days; it was considered a favorable one. Our route was farther off the coast than I desired, in consequence of experiencing for the first two days fresh gales from the southwest, accompanied with a heavy sea, which drove us off the coast; it would have been but lost time to have regained the coast, and followed it down on soundings. One of the squadron, the Relief, sighted the coast frequently on her passage from Rio de Janeiro to Orange Harbor, stopping for two days at Good Success Bay; she made the passage in 42 days, the same length of time taken by the squadron, although we passed eight days off Rio Negro. On the seventh day we reached the Straits of Le Maire, previous to which we passed near to, but a little to the westward of the place assigned the L'Aigle Rock: its position is given as latitude 51° 50′ south, longitude 64° 45′ west, which had been searched for previously by others without success.

The weather we met with before entering the Straits of Le Maire was boisterous, but not more so than we anticipated or had reason to expect. The winds prevailed mostly from the northward; those from the southward were dry and cold; the northerly ones brought damp and rainy weather: they change to the southward and westward by the north and west; the precursor of this change is usually a heavy bank of cumuli in that quarter. The barometer was an indicator of bad weather; but I here observed, for the first time, that the wind did not begin to blow until the mercury began to rise. Any change from the northward to the southward was attended by a fall in temperature of several degrees.

The winds on the east coast of South America for the most part prevail from the northward and eastward, or the southward and westward, and very seldom are found to remain long in the southeast; but the severest gales that are felt in these latitudes are from that quarter.

Off the coast, near Watchman's Cape, lie the Bellaco Rocks. There are two distinct rocks, bearing from each other south 17° east (true). The northernmost was seen by Captain Stokes, in 1828; he placed it in latitude 48° 30′ 50″ south, and longitude 66° 09′ 25″ west. The

Relief made it in latitude 48° 30′ south, and longitude 66° 07′ 11″ west. This I have named Stokes's Bellaco, while that which lies in latitude 48° 38′ 44″ south, longitude 66° 03′ 53″ west, about 10 miles distant, I have called Long's Bellaco. The latter was discovered by Lieutenant-Commandant Long, of the Relief, who appears to be the first navigator who saw and verified both rocks. The latter is believed to be the true Bellaco of Nodales.

Watchman's Cape should be cautiously approached, and if not required to be sighted had better be avoided, in consequence of the strong currents that prevail in its neighborhood.

To pass through the Straits of Le Maire, I would always recommend making the land to the westward with the ebb tide, but Middle Cape on Staten Land, with the flood; the reason is, that the ebb sets towards the Staten Land shore, and the flood to the Tierra del Fuego side.

Our passage through the Straits of Le Maire was effected in a few hours, although we were not particularly favored with good weather. We entered the Strait with a fair wind and all sail set, but were reduced before we left it to close-reefed topsails, in consequence of the squalls that came rushing out of the ravines of Tierra del Fuego, as we passed them. We made the land off Cape St. Diego in the morning about 8 o'clock, and by 3 o'clock we had passed through, and had Cape Good Success bearing to the northward.

Some navigators have thought proper to caution others against attempting this passage. I have carefully examined the supposed difficulties, and think they are more imaginary than real. The Strait is 12 miles wide; has no hidden dangers, and its coasts are high, and may be closely approached by any class of vessels without fear; there is, in fact, nothing to contend with but the tide, which runs occasionally with great velocity, and with a contrary wind produces a short, and sometimes a heavy sea. We were exposed, in the Porpoise, to a strong gale of wind, and passed through what has been reported as "The Dangerous Race," off both Middle Cape and that of St. Anthony, on Staten Land, without difficulty.

It is high water, at the full and change, off Cape St. Diego, at 4 o'clock, P. M. Here again we encountered the "Race," and although we were knocked about with some force while in it, yet we did not apprehend or perceive any danger. I would recommend keeping near the middle of the Strait, as the squalls or "*williwaws*" do not blow so

furiously as near the high land, nor will vessels be subjected to calms as on the western side. Good Success Bay offers a stopping-place for vessels in case the weather should prove bad. The anchorage is good during gales from the southwest, but when it blows from the southeast, the sea sets in, and it becomes rough and quite dangerous. The Porpoise and Relief stopped here: the former, on the wind veering to the southeast, was obliged to slip her cable and leave the anchorage, owing to the heavy sea. As at Rio Negro, it is necessary to slip when the windward tide is running strong.

The survey of this bay by the Beagle we found correct, but the directions are not quite so plain as is desirable. When sailing along the coast from the south, on which side it is generally approached, there is little appearance of a bay. The "Broad Road" of Cook, though given as the direction for it, is not sufficient. The first guide is the "Sail Rocks:" they lie 5 miles southwest-by-south from Good Success Bay. The two jagged, rocky heights, resembling a cock's comb, will present themselves when the bay is open to view. The best place to anchor in, is in 10 fathoms, sand and shells, a short distance outside the line of kelp, the "Cock's-comb" bearing southwest-by-west,—a berth convenient for procuring both wood and water. Scurvy-grass and wild celery, with berries, may be obtained in quantities.

The currents, from Rio de Janeiro to the Rio Negro, we found south 39° 30′ west, 167 miles. From Rio Negro to the Straits of Le Maire, north 20° east, 126 miles.

In proceeding from the Straits towards Cape Horn, I would strongly advise vessels to take the route inside of the Hermit Islands, by Nassau Bay. A vessel standing to the westward, for Nassau Bay, by keeping close to New Island, would avoid the currents, which set strong outside a line drawn from Cape Good Success to Cape Deceit, the easternmost land near Cape Horn; and even if intending to pass to the south of Cape Horn, with a contrary wind, it would be better to pursue this course. All vessels ought to beat up to this Cape within the above line, as they would thereby very much shorten their passage, and be enabled to round the Cape, or to await the first good opportunity that offered, without being subjected to the great wear and tear from an exposure to the heavy seas and strong gales that must be encountered to the south. The dangers are all visible or pointed out by the kelp; the sea is comparatively smooth, although the squalls are violent and accompanied with hail, rain, and snow; but

there is ample room for working a ship, and no danger to be apprehended from a lee shore. The winds, together with the tides, will assist very much in making progress to the west, and the smoothness of the water will avoid much wear and tear to a vessel. There are several anchorages that are convenient and perfectly safe: New Island, Goree Roads, Gretton Bay, Sea-Gull Harbor, Orange and Scapenham Bays; the latter two may be known by the "Sentry-Boxes," which are conspicuous craggy peaks behind Scapenham Bay. This course would be much more desirable at some seasons of the year than at others, and particularly during that portion of the year when daylight prevails.

In fine weather the passage outside the Hermit Islands and round Cape Horn is attended with no difficulty, and the Cape may be closely approached. The squadron was much favored, and passed within 3 miles of it.

I should not have taken the outside route around the Cape if the Admiralty Charts had been in my possession, as I very much preferred that through Nassau Bay.

The Relief had previously reached Orange Harbor, by the inner route, from Good Success Bay. She anchored for a day under New Island, where they obtained observations, by which I find an error in longitude of 6′ west, as laid down on the Admiralty Charts. As New Island is a well-defined object on which to get bearings, it is important that its position should be accurately given. The situation of Orange Harbor is easily known by Packsaddle and Burnt Islands: the former lies some 5 miles to the north, and cannot well be mistaken, from its remarkable appearance; the latter protects and forms the harbor, and is readily recognized by its smooth surface. In entering, either side of Burnt Island may be taken, but I recommend that to the north, bearing in mind that there are no dangers without the line of kelp. The best position in which to anchor is towards the head of the harbor.

Orange Harbor lies in longitude 68° 02′ 40″ west, latitude 55° 31′ south. The tide rises 4 feet, and it is high water, full and change, at 4 o'clock. The flood runs to the eastward 5 hours.

The water we procured here, although apparently highly impregnated with vegetable matter, was found quite wholesome.

It is scarcely necessary to add that it was almost impossible, from the fickleness of the climate, to get a series of observations, and that

we considered ourselves fortunate in making as many as were requisite to ascertain the rates of our chronometers.

Vessels desiring to stop for repairs, or wood and water, will find Orange Harbor far preferable to any other port on the coast. It is both convenient and safe, and affords every facility to procure those articles, as well as scurvy-grass, wild celery, and berries; and fish may be also taken in abundance. Temporary anchorage is found in the Bay outside Burnt Island. The stay of a part of the squadron in Orange Harbor for 60 days, during the months of February, March, and April, afforded us an opportunity of testing its advantages. During this time the weather was extremely changeable. The wind prevailed 47 days from the westward, 12 days from the northward and westward, and but 1 from southeast. Eleven gales of wind occurred, of from 2 to 3 days' duration. Nearly all navigators report that the summer is the best time of the year to make the passage round Cape Horn; but it is doubtful, as it would appear almost impossible for gales of wind to be more frequent than we experienced them.

But to return to the inner passage. I here speak of it in contradistinction to the outward or southern one round Cape Horn. Once having reached Gretton or Orange Bay, the first opportunity of a favorable wind and tide which offers may be taken, of passing out of the western channel, round False Cape Horn, to the southward and westward. With the wind from the northward and westward, a course may be made good to the west of Diego Ramirez, and under favorable circumstances even to reach the Ildefonso Isles. It is advisable to stand as long as possible to the west, provided a vessel does not go to the southward of latitude 58° south; if the longitude of 75° west has been reached, it would be better to stand to the northward again, and close with the coast: no apprehension of a lee shore need be entertained. All navigators who have had any experience on this coast, from Cook down, agree as to the wind not "blowing home," and the fact of the currents setting off shore to the southward would make it impossible for any vessel to incur danger, with ordinary care. When the gales blow from the westward, they seldom continue long from the same quarter, but vary from the northwest to the southwest. This offers many facilities in making the passage, and advantage should be taken of these changes, standing upon that tack which gives the best opportunity of making westing.

From a careful examination of the tracks of very many vessels that

have passed the Cape, I am well satisfied that much time, besides great wear and tear of the vessel and fatigue to her crew, will be saved by following the inner route, and continuing along the coast as far as Cape Pillar. Some objections have been made to approaching the southern shores of Tierra del Fuego, to the east of the Hermit Isles; but they are bold and high, and no hidden dangers exist to cause alarm. The danger attending the passage through the Straits of Le Maire from the velocity of "the races," caused by the tides, many deem the great objection to attempting this inner route; but I cannot conceive why, if the weather will permit carrying sail at all, there can be any difficulty in beating to the westward, within the line I have indicated, between Cape Good Success and Cape Deceit. Once up with the Hermit Islands, and being overtaken by night, it would be well to seek anchorage in either of the bays spoken of, and await daylight or a favorable time to proceed. The only inconvenience that a vessel can be put to is in getting her ground-tackle ready for use, which is not to be considered in comparison with the wear and tear, if exposed to the violent storms at the south. In nine times out of ten, the passage round Cape Horn, by taking this inner route, will be not only much shortened, but deprived of its hardships and terrors, and subject to much fewer casualties than that by the outside.

The charts of Captain King, and his sailing directions for Eastern and Western Patagonia, are admirable guides through this navigation, and are very necessary for every navigator in doubling the Cape, or when frequenting this inhospitable coast.

Captains King and Fitzroy deserve great credit for the perseverance and ability displayed in conducting the surveys in these boisterous latitudes, the results of which are embodied in the Admiralty Charts, with the directions of Captain King.

As far as our experience goes, the barometer is extremely useful, and indicates truly the weather. Those in the habit of using it in northern latitudes would be inclined to doubt it, for its indications are directly opposite; fine weather accompanies its fall, and a gale is seldom felt until it has begun to rise, when the wind veers several points and increases till it blows with great violence; this continues until the mercury has attained its ordinary height.

There is another view of this subject, that will probably show the utility of adopting this route, viz., that it places the vessel in a situa-

tion, the moment a gale has subsided, to take advantage of the short space of fine weather that succeeds, and in all probability to make the desired westing, before a recurrence of storms; for the distance to be run is but some 350 miles, and may be passed over in a very short time.

There seems some difference of opinion relative to the longitude to be reached before keeping off to the northward. In most cases, it is that of 80°, in the latitude of 57° south; but during the winter season, from April to October, as the north and northwest winds prevail in the Southern Pacific, it would be better for vessels to attain the longitude of 82° west before steering away to the northward, thus in all probability avoiding the heavy northwest winds which blow near the coast of Chili, saving much time, and sooner enjoying fine weather, which is generally less boisterous as the distance from the coast is increased. My own experience is decidedly adverse to nearing the coast, or being forced upon it by northerly winds. For nine days (from the 2d to the 11th of May), between the latitude of 40° and 47°, we had constant and unintermitting north winds.

Another argument I would urge in favor of these views is, that nearly all the disasters that have happened in passing the Cape have occurred to the eastward of Diego Ramirez, where the currents are found to have greater strength, and the winds appear to hold longer from one quarter, and do not veer, as has been noticed in the preceding remarks.

At all seasons, the navigator is well assured that he is not so liable to meet with icebergs,—one of the most serious impediments in the spring and summer months. In the year 1832, the ocean was found so covered with them that many whaling vessels, bound round Cape Horn, encountering them, put back to Valparaiso, there to await a more favorable season, considering it too dangerous to involve themselves with the numbers that were seen.

From our experience of the weather, after we left Orange Harbor, I cannot represent it as being stormy: it was boisterous, as one always must expect it to be in these high latitudes, and off the extreme end of the continent, it is subject to great vicissitudes, and the seas produced by the meeting of the waters of two great oceans are heavy.

In the Vincennes, we were but eight days in attaining longitude 78° 30′, in latitude 56° 30′ south, when we bore up to the northward. This longitude will not leave as much room as is to be desired to

weather the coast of Western Patagonia to the north of Cape Pillar. The gales that prevail during the winter season are from the west to northwest: these have a tendency to force the navigator on the coast, although there can be no apprehension of suffering from a lee shore. Yet I deem it safer to avoid the chances of it, notwithstanding I was successful in the course I took. It ought to be recollected, that after getting to the north of the parallel of 40° the most stormy latitudes have been passed, and the navigator is relieved from his excessive toil and watching.

On the whole, although the passage around Cape Horn is boisterous, I cannot bring myself to look upon it as so surrounded with dangers as has frequently been represented, and do not believe that the great precautions recommended to be taken are necessary; at the same time, the navigator should not be off his guard, or avoid putting his vessel in the best possible condition to meet with bad weather. The precautions alluded to, however, are the striking below of the guns, and other like acts. The ordinary winter weather experienced by vessels navigating our own coast and the North Atlantic, is as severe as that encountered in passing the Cape. To draw a comparison between the two would be impossible, they have so few points of similarity. The exposure, however, in passing round the latter is little when compared with the former.

By the ordinary route pursued, doubling the eastern end of Staten Land (Cape St. John), it frequently takes from 20 to 25 days—say from the longitude of 62° to 80° west, on the parallel of 54° south, a distance of about six hundred miles. Anything short of this time may be considered a good passage, supposing a vessel to meet with a full share of boisterous weather: there are times, however, when the weather is equal to that of the tropics; indeed, on our first arrival off this dreaded promontory, it was of this character, but our stay was long enough in these desolate regions to satisfy every one that its fickleness is not to be surpassed in any quarter of the globe.

The current from Cape Horn to Valparaiso was south 72° east, 364 miles.

The wind hauled to the southward and eastward, in the latitude of 36° south.

Anchoring on the western coast of Tierra del Fuego is to be avoided. Noir Island is a dangerous anchorage, as was sufficiently proved by the Relief. For an account of her disasters, see Narrative, Vol. I, page 161.

FROM VALPARAISO TO CALLAO.

From June 7th to 20th, 1839.

Our stay in Valparaiso was twenty days. When this place was first visited by American vessels, they anchored towards the head of the bay, before the town; this exposed them to all the violence of the south winds during the summer season, and also during the *northers* to the heavy sea that rolled in from that quarter.

The requisite precaution in approaching this harbor is, to make the coast to the southward. If it should be late in the day, and there is no prospect of reaching an anchorage, it would be advisable for vessels to keep off the land some 8 or 10 miles with the light on Point Angelos bearing southeast, as they would then be beyond the influence of the strong northerly current that sometimes prevails near the coast, and within 6 miles of the land; and in the event of calm, which is frequently the case during the night, a vessel may be set very far to leeward of the port before daylight by being exposed to it, and placed in a somewhat critical situation. Near the beach of Concon, or that of Quintera, the current is usually strongest about the time of new and full moon, when a most remarkable increase of the surf occurs on this coast; indeed, as far as my observations have extended, the entire west coast of South America is subject to this phenomenon.

The anchorage is now under the bluff to the north of Point San Antonio. During the winter season, thick, rainy weather, with fogs, are frequent, attended with little or no wind, making it extremely difficult to get out of the harbor or bay during its continuance. The summer season is remarkable for the regular southeast wind: the morning being usually calm and pleasant until about 11 o'clock, when a breeze comes up from the southeast, gradually increasing to a strong gale, with perfectly clear weather. During the continuance of these high winds, the discharging of cargoes and even intercourse with the shore are for the time suspended; it becomes therefore necessary, in anchoring in the bay, during the summer months, to give a longer scope to the southeast cable; and in the winter months, to moor with the heaviest anchor to the northward and westward.

Gales from the north, termed *northers*, occur seldom, once in several years. In June, 1823, I experienced one of the most violent and

destructive ones which ever happened at this place, in which 18 vessels—nearly all of them large and fine ships—were cast on shore, in consequence of their cables having been chafed off—chain cables not being then generally in use, and the bottom much fouled by lost anchors. The risk in this harbor from such causes is much less now, on account of the nearly universal use of the chain cable.

The northers are indicated by a fall of the barometer, with a day or two of dull, heavy weather, and an increasing swell setting into the Bay, giving timely warning to prepare by securing boats on board and everything else for riding at anchor in a heavy sea. The immediate precursors of it are a lighting up of the clouds and a bright clear sky to the northward and westward, and the looming of the land to the northward off Concon and Quintera, which is not usually visible from the Bay. The worst riding is experienced on the flood tide, the sea setting in very heavy. It is somewhat more moderate with the ebb, which setting to windward and acting as an undertow, prevents so great a strain on the cables; the sea is shorter, but nevertheless vessels ride easier.

From the experience I have had in this Bay, some precautions in anchoring are deemed necessary, and it would therefore be well to observe the following directions. In the summer season, a single anchor to the southward and eastward is alone required, having a long scope, as the winds are strong from that quarter, and frequently come in heavy gusts off the highlands, rushing down with great force, when vessels are liable to drag off the bank, which is steep. If anchoring to the north of Point San Antonio, you moor with open hawser to seaward; if to the south of it, in the summer season, it is better to ride at single anchor, steadied by a kedge. In winter, care should be taken not to be in the hawse of other vessels, the harbor regulations being indifferently attended to. Vessels frequently suffer great damage from collision, as any vessel breaking adrift, must necessarily come in contact with many others. All should endeavor to moor in a clear berth, so as to be able to ride with a cable on each anchor, say from 90 to 100 fathoms, to insure the certainty of not dragging; the usual depth of water is from 15 to 30 fathoms, mud and sand.

The anchorage for men-of-war is to the north of Fort San Antonio.

It is high water, full and change, at 11 hours 30 minutes, A. M.; and the rise of the tide is 4 feet 9 inches.

Provisions of all kinds are plenty. Wood, however, is dear and with difficulty procured. Water can be obtained by the boats of a vessel; but it is a great saving of time and expense, to have it brought off in tanks. The price is one dollar per tun.

The current between Valparaiso and Callao was found to be north 82° west, 162 miles.

The trades, at the season of the year when we passed over this route, were uncertain and unsteady, but they generally prevailed from the southward and eastward. When the wind was not strong, the breeze would veer to the northward and eastward for a few hours. The sky was for the most part overcast, though the weather was mild and pleasant.

During the winter, April to October, it is better to steer directly off from the coast until you reach an offing of from 100 to 150 miles, and then make a direct course for your port; by this means you get within the influence of the regular trade, which is generally found at this distance from the coast, and beyond the influence of the north monsoon, which prevails near the land; you are then sure to have a favorable breeze to carry you forward to your destined port.

The Vincennes was 13 days on this passage; but it is frequently made in 8 days.

At Callao we remained from the 20th of June till the 19th of July. During the greater part of this time we experienced thick, misty weather, so as to render it difficult to obtain the necessary observations for rating our chronometers. The longitude deduced by them was 77° 11′ 10″ west, and the meridian distance between Callao and Valparaiso, 5° 31′ 50″.

The Bouqueron Channel seems to be seldom used by large vessels; yet coming from the windward it is certainly preferable to passing round Point Galena, the north Point of San Lorenzo. The directions for passing through it are extremely simple. Stand in to the southward of Isle del Fronton until La Horadada Rock and Point Morro Solar are in one; then steer directly for the inner point of San Lorenzo, until the town of Callao is seen to open with the Castle, when haul in and anchor in the roads, in any berth that may be convenient.

I passed through the Bouqueron Channel after dark, and over the tail of the shoals at its entrance in 3½ fathoms, anchoring opposite the burial-ground on the Island of San Lorenzo. Our observations place

the wharf in longitude 77° 16′ 45″ west, and latitude 12° 4′ 46″ south.

Callao Bay is at all times smooth. The sea-breeze sets in usually about noon and continues until towards sunset. The nights are for the most part calm and pleasant, although frequently the almozo or dew is heavy. With the exception of not being able to land the stores of a vessel conveniently, it is one of the best ports of the Pacific to effect repairs in. Water is here obtained from pipes at the mole with ease, and is good; wood is scarce, and consequently dear. The markets are well supplied with provisions, and tropical fruits are abundant, when there are no intestine wars to disturb the country.

FROM CALLAO TO TAHITI, THROUGH THE PAUMOTU GROUP.

Between the 19th of July and the 10th of September, 1839.

The time employed in making this passage was 53 days—this includes that spent among the islands of the Paumotu or Dangerous Archipelago, amounting to some 25 days. Our route lay between the parallels of 12° and 18° 30′ south latitude. Within these parallels I hoped to have been favored with a strong trade-wind; but the winds at this season of the year (July), on the parallel of 18°, cannot well be so termed, although generally prevailing from the eastward. The effect of the southwest monsoon is evident from the interruptions, and by the long swell from that quarter. The sky was unattended with the usual light clouds that are met with in the trade winds: instead of this, we had the scud flying at times rapidly from the southwest. I would therefore advise that vessels, when bound for the Society Islands from the coast of South America, should keep to the northward of latitude 15° south, or even as far as 12° south, in order to insure good weather and steady breezes; and when approaching the longitude of the Paumotu Group, to steer for the Disappointment Islands, and after sighting them, thence on a southwest-by-west course for Raraka, passing between it and Katin or Saken Island, and afterwards between Fakarawa and Faaite to Tahiti. This route is the most practicable as well as the least dangerous, and will materially shorten the passage by preserving a favorable wind through the whole distance, and can be navigated during the night as well as the day.

The currents on the passage from the coast were variable, and nearly neutralized each other; the amount we found to have influenced us during the passage was north 57° east, only 17 miles. At other seasons of the year the currents may be stronger, and more in favor of the vessel bound to the west. To judge from our experience, it would appear that these westerly currents are influenced by the westerly monsoon, for the currents that are known to prevail during this portion of the year in the Pacific set in an opposite direction.

On this passage we had an opportunity of verifying the positions of the Island of Clermont de Tonnerre and that of Serle Island, and to prove the non-existence of Minerva Island. Whether the latter is identical with either is a matter of little moment to navigators. The existence of a separate island it was necessary to disprove, and in so doing it involved the position of the two others; and although neither can be, from the description, identified as Minerva Island, yet if it existed, it must from its position lie between them. In order to reconcile the various observations, it is most probable that the Captain of the Minerva saw the northwest end of Clermont de Tonnerre, as his description of the island is totally at variance with the truth, unless this is admitted. Both the latitude and longitude would warrant the belief that such was the case. I have therefore supposed it identical with Clermont de Tonnerre, and not Serle Island.

There were no perceptible currents experienced during the period we were cruising among the Paumotu Group. We had many opportunities of trying the current, but none was found; neither did the position of the ships, when hove to, or beating to windward, indicate any, and I feel warranted in the belief that at other seasons of the year none will be found to exist. The operations of the Porpoise were not at all impeded by them in this group in the months of December and January.

The passage from the coast of South America to the Society Islands is ordinarily made in about 40 days.

The Island of Tahiti is the most resorted to, particularly its harbors on the north side, from Point Venus on the east to Papieti on the west. This island may be seen some 80 miles, in clear weather, but ordinarily not beyond 40 or 50 miles. The peaks are seldom seen, being usually covered with clouds. In approaching the harbors of Tahiti, it is decidedly advantageous to do so from the eastward, or windward. A pilot may be found in the offing, yet no one need have

any hesitation in running in, provided a good lookout is kept from aloft. The shoals and reefs are all laid down on the charts, and can be easily avoided.

FROM THE SOCIETY ISLANDS TO THE SAMOAN GROUP.

Between the 29th of September and the 10th of October, 1839.

Vessels bound to the westward should leave the harbor of Tahiti as soon as the sea-breeze or trade reaches there; this is during the forenoon, and when it is well advanced. If in the harbor of Papieti, it would be better, from its being so far under the lee, to get under way at an earlier hour, taking advantage of the land-breeze, which will generally be found to extend beyond the sea-reef. The weather harbors and bays get the full force of the trade winds, which almost constantly prevail. In standing to the westward, pass to the northward of the Island of Eimeo. The trades generally blow fresh, except during the months of November, December, and January, when it would be advisable to take the route to the northward of the Society Group, and get into a lower latitude, especially during the above months, the summer of the southern hemisphere. When in latitude 13° south, a course to westward may be pursued.

The passage to the Samoan Group is usually made in 6 or 8 days; a distance of 1200 miles. The parallel of 15° south will avoid all the islands and reefs. Between these two groups the winds will be generally favorable, but there are exceptions, and bad weather is frequently encountered. When we made the passage, in October, we encountered much rain, and winds from the northwest, south, and southwest; but very little regular trade. The Peacock and Flying-Fish made the passage 10 days later, and had very strong trades all the way. It seems that little dependence is to be placed in the winds at this season, to the southward of the parallel of 15°; indeed, I should advise navigators to avoid the belt of ocean between the latitudes of 15° and 18° south: the trades are not to be depended upon south of the former, nor is there any certainty of winds from the westward in any season. Many anomalies seem to take place to the westward of the Paumotu Group, although I am not inclined to believe that they can arise from any influence that is exerted by that group, for, as I have remarked, this same vacillation of the winds seems to exist between

this archipelago and the coast of South America, between the same parallels. The currents during our passage were from the south, but trifling; and we found the sea remarkably smooth and the winds variable.

Rose Island, the easternmost of the Samoan Group, may be run for in the daytime: its rounded clump of trees can be perceived at a long distance. Its longitude is well established. It is better to pass to the southward of it and Manua; by doing so, you will keep to windward and preserve the breeze; and if bound to Tutuila, can enter Pago Pago Harbor; if to Apia or Upolu, pursue the same course, and then pass between Tutuila and Upolu.

FROM THE SAMOAN ISLANDS TO SYDNEY, NEW SOUTH WALES.

Between the 10th and the 29th of November, 1839.

This passage was made in the month of November, and occupied 19 days. Upon leaving the Samoan Islands, we steered for Uea or Wallis Island, which consists of several islands enclosed in the same reef: it is moderately high and can be seen at the distance of 10 miles. The entrance to the lagoon is on the south side, where communication and supplies may be had. (See Uea or Wallis Island, in this volume.) From thence we passed to the west of Hoorn Island, which we sighted; thence steering southwest-by-south, passed 150 miles to the westward of the Feejee Group, and approached close to Mathew's Rock. We were favored with fair winds nearly the whole distance to Lord Howe's Isles, mostly from the eastward and southeast. The winds generally increased towards evening, and the trades were not lost until to the southward of the parallel of 25° south; then the wind came from the northward and westward, after a short gale and severe lightning and thunder, and with a heavy swell from the southwest; it gradually hauled to southwest, and then to the southeast. The currents were generally from the eastward, until we had passed the Feejee Group, when they came from the southward, but were of little strength.

In approaching the coast of New Holland, care should be taken not to make a land fall to the southward of the port, as some delay may be experienced at this season of the year (November) in entering the port of Sydney, from the southerly current, which resembles a

miniature Gulf Stream. It at times flows rapidly, and retards vessels sailing to the northward from Van Diemen's Land, if they keep within it. When entering this stream a rise of several degrees of temperature takes place: this is more noticed in the winter than in the summer season. The stream is about 30 to 40 miles wide, and has an eddy on its inner edge, which is not felt beyond 6 to 10 miles from the shore. Small vessels may keep along the coast, if bound to the north. The Heads of Sydney are readily distinguished, being the most elevated land on this part of the coast.

On the east coast of New Holland, according to King and Flinders, the winds blow from the southeast during the summer months, and from the southwest and west in the winter and spring. The months of March and April are the most stormy, when bad weather sometimes lasts for a long time. The port of Sydney is at all times accessible. The lighthouse on Sydney Head gives a very brilliant light, and affords every facility to enter during the night, with or without a pilot. Captain King's chart may be confidently relied upon as accurate. We had ample opportunity to prove its correctness.

FROM CALLAO TO THE HAWAIIAN ISLANDS.

Between the 20th of July and the 2d of September, 1839.

The Relief made this passage in 44 days. She experienced for the first four days the current setting to the west, and afterwards, to the longitude of 104° west, to the south and southeast, and crossed the equator in 109° west longitude, making a west-northwest course. The wind continued fresh from the southeast, until 9° of north latitude, when she encountered south and southwest winds, until the latitude of 15° north and 124° west longitude had been attained. The currents were also variable, sometimes setting southwest, then north and west, and again southwest. On reaching the latitude of 16° 30′ north, the northeast trades were entered, which carried them to the Hawaiian Islands. Between the longitude of 125° and 130° west, the currents were variable; from thence to the Hawaiian Islands, their set was to the south.

This passage was considered a long one. It was not made with a view of following the shortest and most direct route, but of examining the locality between 130° and 135° west longitude, and on the parallel

of 16° 30′ north latitude, for islands that were said to exist thereabouts. Instructions were given to deviate from the direct route for this purpose. If it had been intended that the most direct course should be pursued, orders would have been given to cross the equator in from 130° to 135° west longitude, thence to steer direct for the island of Hawaii. This course would carry a vessel sufficiently far from the coast to avoid the winds which affect the steadiness of the trades more to the eastward, between the latitudes of 10° to 15° north; besides, a vessel would derive the greatest benefit from the equatorial current. The time occupied on this route, in an ordinary sailing ship, should not be over 35 days.

FROM THE HAWAIIAN ISLANDS TO SYDNEY, NEW SOUTH WALES.

Between the 20th of September and the 31st of October, 1839.

Forty-one days were occupied by the Relief in making this passage. The route was direct, passing between the Phœnix and Ellice's Groups, to the westward of the Feejee Islands, and a short distance to the east of New Caledonia. The equator was crossed in 172° west longitude, in ten days after leaving Oahu. The winds were fresh from the northeast, until reaching the parallel of 9° north latitude, when they gradually veered to the southeast, and continued from that quarter without cessation until they reached the latitude of 30° south. These were succeeded by winds from the north and northwest, which continued to Sydney.

The currents felt, to the latitude of 9° north, were to the west; thence to latitude 4° north, to the east-northeast; after which the equatorial current was experienced to latitude 7° south; from which parallel to the latitude 18° south the set of the current was to the east-southeast; the next nine degrees, or as far as latitude 27° south, it took a southwest direction, and then an easterly one. The weather was remarkably fine, and the passage considered a short one.

FROM SYDNEY, NEW SOUTH WALES, TO CAPE HORN AND RIO JANEIRO.

Between the 20th of November, 1839, and the 29th of January, 1840.

This passage occupied a period of 70 days, and is to be considered short. The route taken was by Cook's Straits, between the islands of

New Zealand: they were reached by the 1st of December, a distance of 1000 miles, in ten days. For the first half of the passage the winds prevailed from the north and west, and the latter half from the southwest. The currents experienced were strong from the northeast. Cook's Straits were passed through without difficulty, the wind and current being favorable. The lands are high and the shores bold, and no dangers to be apprehended. It would be advisable for a stranger, if he should be late in approaching the Straits, not to attempt them until the reappearance of daylight. There is no particular caution necessary, except to keep the mid-channel, where a vessel would be least affected by the tides, and have all the benefits of the current, if any existed. In case vessels desired to stop, they may seek temporary anchorage in the bays on the north or south. Here some supplies can be obtained. Formerly much was to be apprehended from the savage disposition of the natives, but since the large immigration of English, they are friendly, and desirous of trading for their productions, which consist of potatoes and hogs.

The Relief's run to Cape Horn was made in 31 days, a distance of 4500 miles. The course was almost a direct one, with a fair wind, either on one side or the other, all the distance. The first 900 miles after leaving New Zealand, it blew from the north to north-northeast; for the next 600 miles, from the southwest and south; then it came out again from the north until they reached longitude 127° west, where they encountered, but for a day, the only head wind during the passage; then it again blew from the southwest or northwest until they reached Cape Horn, passing which they arrived at the latitude of 45° south, in the South Atlantic, where they were met by the northwesterly winds, which compelled them to make a considerable deviation from their course, and retarded their arrival at Rio. At no time of the passage did they enter the southeast trades. The winds were from the southwest and west, resembling in character a monsoon. Until within several hundred miles of Cape Horn, they may be said not to have had any current: that which they did meet with was from the northward, but as they approached the Cape it was found to be 30 miles a day, setting to the east-southeast; and after passing the Cape, it set to the northeast and east, to the latitude of 45° south, when it changed to the southwest, southeast, northeast, and west, for the last few days, before their arrival at Rio Janeiro.

This may be said to be the best time of the year to make this pas-

sage: no ice was seen, and the long days make it less hazardous to encounter. In some years, during the months of December and January, much ice has been met with, so much so that many of our whale ships have considered it far safer to put back to the northward again, and wait until it disappeared.

The passage by Cape Horn may be at all times considered the best for homeward-bound ships from the coast of New Holland or New Zealand. The track during the summer to insure steady and favorable winds, is between the latitudes of 45° and 50° south. In the winter months of the southern hemisphere, it would be much better to keep near the parallel of 40° south, until approaching the Cape, when a course which would lead for it should be adopted: this will secure better weather and more constant winds.

THE ANTARCTIC CRUISE.

Between the 26th of December, 1839, and the 11th of March, 1840.

Although this does not come within the usual limits of the passages or routes of vesels, yet it may prove of use to navigators who visit the high southern latitudes.

On leaving Sydney we had easterly winds, which enabled us to stand to the southward, and favored us for several days, gradually hauling to the northward and eastward. On reaching the latitude of 45° south, the wind came from the north, and northward and westward, accompanied with lightning and thunder, a change of weather, boisterous, misty, and disagreeable, settling into thick fog, attended with a fall of the mercury in both the barometer and thermometer. On the tenth day we made Macquarie's Island. The westerly winds, which had set in strong, with a northeasterly current, carried us to leeward of that island. Vessels wishing to visit Macquarie's Island ought to allow for a northeasterly set of 20 to 30 miles in the 24 hours. The south end of Macquarie's Island we place in latitude 54° 44′ south, and longitude 159° 49′ west: it is within the stormy latitudes. After leaving it we cannot be said to have enjoyed any continuance of fine weather in the higher latitudes, along the Antarctic continent especially, while the wind was in the western quarter. After passing to the west of 160° longitude, instead

of northwest and southwest winds, they prevailed from the eastward, with better weather, although our hardest gales came from the southeast, arising very suddenly; they were generally preceded by fine weather whilst the wind continued to the northward of east; the barometer falling, while the temperature rose. Easterly winds prevail to the southward of latitude 60° south, but to the north of that parallel, westerly winds, accompanied by fog, snow, sleet, but seldom rain. Heavy cumulus clouds in the southwest indicate wind from that quarter, as they do to the south of Cape Horn, but though boisterous they are not to be classed as storms. The barometer's range is low, the mean being 29·04 inches; its movements are rapid, frequently a great change occurring within an hour. The wind increases as it rises, and continues for some hours after it has become stationary.

In navigating towards the Antarctic, vessels should be well found, not only with good sails and rigging, but protected against cold and wet; the temperature, though not very low, is remarkably searching, and from its being a low equable temperature and damp, there is no opportunity to ventilate or dry the vessel except by artificial means. Icebergs are seldom met with until the latitude of 56° south; to the westward of New Holland, they have been encountered in as low a latitude as 42° south, by vessels making the passage to New South Wales, in October and November; but this is unusually far to the northward at this time of the year; later in the year they have been met with off the Cape of Good Hope, where several accidents have happened by vessels coming in contact with them. The prevalence of a current setting to the northeast, is the only way in which these masses of ice can be carried to so low a latitude as a few degrees to the southward of the Cape of Good Hope.

In this Southern Cruise we passed over the locality of Emerald Isle, assuming its position to be in latitude 57° 15′ south, and longitude 162° 30′ east, but saw nothing which indicated its existence. During the continuance of our cruise of 1500 miles along its coast, we were for a large part of the time surrounded by vast numbers of icebergs, as well as having the icy barrier attached to the land to avoid, consequently it became difficult to ascertain if any current existed. The small movement of the ice to and fro, when we had an opportunity of observing it, indicated that the tides were not of

much strength. The most unpleasant occurrence in this navigation is the sudden rising of fog, frequently when the ship is surrounded in all directions by numbers of these bergs of all sizes and shapes, differing in height as much as they do in length, from 5 above the sea surface until they reach that of 220 feet. Those who attempt to navigate among these bergs would do well to observe the rule, never to pass very close to windward of them; the wind is apt to fail at the most critical moment, or haul a point or two, and the set of the current is sure to be towards them, involving a vessel in much hazard, as well as creating great anxiety for her safety. So far as the fear of the bottom striking, or the hull coming in contact, there need be no apprehension, the spars would be the first to touch, the iceberg continuing the wall-sided structure to a great depth below the surface. I can only add that there is very great hazard in navigating along the Antarctic coast during the season of all daylight; how much more so must it be with a part of the time night.

Our return route from the coast of the Antarctic continent, in longitude 98° east and 65° south, was made to the northeastward, towards the south of Van Diemen's Land. Here we were favored with strong gales from the southwest, such as usually prevail between the latitude of 50° and 60° south of New Holland; and from our own experience as well as the character given of the latitudes in this locality, I am satisfied that this may well be termed a region of storms. I have heard an opinion entertained that a southern passage was the most advisable on leaving Sydney for England; that is, passing to the south of Van Diemen's Land. It has frequently been attempted, and perhaps in a few instances with success, but I am well satisfied that it cannot prove of any advantage to the navigator to take this route: the winds will be found to prevail for the most part between the northwest and southwest: they are boisterous, and accompanied with heavy seas from the same quarters. After visiting the high latitudes, I cannot believe any one could have the hardihood to advise it, let alone to make the attempt. The wear and tear of such a voyage, its length and chances of sustaining damage, are greatly against it; in all probability, making a return to port absolutely necessary: the expenses thereby incurred would be more than sufficient to pay for navigating in the tropics for months.

On our return, we encountered the currents, already mentioned, setting to the southward, along the coast of New Holland; which

readily accounts for the difference in the length of passage from Sydney to Van Diemen's Land and back. By keeping off from the coast a sufficient distance, the return passage will be much shortened, or, if in a small vessel, by hugging the coast, the eddy current may be taken advantage of during the fine season.

FROM SYDNEY TO BAY OF ISLANDS, NEW ZEALAND.

Between the 19th and 30th of March, 1840.

Sydney and the north point of New Zealand lie very nearly in the same latitude; the course is therefore nearly due east. We enjoyed fine weather, smooth seas, and fair winds, and made the run in eleven days. The winds prevailed from the north, and northward and westward. On approaching the island, the wind was from the southwest, and after getting to the eastward of Cape Otou, variable. The currents during the passage were from the northwest, until approaching New Zealand, when they came from the southeast. After the month of March, on the coast of New Holland, the winds prevail from the southeast, when it is difficult to get an offing. The Peacock, in the month of April, experienced light southeast winds for 12 days after she left Sydney, on her passage to the Friendly Islands; at the same time was set by a strong current to the northwest, which carried her within 150 miles of New Caledonia before she could make easting. Her passage to Tongataboo was in consequence greatly retarded, having been 32 days making the distance of 1700 miles. I think it would be preferable if, on leaving Sydney, the wind should be encountered from the eastward, to stand to the southward until sufficiently out of the influence of the coast, or if the wind did not permit that tack to be taken, then beat directly to windward until 100 or 150 miles from the port, rather than pursue the northern route.

FROM BAY OF ISLANDS, NEW ZEALAND, TO TONGATABOO, FRIENDLY ISLANDS.

Between the 6th and 24th of April, 1840.

This passage was made by the Vincennes, Porpoise, and Flying-Fish, in 18 days. On the 13th, passed over the Rosetta Shoal. Not finding it, have erased it from the charts. On the 8th day we sighted

Raoul or Sunday Island, the most northern of the Kermadec Islands. The winds were variable, which was also the case with the currents. The course was a direct one. The passage might have been performed in less time, if we had gone to the eastward of the Kermadec Islands; by which route, I am of opinion, we should have found the southeast trades in a higher latitude. These islands, situated in latitude 30° south, exert considerable influence on the course of the trades, and produce calms in their neighborhood, particularly to the westward. In sailing to the Friendly Group, Eooa is the best to sight; it is high, and may be seen at a considerable distance. At some seasons currents are said to prevail off these islands, setting to the westward; but we experienced none.

On this passage, Vasquez Island was searched for, in latitude 24° 44′ south, and longitude 174° 25′ west; but without success.

Intending to enter the harbor of Tongataboo by the Astrolabe Gut, a vessel should be off its eastern entrance at an early hour of the day, to take advantage of the sea-breeze or trade which then usually sets in. The Gut is 9 miles long, and contracts from 2 miles at its mouth to a quarter of a mile in width at its western terminus, and is difficult to navigate unless with a fair wind. Coral reefs border each side, and no anchorage can be had until the western end is reached, where the island and reef of Magonha separate it from the harbor. The channels on either side of this island may be taken; though narrow, they are perfectly safe, and after passing through safe anchorage is found in the spacious harbor, well protected by the surrounding land and the outlying reefs, which are of great extent. The anchorage near the island of Pangaimotu is the best, but that off the town of Nukualofa is usually preferred, being more convenient for obtaining supplies. The shore-reef is of great extent, bare at low water, making it extremely difficult to land in boats, so that intercourse with the shore is generally limited to the time of high water.

FROM TONGATABOO TO THE FEEJEE ISLANDS.

In May, 1840.

We were two days on this passage. The squadron went to sea through the reefs by the north channel, and with a favorable wind sailed past the islands of Honga Tonga and Honga Hapai, steering to sight Turtle Island; after which, the course was changed to make the island of Ongea, one of the eastern group of the Feejee Islands. This is one of the best islands to sight, if bound into any of the harbors of the Feejee Group from the southeast. It forms the eastern side of the Fulanga Passage, which may be passed through, but it would be advisable to go to the southward of Fulanga and steer for Moala, running close to Kambara. When to the westward of Kambara, if overtaken by night, there is plenty of sea-room, to await daylight; a vessel can then pursue her course towards her port with safety. For further remarks on the entrance to the Feejee Group, the sailing directions of that group in this volume are referred to, as embracing full instructions.

FROM THE FEEJEE GROUP TO THE HAWAIIAN ISLANDS.

Between the 14th of August and 24th of September, 1840.

As this passage was made by the vessels of the squadron at the same time, following separate routes, and crossing the equator in different longitudes, it affords information tending to show the best route to be taken when bound from the Feejee Group to the northern hemisphere, during the months of August and September.

On the 14th of August, the Vincennes, Peacock, Porpoise, and Flying-Fish left the harbor of Muthuata by the Malu Passage, on the north side of the Island of Vanua Levu; on getting clear of the reefs the Porpoise parted company, to visit again the eastern portion of the Group, while the Flying-Fish was sent to run along the great sea-reef, to complete some minor examinations. This separation led to the diversity of routes followed in proceeding to the northward.

The Vincennes and Peacock also parted company, the second day

out: the former stood to the northward, on the meridian of 178°, with the southeast trades, which were carried to the latitude of 8° south, when the wind hauled to east-northeast, with a long swell from the northward and eastward. The wind had been previously found to veer several points to the northward toward night, and generally continued until morning, when it would veer to the southward again. This obliged us to make northing too fast. On the wind's hauling more to the southward, I determined to make easting, instead of running with the wind free to the north. The winds were very light. On the seventh day out, we made an island, which we supposed to be the Kemiss or Gardener's Island of former navigators, and passed the day on it making observations. Here we found the flood setting strong to the northward, and the rise of the tide was 3½ feet, which nearly overflows the island. The next day we discovered McKean's Island, in nearly the same longitude, but a degree north of Kemiss. The winds were quite light, with some rain, which was succeeded by dark, cloudy weather, and showers, with light breezes from the westward. Under these circumstances, I steered to the eastward, for the Phœnix Group. After copious rains (5·2 inches), the weather cleared up; the wind returned again to its old quarter, northeast. We had heavy rolling seas from the southward, and a current of half a mile, setting south ¼ west.

We passed 10 days in examining the Phœnix Group: three of the five islands of which it is composed were surveyed. They are situated between latitude 5° south and the equator; and between longitudes 168° and 173° west.

The winds were very variable, as well as the weather, and the currents vacillating: some days equal to 30 miles to the west, again to the southwest, and then none at all. It was not until the 4th of September that we crossed the equator, in longitude 168° west. The day before crossing, the weather was delightful, with a strong breeze from the east; we then stood to the northward, keeping the ship a good full by the wind, which now veered from southeast to east-southeast, with occasional squalls and rain. This weather continued until we entered the northeast trades, between the latitudes of 9° and 10° north. We were from this time, 11th of September, until the 19th, beating up for the Hawaiian Islands, taking every advantage of the variation of wind to make the most easting, when we made the Island of Kauai, and two days aftewards anchored off the town

of Honolulu, Oahu: making the passage in 41 days, including the ten days detention in the explorations of the Phœnix Group.

The Peacock's course was different. Captain Hudson determined to keep at once to the northward, and crossed the equator in longitude 174° 30′ west, about 350 miles to the west of where it was cut by the Vincennes. The Peacock passed over the locality of the shoals reported by Captain Swain, of Nantucket, as lying near Solitary Isle, of Arrowsmith's charts, but saw nothing of them. She experienced the same kind of baffling and light winds as described by the Vincennes, but they were somewhat more to the northward and eastward. The weather was fine, but warm. In latitude 2° south, the Peacock experienced the same heavy swell from the eastward as the Vincennes, which occasioned the ship to roll excessively,—the surface of the ocean being as smooth as a mirror. It was followed by the wind from the west and southwest, and after rain again returned to the eastern quarter, inclining to southeast, though baffling and squally, which continued until they had reached the latitude of 5° north; the atmosphere being hazy and the weather sultry. Here they encountered the northeast trades, but exceedingly variable in direction, changing from northeast to east, with frequent squalls and rain. Between the latitudes of 6° and 7° north, they made a tack for several days to the southward and eastward, and were favored by the easterly current. The winds were found too baffling and uncertain to make much progress in beating to windward; besides, the ship was light, and not in a condition to hold a wind; notwithstanding, it is evident that she made much progress to the east, which could not have been done if a strong easterly current had not prevailed.

On the parallel of 10° north they had fairly entered the northeast trades, and made the best of their way to the northward, arriving at Oahu on the 1st of October, making the passage in 50 days. Captain Hudson found the northeast trades very strong and squally, much more so than we experienced them. The lightness of his vessel may account for the difference in the passages, but I am almost inclined to believe that there is something in crossing the equator in a more easterly longitude, thereby preserving the southeasterly winds longer, and being less subject to calms. The southeast wind, during the Porpoise's passage from the Samoan Group, while it lasted, enabled her to make considerably more easting, crossing the equator in 165° 30′ west; she also kept a fresh southeast wind to latitude 5° north,

having crossed the equator on the tenth day, and making the passage from the Samoan Group in 27 days; being only 17 days from the line, while the Vincennes and Peacock were respectively 26 and 33. I would not assert that this fully establishes the fact of its being a better route; for the Samoan Group lies some 500 miles to the eastward of where the two ships crossed the same parallel. This easting may be considered a full equivalent for the difference in length of the passages; but I feel satisfied, after making a careful examination of the whole route, that it is also due to the prevalence of more favorable and stronger winds.

The Flying-Fish crossed the equator in the same longitude as the Porpoise. Passing to the eastward of all the small groups, she preserved the southeast trades, and made the passage in 33 days: this length of passage cannot be compared with that of the other vessels, the schooner being well adapted for plying to windward, and only shows the prevalence of fresh southeast winds.

The weather, so far as respects its general character, appears to have been nearly similar with all. The currents on the western track were more variable in direction than those to the eastward, in the same latitudes, and of greater velocity. All experienced the northeasterly set of the current between 4° and 9° of north latitude. After entering the northeast trades they encountered a strong westerly set, averaging 15 miles in 24 hours, and this continued to the latitude of the Hawaiian Islands.

It will now be apparent that there is no necessity for vessels bound to the northward and eastward across the Pacific Ocean, to make for the northern variables, as has heretofore been the practice,—thus making a very circuitous course and occupying a much greater portion of time, besides subjecting themselves to encounter much bad weather. This, however, is not to be understood as applying to vessels to the westward of 180° longitude: they ought to make the shortest possible stay within the trades; and if this course is determined upon, they should steer due north, without regard to making easting, until they have fully entered the variables. It is, however, at times very doubtful where they will encounter them; and as far as our experience goes, and that of other navigators whom I have consulted, they ought not to be expected short of 27° to 30° of north latitude, to which parallel the trades often reach. The great difficulty seems to be, with many, that on the first wind from the west being en-

countered, they are induced to believe that it will prove constant, when nine times in ten they will be deceived.

FROM THE HAWAIIAN ISLANDS TO THE COLUMBIA RIVER AND STRAITS OF FUCA, OREGON.

Between the 6th of April and the 1st of May, 1841.

The remarks which follow are applicable to any part of the Northwest Coast, so far as general directions for sailing towards that coast are concerned. The passages made by the Vincennes and Peacock, the one in April, the other in July, show the winds during those seasons on the above route, and the time when it is most favorable to visit that coast. That different winds as well as currents are met with, is clearly shown by the tracks of the two ships on the General Chart of the Pacific.

The Vincennes left Oahu on the 6th of April, and passed between Oahu and Kauai. For the first 8 days the wind was from north-by-east, the weather being disagreeable and cloudy. On the 14th, we had reached the latitude of 26° 30′ north, longitude 160° west, and had passed through the zone of calms (then about 300 miles from our port of departure), when the wind hauled to the southeast; with but a few hours' exception, the Vincennes carried the southeast wind to the coast: it was quite strong, attended with much haze and fog. In latitude 28° 30′ north, we had the report of land; but it proved a false alarm. Many navigators have looked for land in the space comprised within the latitudes of 33° and 43° north, and longitudes 140° and 150° west, as yet unsuccessfully: all have been satisfied that the appearances of land are frequent and not to be mistaken, landbirds in particular being numerous. This part of the ocean, from the low temperature of the water and the warm air blowing over it, is nearly always enveloped in fog and haze, rendering its examination exceedingly difficult; consequently rocks or even small islands may exist which have not yet been discovered.

In passing over this space, I endeavored to take such a course as would lead clear of the tracks of navigators who had preceded us. This part of the North Pacific should be examined in the winter season, when it is probable these fogs do not exist to the extent they are found the rest of the year.

The quantities of villella that we met with exceeds belief. The sea was literally covered with them, having the appearance of a vast sheet of water spread over with cinders. What seems remarkable, the position of these zoophytes has not changed since they were met by Vancouver fifty years before. This seems to me to offer a strong proof that, having been brought by currents from the north and deposited here, they are retained by the absence of all current within these limits. There was no perceptible current experienced as we crossed this space of ocean; but to the northward of it, we experienced a very strong one, setting to the southeast some 35 miles a day, from 150 to 700 miles from the coast. The temperature of the water, also, indicated a southerly current.

Notwithstanding the detention we met with in passing through the calm latitudes, we made the passage in 22 days to the mouth of the Columbia River, which was unusually short. It is well here to state that the southeast wind is not to be regarded as the regular one of this coast,—seldom blowing except during the winter and spring months. The southerly currents experienced by the Vincennes (as shown on the Pacific Chart), on approaching the coast at this season of the year, may be expected, and no doubt prevail during the other spring months with equal force.

The Peacock made the passage in June and July. She did not get through the calms until reaching latitude 33° north, in longitude 157° west. The winds afterwards were from the east, and carried her to the latitude of 44° north before she was enabled to make easting; then she encountered the prevalent winds from the west and southwest. Instead of the current which the Vincennes experienced, it was found to set in an opposite direction, though not strong. Her passage was made in 27 days, although the route was farther to the westward than that of the Vincennes. The villella were met with in latitude 40° north, longitude 157° west, and were lost sight of in latitude 43° north, longitude 155° west. The limits of this mollusca may therefore be said to extend nearly through 18° of longitude on the latitude of 40° north, and to cover a space equal to 800 miles in length and 180 miles in width.

From these two passages, it would appear that very different routes are to be pursued at different seasons. In the spring, the winds will be found, after having passed beyond the calms, more from the southeast than in summer; consequently, vessels should hold more to the

east, and cross the calms in the most eastern longitude, and as quickly as possible; it likewise shows that the calms are of less width, though more difficult to pass through, in the spring. As was proved, the error committed in the Vincennes was in not keeping by the wind, and therefore too far to the west, thus falling under the lee or influence of the currents of air in the neighborhood of the Hawaiian Group, which detained us. The information received from those who were supposed to be well informed upon the subject, induced me to take this course, expecting to meet the northwest and westerly winds in a low latitude, and consequently be in a situation to take full advantage of them. The plan I should have adopted was, to stand directly to the north, or to the northward and eastward, and thus make a more easterly route. This the Peacock did, and the first part of her passage was made in much less time. I would, in making the passage again, in the spring or summer, expect to have east and southeast winds to latitude 40°, making as direct a course as they would permit towards the part of the coast for which I was bound. All vessels may expect to meet with fogs and hazy atmosphere between latitudes 33° and 40°. This space may be very truly called the region of fog, the temperature of the water decreasing some 15°; and what perhaps is more remarkable, on a near approach to the coast, it again rises.

The navigation from the Columbia River to the Straits of Fuca requires some care. There is a current setting upon the coast, of some force, during the spring months. In our passage we experienced it, and came very nearly meeting with a serious accident off Destruction Islet, near Cape Grenville. Fogs usually prevail until a late hour in the morning, and care should be taken to keep a good offing. The distance from shore may be readily ascertained by the soundings, and it would be advisable, in unsettled weather, or fog, not to approach nearer than 90 fathoms water, which will be found at the distance of 35 miles from the coast, muddy bottom. If, in standing along the coast, the water should become of a light green, and the waterfowl be numerous, no time should be lost in changing the course: it is not safe to approach the coast nearer, as there are many outlying rocks on which a vessel may strike. This is particularly the case in the neighborhood of Cape Flattery, near the entrance to the Straits of Fuca. The coast runs a little to the westward of north; but it may with proper precautions be considered safe,

as the prevailing gales enable a vessel to make an offing, either on one tack or the other, and the Straits of Fuca are at all times under the lee, with good harbors and anchorages, and may be entered without apprehension.

FROM THE STRAITS OF FUCA, OREGON, TO SAN FRANCISCO, CALIFORNIA.

Between the 3d and 14th of August, 1841.

This route is along the line of the coast of Oregon, where the prevailing winds in summer are from the southwest to northwest; generally to the southward of west before meridian, and after that time to the northward: the distance is over 10° of latitude. It is advisable, in sailing coastwise, to keep off shore from 60 to 100 miles. The winds will be found much more constant, and there will not be the same liability to fog, and the currents, if any, will be favorable, when bound to the southward. Excepting in the early spring months, there is but little current. From five to seven days will be the average passage. In approaching the harbor of San Francisco, it is advisable to make the Punta de los Reyes, which may be considered the northern point of land, forming the Bay of San Francisco. By this course vessels will avoid the islands and rocks of the Farallones, which lie off from the land 22 miles. The passage is quite safe on either side of these rocks, and they can be closely approached; but if at night, give them a good berth.*

The return passage to the northward is more difficult in the fine season, as the prevailing winds and the trending of the coast make it necessary to beat nearly the whole distance; but there are times when a vessel may carry the southwest wind from the one port to the other. On leaving the Bay of San Francisco an offing should be obtained as soon as possible, from 100 to 150 miles, when any slant that may offer could be taken advantage of, and the passage made in the shortest time.

* There is some intention of establishing a lighthouse on the largest, which appears to me a very suitable position for one.

FROM SAN FRANCISCO TO THE HAWAIIAN ISLANDS.

Between the 1st and the 15th of November, 1841.

This passage was made in 15 days. On leaving the coast, we were favored with a fresh wind from the northward and westward, accompanied by a dense fog for 150 miles from the coast. We steered a southwest course, to enter the trade winds as soon as possible. As we made southing, the wind veered to the northward, and when in latitude 26° north, and longitude 132° west, to the northward and eastward; with the usual appearances of the trade winds. In latitude 20° north, it veered more to the eastward, and we kept off on a west-by-south course. The weather was delightful, with a long and regular sea from the eastward. We passed to the west nearly on that parallel until up with the Hawaiian Islands, when we stood to the south, and entered the Pailolo Passage, between Maui and Molokai. This passage is safe, and affords, I think, the best route to the Island of Oahu; if belated, a vessel may lie on and off the west end of Molokai at night, and reach Oahu in time to enter the harbor by early dawn, when a pilot can be obtained. If a vessel is of small burthen, or light draft of water, there is no difficulty in running into the harbor without one, sufficient way being preserved on the vessel to pass within the buoy. The directions for entering this harbor or leaving it, will be found in the part of this work which treats of the harbors of the Hawaiian Islands. The amount of current experienced during this passage was 56 miles, south 71° west.

Some would probably prefer the direct course from the coast to the Hawaiian Islands. I am satisfied there is little to be gained by it; and I should prefer taking the route which we passed over, getting into the trades as soon as possible, and after entering them, steering a direct course to the west, for the windward islands, taking care, however, to pass to windward or the northward of those lying east, and thus avoid being becalmed under them. I do not think it necessary to point out any particular directions for making this passage at other seasons, as they vary but little; the prevailing winds being those we experienced, when an offing from the coast is obtained.

FROM THE HAWAIIAN ISLANDS TO MANILLA AND SINGAPORE.

Between the 1st of December, 1841, and the 14th of January, 1842.

This route is much frequented in all seasons. In the months of December and January, the passage from the Hawaiian Islands to the entrance of the China Sea took us 41 days. As part of this time, however, was occupied in searching for islands and reefs, and as we were obliged to deviate from the direct course for that purpose, it is not a good criterion of the usual time, for I was not intent upon merely making a quick passage; many delays occurring from the necessity of shortening sail and lying to during the nights, in order to avoid passing over parts of the ocean without examination; we also approached several degrees nearer the equator in our course, where the winds were neither so steady nor so fresh.

I would recommend vessels bound to the west to keep on the parallel of about 18° north latitude, where the trades will be found stronger and more constant. This was satisfactorily proved when we hauled up to regain a higher latitude, in our search for Wake's Island; which we found in latitude 19° 15′ north, and longitude 166° 30′ east. Another reason that may be assigned for keeping on this parallel is, the influence of the westerly current, which is about half a mile per hour. I would not advise making Wake's Island on this passage: it is low and at night dangerous. Its latitude being now well established, there is no difficulty in passing it safely. Wake's Reef, also, is in this range; its position is said to be in longitude 173° 45′ east, and in latitude 17° 54′ north. I am very much inclined to the belief that they are one and the same, as it is probable, from the exploration we gave the island, that it is at times submerged, having then the appearance of a reef rather than that of an island.

After the extensive searches we made on this route towards the Marianne Islands, I feel confident there are no dangers which lie in the track of vessels. The positions assigned several islands we found to be erroneous, and passed directly over the place occupied on the charts by Halcyon and Folger's Islands, and saw nothing whatever of them.

From the Hawaiian Islands to the Mariannes we experienced a current setting north 68° west, 300 miles, which gives an average for

a westerly current of 10 miles per day. The Marianne Islands lie north and south. Vessels generally pass to the northward of Grigan and between it and Assumption; but I think, if there is no necessity to sight them, that a quicker passage may be made by keeping a degree or two farther to the north, as the winds are undoubtedly more or less influenced by the high land of this group. In our route we went between Assumption and Grigan, and over the position assigned the Mangs by Freycinet. It is not a little singular that the position of these rocks has been laid down to the south, when in truth they lie to the north, of Assumption; and that this error has crept into the work of one so generally accurate as the above celebrated navigator. As far as I have examined and made search for them, there are no rocks or shoals existing south of Assumption, and between that island and Grigan, and I am quite certain the Mangs have been erroneously placed.

We were 11 days from the Ladrones to the Bashee Islands: this was in the first part of January. We found the winds variable, generally from the southward, but veering several points, with frequent squalls of rain—what would be termed unsettled weather, and destitute of any resemblance to the trade-winds—until we approached within a short distance of the Bashee Islands; then we took the northeast monsoon. The current from the Marian or Ladrone Islands to the Straits of Balintang was north 72° west, 7½ miles a day. The cause of the variable winds and absence or interruption of the trades, on the route between the Ladrones and the China Sea, is to be accounted for by the prevalence of a southwest monsoon between the Marianne and Philippine Islands, which encounters and interrupts the northeast trades, on the parallel of 19° north.

Our route to Manilla, along the west coast of Luzon, was made without difficulty, although somewhat delayed by light winds. The entrance to the Bay of Manilla is often tedious. The channel on the north side of the Island of Corregidor is the best, the winds being more regular and stronger. I made a mistake in beating up in the south channel, which, through having more space to beat in, I am satisfied is not so good as the north, particularly as greater advantage is to be derived from the tide, which sets strongly through the latter. The "inbat" or sea-breeze generally prevails in the afternoon, or from 11 A. M. until after sunset.

A vessel may anchor anywhere in the bay. There are some shoal

places, but they do not lie in the track of vessels entering or departing. The anchorage off the city of Manilla is safe, except during the season of the typhoons. These sometimes are experienced at Manilla, and do great damage. From the extent of the bay, vessels are exposed to the full violence of the wind and sea, and until within a few years they have never attempted to ride them out. The port of Cavite, which lies on the south side, between Manilla and the entrance or Island of Corregidor, is quite safe. It is there that the Manilla gunboats and galleys are stationed, and the government has a dock-yard and some means to make repairs. In the event of a vessel receiving damage, she may find facilities for undergoing repairs there, but it very much depends upon the individual who is Governor of these islands, whose permission it is necessary to procure.

FROM MANILLA THROUGH THE SOOLOO SEA TO SINGAPORE.

Between the 25th of January and the 3d of February, 1842.

As my instructions embraced the exploration of the Sooloo Sea, I endeavored to acquire, during my short stay at Manilla, all the information that was to be had upon the subject. Captain Halcon, of the Spanish Navy, was kind enough to offer me all he possessed, but regretted exceedingly that it was so limited. He had himself been engaged in several explorations or surveys near Manilla, but beyond the Straits of Mindoro, he said, all was uncertain, and little known. I failed also in procuring a pilot who had any knowledge of the general route pursued by vessels bound for Sooloo. Viewing my time as exceedingly limited, it occurred to me that the best course would be to secure a knowledge of the entrances, particularly the Straits of Mindoro on the north, as well as the Straits of Balabac on the west, and Basilan on the south.

Although the route chosen and surveyed by the Expedition was the straits on the west of Mindoro, it is not, in my opinion, the best. I should prefer passing into the Sooloo Sea from the northward, through the Embarcadero Passage, between the islands of Luzon and Mindoro, which leads to the east of the latter island: this passage is clear of sunken coral reefs, and easily passed through. When up with the east end of the Isle of Verde, a fair wind may be expected, and the route being free from all obstructions, it may be navigated

in the night as well as the day. The Embarcadero leads to the Straits of San Bernadino: its length is about 50 miles, its average width 10 miles. Intending to take this route, it is necessary to pass to the eastward of Luban Island and turn into it, giving Point Santiago a good berth to clear the Minerva Rock, stretching over to the Mindoro side, for the wind will generally be found to draw through the channel from the eastward; consequently it will be a dead beat. Anchorage may be found in Calapan Roads, on the coast of Mindoro, and within the Bacos Isles. It is high water, full and change, at 7 A.M. The tides flow through with some strength. The south end of the Island of Luzon affords many anchorages, which may be used temporarily to await both wind and tide. In this channel lies the Island of Maricoban, the Isle of Verde, and the Bacos and Silunay Islands. In their neighborhood it is comparatively narrow, but there is ample room to work a large vessel.

The entrance through the Straits of Mindoro is rendered dangerous by the Apo Shoal. This shoal lies 12 miles from the Island of Mindoro, is of a triangular form, and has several small sand-islets on it, and a mile to the west is a small sand-island. The longest side of the shoal makes a sweep from west-northwest to east-southeast, while the two others join, forming a tail, at the south. On each side of it there is a clear passage: that nearest Mindoro I have called the Pandan Channel; the outer one has been known as the Northumberland Channel: the former being 10 miles, and the latter 15 miles in width. I much prefer the Pandan Channel. In the event of night coming on, one may anchor with safety in the small bays, which I think is preferable to beating about, subjected to tides, and in danger of being set on a coral rock or reef, many of which, though of small extent, exist off the south end of Mindoro Island, and render it necessary for large vessels to be very cautious.

After reaching Ylin Island, off the south point of Mindoro, the route is to windward, around the Island of Semerara, before standing over for the coast of Panay: this, though the safer course, is nevertheless attended with delay; and one is greatly tempted to pursue the straight course, and pass directly through the coral reefs and shoals; but it requires both confidence and self-possession. By keeping a good look-out, however, with a commanding breeze, the gauntlet may be run. The shoals and reefs can be distinctly made out in the morning hours by the color of the water, and avoided.

After rounding the Island of Semerara, it is desirable to steer direct for Point Nasog, the north end of the Island of Panay, and continue down its coast, passing inside of Hat Island of the charts. The winds here will be found generally to prevail off the land, and usually, when close to the island, are light, from the eastward, from which direction it blows for the most part of the year.

The coast of Panay, within the line of Banco Seco, and Hat Island, is clear of danger: this gives a good beating channel of about 20 miles in width; but the wind will be generally found favorable when passing either to the north or south along this coast, which trends in the same direction. West winds are sometimes felt as eddy winds when abreast of the high land of Panay: these will be found of great assistance, allowing a vessel to stand along the land.

After leaving Panay, the west point of Mindanao lies due south, which is the north point to the entrance of the Straits of Basilan. There is nothing to obstruct the navigation. The Islands of Negros, Zebu, Bohol, and Leyte, lie to the eastward of this track, and although high, they do not offer any obstruction to the prevailing wind, which will be found steady in passing by them.

At the western entrance of the Straits of Basilan is the small port of Caldera, which offers at all times a safe and convenient anchorage for vessels passing through, and where they may await a tide. To the east of Caldera lies the town of Samboangan, the largest on the island: it is the headquarters or residence of the Governor. The anchorage off it is rocky, and exposed to the strength of the tides. A little fruit may be had here, but no other supplies of consequence. Vessels touching here are liable to meet with some annoyances in consequence of Spanish jealousy.

The Straits of Basilan offer no difficulties to the navigator, and may be passed through during a tide. There are several sandbanks, about one and a half miles off Caldera, with ten fathoms water on them. The chart of this strait will point out all the dangers. The south side is the safest, where anchorage may be found in moderate depths of water. The flood-tide sets to the northward and westward.

On leaving Caldera, we passed directly towards the Island of Sooloo, between Pilas Island and the Sandboys: these last are readily known by the two pointed peaks. This, though a practicable route, cannot be recommended for vessels: if bound to the west, through the Sooloo Sea, it is better to pass to the northward of all this small

cluster of islets, from which a direct course, nearly due west, may be pursued to the Island of Cagayan Sooloo, which will carry a vessel clear of all the islands and shoals. There are several coral sand-banks, with from 15 to 30 fathoms of water on them, suitable for a vessel of large size to anchor on, in the event of calms, rather than be subjected to the strong tides and cross currents that are found to prevail; indeed, the difficulties which seem most to impede the navigation of this sea, are the currents and light airs and calms of the night hours, when it would be advisable for large ships to anchor, if they are fortunate enough to obtain suitable bottom. I practised this myself to advantage, and felt it a security as well as time gained in saving the distance the ship might have been carried by the tides to the southward and eastward. Unless there is this reason for it, there is no necessity to have recourse to anchoring, as the weather is seldom stormy, or subject to anything more than strong breezes, of short duration. Typhoons have never been experienced; and what is still more advantageous for vessels pursuing this route, they never meet with the rough seas which are encountered in the Palawan Passage or China Sea. After passing beyond the Straits of Balabac, they are in a situation to take advantage of any favorable wind that may offer for the purpose of reaching the Straits of Sunda, if in the southwest monsoon, either by stretching across the China Sea, or beating down the west coast of Borneo.

If the navigator desires to pass to the west, through the Sooloo Sea, from the Island of Panay, after having passed the Banco Seco, or abreast of Antique, he may take the direct course between the Cagayanes Islands and the Cayos Isles. The only dangers to be avoided are the Golconda Shoal, to the south of this track, and Piedra Blanca to the north, lying south of the Cayos. In all probability a favorable breeze will enable both to be cleared before night, after which there is plenty of open and unobstructed sea to work to the westward in; the direct course is about west-southwest. The current will generally be in the opposite direction to that of the monsoon blowing in the China Sea. This direct track, if intended to be pursued, should be confined to the northward of the small banks and islets lying in the same direction as the Cagayanes, viz., Cabreja, Cavalli, Temerario, Tob, Bataka, Bancoran, and San Miguel.

When up with Bajo Neuvo both the peaks of Banguey and Balabac will be in sight, and it will be better to steer for the former, with a

view of sighting the Mangsee Islands, and passing through that channel, as there are fewer concealed banks than on the north side of the strait.

In consequence of the monsoons not prevailing in the Sooloo Sea with the same regularity as in the China Seas, there is much greater opportunity of advancing against their directions. They are interrupted by the highlands, lying both to the east and west, which bound this sea. In the months of June and July, fresh gales occur, while in August and September, the winds are usually from the south, sometimes blowing strong. In the months of December and January north winds prevail. The usual direction of the wind is, however, from the same quarter as the monsoon is, though much less strong, the weather being more or less of the same character.

In the Hydrographical Atlas will be found correct charts of the Sea of Sooloo and its three entrances, viz., the Straits of Mindoro on the north, Basilan on the south, and Balabac on the west; also of the Island of Sooloo, and Harbor of Soung: these are derived from the best surveys by the Spanish, as well as our own observations; and I think those parts that we were not able particularly to examine may be relied upon.

The impression that these islands are infested by pirates is but too well founded. They are, in fact, seldom visited, so great is the dread of an attack by these freebooters. It is surprising that they have been permitted so long to set at defiance the laws of nations and civilization; but the time is not far distant, perhaps has arrived, when our own country and the European governments will interpose the strong arm of power, and render this sea entirely free from apprehension and danger, by compelling these lawless hordes to seek occupations less destructive to the lives and property of others. Were it not for the great fear all navigators have of falling into the power of pirates, by pursuing this route, it would have been long since much frequented; being, without doubt, the best, when it is desired to make a voyage up or down the China Seas, against either monsoon. From what I have seen and experienced, and the information procured from reliable sources, I am quite confident it will be deemed so hereafter.

Vessels leaving Singapore, or the islands of Sumatra and Java, for the northern ports of China, can save much time by passing through the Straits of Balabac. Although the winds may prove unfavorable,

yet the current sets on the coast of Borneo, to the north, in their favor, and with great velocity. The approach to the Straits of Balabac ought not to cause anxiety. The Peak of Balabac on the north, as well as that of Banguey on the south, are good and distinct landmarks; all that is then required is to keep a good lookout from aloft for the shoals and reefs in the range trending north-northeast and south-southwest. The passage through the shoals, sailing westward, is best made when the sun is in the east, or during the morning hours; and it is almost needless to say, that when sailing to the eastward, the sun should be, for the same reasons, in the west. I would strongly advise that the Great and Little Mangsee should be run for, as they will afford the necessary landmarks to insure a clear passage, and if desirable, at the setting in of night, a vessel may anchor under them until daylight. A few hours will suffice to clear the dangers, and place a vessel in such a position in the China or Sooloo Seas, that she will be enabled to pursue her route, or to seek any port of destination whither she is bound, without further anxiety or detention.

FROM SINGAPORE TO THE CAPE OF GOOD HOPE.

Between 26th February and 13th April, 1842.

This passage occupied 46 days. On leaving Singapore I chose the route by the Straits of Rhio, thence to the eastward of Lingin Island to the Straits of Banca, and through them to the Straits of Sunda. This I thought the preferable and shortest route. It was taken with a view of examining more particularly the charts extant of these straits.

Before leaving Singapore, I was permitted, by the kindness of Lieutenant Dittlof Jassen, of the Royal Dutch Navy, to take a copy of his MS. chart of the Straits of Rhio, on which he was then engaged. This I examined carefully, and I am gratified in being able to state the confidence I feel in its correctness, and to vouch for the accuracy of very many of its details.

Leaving Singapore at an early hour, a vessel will reach the entrance of the Rhio Straits before the setting in of the trades, and may be able to pass through to the southern entrance of the straits before being overtaken by night, particularly if the tide should serve. In case of detention, it would be well to drop anchor: this may be done anywhere within the straits with safety; the depth ranges from 5 to

15 fathoms; the tide sets in a line with the straits, the flood to the north, the ebb to the south: it is high water at full and change, at the northern entrance of the strait, about 10 o'clock; strength of the tide from 1 to 3 miles per hour. In rounding Lingin Island, if at night, it would be advisable to give it a berth of from 3 to 4 miles, and pass around it in from 15 to 18 fathoms depth of water. After passing Lingin Island, if it is thought preferable, the route by Gaspar's Straits may be taken. In the season of the northeast monsoon, this may be preferable to that by the Straits of Banca, as the wind will be more likely to hold, and the route may be pursued during the night. There are some shoals in these straits which have been recently examined by the late surveyors, the positions of which are now well ascertained. The east or west channel may be taken, according to circumstances. Accidents in passing through these straits ought to be imputed more to carelessness, than the want of good charts and directions to pass through them. The sailing directions for Banca Straits, as given by Horsburgh, were found in the main correct; the only difficulty is in passing through the Lucepara Passage after nightfall. There are many places of shoal water, but the bottom is soft, and not much danger to be apprehended. I should recommend always anchoring on the approach of night, while in the straits. After getting through the Lucepara Passage, we found good anchorage under the Two Brothers; the next night anchored off North Island, and the day after reached Hout's Island, at the entrance of the Straits of Sunda. Here we also anchored, owing to a loss of wind and being left to the action of a strong tide. On its making in our favor, with some breeze, we proceeded round Zutphen's Island and Hog Point, and anchored off Rajah Bassa. The weather was what is usually experienced at the end of the northeast monsoon,—cloudy with light winds during the day, and thunder-squalls with copious rains during the night. We left the Straits of Sunda, between the islands of Pulo Bessy and Crockatoa, with the wind from the eastward, but we had not been long in the Indian Ocean before we encountered the northwesterly monsoon, with severe squalls accompanied with lightning and rain. This kind of weather, with strong winds, continued until we reached the latitude of 14° south and 100° east longitude, and may be expected to prevail towards the end of the monsoon. The northeast monsoon of the China Seas, is identical in point of time with the northwest monsoon of the Indian Ocean; and during the south-

west monsoon of the China Seas, the southeast monsoon prevails; while the northeast monsoon is the dry season, the northwest is the rainy; yet this is not the case throughout this sea, but more particularly applicable to the weather coast, the leeward coast being generally subject to great drought during the same periods; and while the southwest monsoon is the wet season of the China Seas, the southeast monsoon is the dry one of the Indian Ocean. The southwest monsoon is supposed to be an extension of the southeast trades; but this I think there is great reason to doubt. We found the limits of the northwest monsoon to extend farther than usual, to the 14th parallel of south latitude; and they extend to the northward of the equator as far even as 5° north. The usual limits are within the latitude of 11° south and the equator.

The passages to and from China have been much shortened by the enterprise of our ship-masters, and the superior class of ships that are now built for this trade; in consequence, these vessels pursue a much more direct route, and instead of making the long detour recommended by Horsburgh and others, for contrary monsoons, steer a direct course towards the Straits of Sunda, and thence beat up the China Seas against the monsoon; indeed, so much difference is there in the length of the passages, that a vessel may almost go and return by the new route, before another could accomplish the distance to China by the eastern passage.

The passage home from the Straits of Sunda is a very simple navigation. When the northwest monsoon prevails, the course is to the southward and westward, to reach the southeast trades as soon as possible: these will generally be entered about the latitude of 10° or 12° south, when the latitude in which they prevail with the greatest strength is to be kept: this is generally between 12° and 20°. The parallel of 15° may be preserved, unless it is in the hurricane months, from December to April, during which period it is advisable to give Mauritius and Bourbon Islands a wider berth, experience having shown that these storms take place more frequently and with more violence in their neighborhood than elsewhere. These gales are represented as more violent than those which occur in the West Indies, but the accounts are probably somewhat exaggerated. The precautions advised by Horsburgh, and all those who have written upon these storms, or the typhoons of the China Seas, cause them to be looked forward to with more anxiety than is necessary. The barometer gives timely

notice of their approach by rising somewhat higher than its ordinary standing, then falling gradually, the sky becomes overcast and lowering, with much lightning in the northwest. On encountering a swell from the northward, with these appearances, in the Indian Ocean, it may be some indication that a storm is approaching; and all the necessary steps should be taken to make ready for what may be expected in a few hours: if, however, the swell should be perceived coming from the southward or westward, I think it may be considered an indication that the storm has passed, and no apprehension need be entertained. A recurrence of these storms, of any magnitude, seldom takes place in the same season.

The axis or centre of the storms of the Indian Ocean describe an ellipse towards the southwest, in their onward course to the west, the wind's veering being from left to right, instead of from right to left.

The storms which take place on the western side of the South Pacific, however, show another variation by their course being from west to east, and the longest diameter of the ellipse being in a direction northwest and southeast. These discrepancies I here point out, not to controvert any of the ingenious theories which have been brought forward, but simply to show that there are many facts connected with these storms, which have not been as yet brought to light or fully investigated.

In navigating towards the Cape of Good Hope it is to be remarked, that the longer a vessel can keep within the strength of the trade wind, the greater is the probability of shortening the passage. It will therefore be more advantageous to pass at other seasons than those subject to hurricanes, nearer to the Mauritius and Bourbon. From December to April is the season of hurricanes; during the rest of the year they do not take place: these islands then may be approached without apprehension. Yet in steering to the west, after passing these islands, it is to be considered whether the coast of Africa ought to be sighted, as calms and southwest winds prevail at the entrance to the Mozambique Channel, particularly during the summer of the southern hemisphere.

In passing the Cape of Good Hope with a view of stopping there, the cold water on the Agulhas Bank will be entered. The use of the thermometer in navigation is now well known and admitted; had it been known formerly, there is no place where it would have saved

more lives than in rounding the Cape of Good Hope. If the thermometer is used, it will give timely warning, and should claim attention, whatever confidence may be put in the position of the ship. All that is necessary in passing the Cape is to preserve the temperature of the water above 70°, which is the temperature of the current setting to the southwest, and which will carry a vessel quickly to the west. The water on the Agulhas Bank is always below 70°, or a few degrees below the temperature of the surrounding ocean, and if due attention is paid, the land cannot be reached without noticing it; no possible danger can occur. When bound into Table Bay, keep within the cold water: the current will carry a vessel to the northward along the coast. When up with it, steer for Green Point, and into the bay, where good berths are found to anchor in before Cape Town. The bay is almost an open roadstead, but dangerous only in the event of a northwest storm, in which case the whole anchorage is open to the ocean, when heavy seas roll in with great force. The periods of the year when it is deemed an unsafe anchorage is during the months of April and May.

CAPE OF GOOD HOPE TO ST. HELENA AND THE UNITED STATES.

Between the 17th of April and the 9th of June, 1842.

If vessels do not intend to touch at the Cape of Good Hope, they of course will keep in the warm current until it is passed, and then direct their course towards St. Helena. It is preferable to give the Cape a good berth, by which course the winds will be less variable and the southeast trades be entered sooner, not being affected by the influence of the Cape winds. These may be looked for on the parallel of 30°, in the longitude of 10° east, which meridian will seldom be passed before the trades are entered; a direct course then may be steered to cross the equator in the longitude of 30° west, thence to strike the Gulf Stream near the 73d meridian west, on the parallel of 30° north. In this route there is almost a certainty of preserving a fair wind the whole distance. The southeast and northeast trades will be more or less fresh, according to the season of the year. They may become light, yet they will be favorable; in our voyage we passed from the one to the other without an hour's calm, with the aid of a breeze from the south-southwest. If, however, they should, as the

equator is approached, be found from the northward and light, it is advisable to keep a good full, trusting without fear, as northing is made, the wind will enable a vessel to come up to her proper course. The only difficulty in this long navigation is to avoid the calms in the North Atlantic, between the latitudes of 28° and 32° and the meridians of 60° and 73°. The northeast trades will be held longer to the west, and for this purpose a navigator ought not to be too anxious to maintain an inflexible purpose of sailing on a Loxodromic curve: a deviation to strike the Gulf Stream to the south of Cape Hatteras, to take advantage of the winds which generally prevail on our southern coast, is the best, and will insure the help of that current. After getting into the Gulf Stream, the passage can only be retarded by the local weather of our coast. In the spring and summer of the year southwest winds prevail; in the winter, easterly as well as northwesterly winds are prevalent: these ought to be considered by the navigator, when about to make the coast and shape a course for his port of destination.

CHAPTER IV.

PAUMOTU GROUP.

SAILING DIRECTIONS FOR THE PAUMOTU GROUP.

Before giving a full description of each island of the Paumotu Group visited by the Expedition, I shall indicate the best routes to pass through this group, with the least danger, and subject to the least delay or difficulties. Few vessels heretofore have been willing to run the risk of a night navigation among them, and have been constrained to lie to until daylight reappears. While I would have every precaution observed in navigating through this dangerous cluster, I can yet see no necessity for detention in passing through them.

Most vessels have the intention of stopping at Tahiti, and as this group lies immediately in the route between it and the coast of South America, it becomes of advantage to pass through the islands which are embraced within it.

During the summer months of the southern hemisphere (from December to March), the weather is the most boisterous: the trade winds are usually fresh, but the vessel cannot calculate on them with any degree of certainty. The currents are not strong, nor do they at any season affect a vessel, and from all the authorities I have consulted, as well as our own experiments, I am inclined to believe that no allowance for current need be made. Some slight current will at times be experienced near some of the islands, during or after a strong wind, but it will be found to be both local and variable.

During the winter season (from March to September), the trade winds are by no means regular among these islands; they seldom extend so far to the south, are very often prevalent from the southwest, and the weather is frequently very unpleasant, inclining to calms and light winds, with an occasional squall; it is, however, the fine

season, for in summer, gales from the west not unfrequently occur, blowing very heavy, with rain, interrupting the course of the trades, an overcast sky often prevails, rendering it impossible to obtain the usual observations for latitude.

A vessel desirous of passing through the group, will find the 20th parallel most free from dangers, and can continue on it until reaching longitude 141° west, when a direct course to Tahiti may be steered: on either side of this parallel, north or south, Whitsunday and Carysfort Island may be sighted, in 138°, and afterwards Teku or Barrow Island on the south, and Nganaiti or Byam-Martin on the north, and further to the westward Heretua or Archangel and St. Pablo: all of these can be seen from seven to ten miles.

The next route is on the paralled of 18° 30′ south, making the Island of Clermont de Tonnerre in 136° 30′ west longitude; passing by Serle Island, and steering direct for Hau or Bow, then pass Dawhaidia, or the Two Groups, to Tahiti. The only dangers on this route are the Buyers; but I think their existence is very doubtful: the space where they are situated, I have every reason to believe has been passed over frequently, though having no knowledge of absolute search having been made for them, they are retained on the chart.

The next route is on the 15th parallel, sighting Henuake or Honden, whence a due course may be steered for Aratica or Carlshoff, or the north end of Taiara or King's; thence passing to the north of Kawahe or Vincennes, to the east of Toau or Elizabeth and Niau or Greig Islands to Tahiti.

I have already spoken of the route by the Disappointment Group of islands. These are the routes to be pursued with a favorable wind; but it frequently becomes necessary for vessels to pass through this group, when bound to the northward or southward. Vessels coming from the North Pacific, for instance, from the Sandwich Islands, rarely can get so far to windward as this group, and if they could, would seldom wish to take the risk, and would not desire to be subjected to a navigation so beset with dangers. When bound from the north, I would recommend making Nairsa or Dean's Island, and passing through between it and Tikehau or Krusenstern's, as being the most safe and advisable to follow. If it is desirable to cut the group more to the eastward, Ahii or Peacock Island may be sighted, and the passage between Nairsa and Arutua taken. If still on a more eastern meridian, I would recommend passing between Raraka

and Saken Islands, previous to which both Tike and Taiara may be sighted; and after passing through the channel between Raraka, Saken, and Tahanea, the wind will generally permit a vessel to pass to the eastward of that island, when the sea will be clear until the 20th parallel is reached.

Another route, still more eastward, may be recommended, which is, making the Disappointment Group, and holding a southeasterly course, to make Ahangatou, and thence pass Amanu, Hau, Harris, Nganaiti, Teku, Hereheretua, Matilda, and Cockburn Islands. Great doubt still exists concerning the Island of St. Juan Batiste: it has not been seen since the time of Quiros, 1606; but I have not felt authorized to expunge it from our chart, for we ourselves verified his discoveries of the Four Crowns, Archangel, and St. Pablo.

On the routes that I have pointed out, reference has been had to the winds, and the probability of a vessel experiencing those prevailing in this part of the Pacific. It is very evident that the islands may be passed through in all directions, by those who are acquainted with them, or feel disposed to incur the risk; but I have felt it my duty to sketch what in my opinion are the safest routes, and those I would myself endeavor to pursue. On these routes there are islands where a vessel may obtain a shelter, as well as all the products that are to be found in this group.

In entering the lagoon of any island, it would not be advisable to attempt it, unless the current should have ceased setting in; off the entrance, the direction of the current will always be known by the race, that is readily perceived either on its influx or reflux.

CLERMONT DE TONNERRE.*

This island has been the subject of much dispute, in consequence of its being identified with that of Minerva Island. Captain Duperrey saw it in 1825, and as it did not coincide with that of Minerva Island, he believed it to be a new discovery, and gave it the name of Clermont de Tonnerre. Undoubtedly he was correct, for if it was seen by the Minerva, it was so erroneously described, as not to be entitled to credit; and although corresponding in situation, I have retained the name of Captain Duperrey.

* For the position of islands and points, reference is made to the table of latitudes and longitudes.

It is a lagoon island, lying west-northwest and east-southeast, 10 miles in length, by 1½ in width; it is 12 feet above the sea, and its rim 600 feet wide. There are cocoanut and Pandanus trees on it, and a number of shrubs. It is inhabited; the natives, however, proved hostile, and we had no communication with them. There is a boat-opening into its lagoon on the southwest side. The reef from its southeast point extends half a mile, on which the sea breaks; and from its northwest point there is another, but its extent is not over two hundred yards. The north side is the most wooded, that on the south being nearly a bare reef.

SERLE'S ISLAND.

Serle's Island is a low coral island, with a lagoon 7 miles in length by 1½ in width. It lies in a northwest and southeast direction. This island is remarkable for having two large clumps of trees at each end, which Wilson, who discovered it in 1797, took for hills. It affords cocoanuts and Pandanus. The south side is for the most part free of vegetation, while the extreme ends and north side are well covered with trees and shrubs. It has no entrance for vessels into the lagoon.

HENUAKE, OR HONDEN ISLAND.

Henuake was discovered by Schouten and Le Maire, in 1616. It is a coral island, with a shallow lagoon in its centre, but no entrance to it. In form it is oblong, its length being in a west-by-north direction 7 miles, and width 4 miles. There are no cocoanut palms on it, nor is there any water. At times there are turtle to be found on the reef; but the landing is at best difficult.

DISAPPOINTMENT ISLES.

These islands were discovered by Byron, in 1765; there are two, Wytoohee and Otooho.

Wytoohee is a low coral island, of irregular form; it lies nearly east and west; has a lagoon, but no entrance into it. The south side is mostly a washed reef, and this is also the case with a part of the northwest side. The eastern part is more wooded than the western. It produces a few cocoanut palms, but not more than the inhabitants

need; the natives are willing to trade for them, notwithstanding the scarcity. I do not consider them friendly. Although Byron was disappointed in procuring supplies for his vessel, yet these islands offer full as much for the sustenance of life, as the other islands of the group.

Wytoohee is five miles and a half in length, and its greatest breadth two miles. The lagoon is shallow, and has many coral knolls that are above water, on some of which there is a scanty vegetation.

Otooho lies 12 miles west-northwest and is in sight from Wytoohee. It is a little over a mile square. It has no lagoon, and is well wooded.

TAIARA, OR KING'S ISLAND.

Taiara was first placed on our charts. We discovered it in 1839. I called it King's Island before knowing the native name. It is nearly round, with a lagoon in the centre, is 7 miles in circumference, has no outlet to its lagoon, and little reef on its leeward side, owing to its being protected from the southwest swell of the Pacific, by the Islands of Raraka and Kawahe. There are cocoanut palms on it in groves. It appeared to have been often frequented by the natives, for pearl-fishing, of which the lagoon affords a large supply.

RARAKA ISLAND.

Raraka was discovered in 1831. It is a low coral lagoon island, in the form of a triangle, its northern side trending east and west 12 miles, and the southeast and southwest sides are 11 miles: while the former is covered with trees, the two latter are submerged, and appear like extensive reefs. On the north side there is an opening into the lagoon, through which a small vessel may enter. The lagoon is very deep, and the sea often very rough. This island has some temporary inhabitants, produces cocoanuts and Pandanus, and is a good station for the pearl fishery. We found the natives inoffensive and kind.

KAWAHE, OR VINCENNES ISLAND.

Kawahe we claim as a discovery of the Expedition, in 1839. In its form it is nearly oval, and some 36 miles in circuit; when off Raraka, a high clump of trees on it is in sight, which has the appearance of a round hill. The rim of coral is very narrow, and the lagoon deep and as

blue as the ocean itself. It is 12 miles in length, by 9 miles wide. There is an opening for small vessels on the north side near the west end. It is visited occasionally by the natives, and affords a harbor for small vessels engaged in the pearl fishery.

TOAU, OR ELIZABETH ISLAND.

Toau was discovered by Roggewein, in 1722. It is a large, low, coral island, lying in a northwest and southeast direction; in length about 23 miles, and 7 miles in width; well wooded on its northern side, but its southern and western sides show but a bare reef. It has an entrance at its southeast end, and a small vessel may enter and find a harbor. This island was one of the Pernicieuses Islands of Roggewein, and also one of the Pallisers of Cook. It is inhabited, and offers some inducement for those who may be engaged in the pearl fishery to visit it. Water may be procured by digging pits.

APATAKI ISLAND.

Apataki is one of the Pernicieuses Isles of Roggewein, seen in 1722. It is one of the large islands of this group; has the same detached, low islets, and in places a submerged reef, with an opening on its west side into its lagoon. The form of the island approaches that of an obtuse-angled triangle, with its longest side trending northwest 28 miles; the north side trends east 20 miles, and the east side south 18 miles. It is inhabited, and the natives are friendly. The island is represented as a good place for the pearl fishery. It produces cocoa-nut palms and the Pandanus.

ARATICA, OR CARLSHOFF ISLAND.

Aratica was discovered by Roggewein in 1722. It was seen by Kotzebue in 1824. Its extent and shape, however, was not known until the visit of the Expedition, in 1839, when a survey of it was made. Its form is that of an isosceles triangle, having its apex to the northeast, and its base to the southwest. Its base is 12 miles in length, and that of its two sides 17 miles. The north side is well wooded, and the southern side little more than a bare reef. On its

northwest angle, it has an opening, through which small vessels may enter into the lagoon; near by there is a pond of fresh water, on the lagoon side. There are a few inhabitants, and fish can be obtained. Cocoanut palms and the Pisonia tree grow quite large on this island: with the latter, the natives build their canoes. The lagoon is deep, and from its weather side being overflown, in the outlet a strong current usually sets out, except a short time before high water, which is, therefore, the best time to enter.

MANHII, OR WILSON'S ISLAND.

Manhii was discovered by Wilson in 1796. It is a low coral island, trending west-by-south and east-by-north, 13 miles in length: its greatest breadth is across the centre, where it is five miles. There is a narrow and tortuous though deep entrance on the southeast side: small vessels engaged in the pearl fishery enter here, and find secure anchorage. At its western end, fresh water can be procured from pools. There are a few detached cocoanut palms of large growth on this island; the rest of the vegetation is small. Some few natives were dwelling on the island. The fish of this island at some seasons of the year are believed by the natives to be poisonous.

AHII, OR PEACOCK'S ISLAND.

Ahii may have been the Waterland of Le Maire, seen in 1616. It very much resembles Manhii, excepting that it trends more to the south. Its length is 15 miles west-southwest, and widest part 6 miles. It has an opening into its lagoon, which is shallow, but plentifully supplied with fish; these at certain seasons, as at Manhii, are reported by the natives to be poisonous. There are no cocoanut trees on this island, and I am inclined to believe never have been. The natives visit it from the surrounding islands for the purpose of catching fish. It has no fresh water. The distance between it and Manhii is eight and six-tenth miles, on a west-three-fourth-north course.

TIOKEA AND OURA ISLANDS.

Tiokea was probably discovered by Le Maire, in 1616, who gave

it the name of Sondergrond. It is about 15 miles in length, by 3½ in width, trending northeast and southwest, and has an opening of sufficient depth for vessels of large size, but they are debarred from the lagoon by large masses of coral which break up the passage; vessels, however, may lie secure in this gut when moored. There is a small harbor within the lagoon. It is the north island of the King George Group, of Byron. Oura is distant 4½ miles from Tiokea, lying north-by-east and south-by-west, 15 miles in length, by 3 in width. It has no opening. Both are inhabited, and Tiokea is well covered with cocoanut groves; on Oura few are now growing: they have probably been destroyed during the wars.

ARUTUA, OR RURICK ISLAND.

Arutua was also seen by Roggewein, in 1722. It forms an acute angle at its southern end; is low, and has its north part, which trends east and west, well covered with trees. Its length from north to south is 20 miles, and greatest width, which is at its northern end, 10 miles; a part of its western side is a low reef, with here and there a small green islet on it. The island is permanently inhabited, and there are extensive groves of cocoanut trees.

NAIRSA, OR DEAN'S ISLAND.

There are various claimants for the discovery of this island, among them Le Maire, in 1616, Byron, in 1765, and The Margaret, in 1803. This is the largest of all the low islands, being in length 45 miles, with a width of 18 miles; at its western termination it is 12 miles: it trends for the most part east-half-south and west-half-north. On the north side, towards its western end, there are two openings into the lagoon, for small vessels, and anchorage is to be found within it. Near the centre of the lagoon is a small island, which is covered with trees. The northern side and western end of Nairsa are well wooded, and some cocoanut trees grow near the entrance of the lagoon. The southern side is for the most part but a submerged reef, on which there are many large oblong coral blocks, standing erect, against which the sea breaks heavily; the eastern end forms an acute angle. It is inhabited, and acknowledges the rule of Queen Pomare, of Tahiti.

TIKEHAU, OR KRUSENSTERN'S ISLAND.

Tikehau was discovered by Kotzebue, in 1816. It is a low coral island, has a large lagoon in the centre, is 15 miles long, by 10 wide; it has an opening for small vessels into its lagoon on the western side. Between it and Nairsa there is a good passage, 12 miles wide. When a vessel is off its eastern extremity, Nairsa is in sight. Water may be obtained on it by digging. It has no permanent inhabitants, but is frequented by the natives who are pearl-fishers.

MATAIWA, OR LAZAREFF ISLAND.

Mataiwa was discovered by Bellinghausen, in 1820. It is a low coral island, the westernmost of this group, nearly round in form, having a lagoon, and an entrance on the west side. It is 13 miles in circumference, and covered with vegetation. Except to the pearl-fishers from Nairsa, there is no inducement to visit it.

METIA, OR AURORA ISLAND.

Metia was discovered by Roggewein, in 1722. It is a high coral island, rising at its northern side 250 feet above the sea, and gradually sloping off toward the south; in shape it is somewhat of a crescent form, the curve being toward the south. It is well covered with trees, and yields abundantly all the products of the Polynesian islands; is well inhabited, the village being situated on the north-eastern side, where a friendly reception will always be found from the natives, who are disposed to offer everything they have to part with, in exchange for old clothing, &c. &c. They are subjects of Queen Pomare. There are plenty of springs of fresh water on the island, but no streams.

TUINAKA, TIPOTU, AND OHITI, OR SEA-GULL GROUP.

These are three small isles, noticed for the first time by the Expedition. Tuinaka was inhabited by about 25 souls, who had been sent

by Queen Pomare to plant cocoanuts. They are all low islands, with lagoons, and all three lie between the latitudes of 16° 36′ 45″, and 16° 50′ 30″ south, and longitude 144° 3′ and 144° 16′ 30″ west. There is a rock in the neighborhood of Tipotu to the south, which is seen at some distance rising out of the sea. Water sufficient for the supply of the inhabitants, is obtained from pits.

ST. PABLO ISLAND.

St. Pablo was a discovery of Quiros, in 1606. It is a small lagoon island, in form nearly oval, higher than most of the low islands of this group, 5 miles in length, by 2½ in width, and has no outlet to its lagoon. It is inhabited; but the natives were not disposed to have any intercourse further than an interchange of presents, and seemed to be desirous of preventing a landing.

HERETUA, OR ARCHANGEL.

Heretua was discovered by Quiros, in 1606. It is a small lagoon island, of oblong shape, lying northeast and southwest; a reef extends off its northwest and southeast ends, on which a heavy surf beats. The northeast and east side is covered with a stunted growth of trees, and on the west and southwest it is only a submerged reef. There are no cocoanut trees, and the foliage of the eastern portion appears as if it had been burnt. There is no opening into the lagoon.

TEKU, OR THE FOUR CROWNS.

Teku was also discovered by Quiros, in 1606. It has now five clumps of trees, which have the appearance of crowns, and from these it no doubt derived its name; it has no opening to its lagoon. The island is not inhabited, nor are there any cocoanut trees on it.

NUKUTIPIPI, OR MARGARET'S ISLAND.

Nukutipipi was discovered by the Margaret, Captain Buyers, in 1803. It is a small, round, lagoon island, two miles in circumference, is well wooded on the north side, but on the southwest side it is a flat, submerged reef. It has no inhabitants.

TAWEREE, OR ST. SIMEON, OR RESOLUTION ISLAND.

Taweree was discovered by Boccheno, in 1772. It has the appearance of two small, low, coral islands: it is four miles in circumference. There is no outlet to its lagoon. There are three clumps of cocoanut trees, and a few Pandanus on it. Fresh water can be obtained by digging pits. The south and west sides are but a bare reef.

TAKUREA, OR WOLCONSKY ISLAND.

Takurea was discovered by Bellinghausen, in 1820. It is a low coral island, of oblong shape, in a north half east and south half west direction, ten miles in circumference. There is no opening into the lagoon. It is inhabited, the north end being high and thickly wooded, while its eastern side is partly a submerged reef.

THE TWO GROUPS.

The Two Groups were discovered by Captain Cook, in 1773. They comprise but two islands, Dawhaida and Manaka. The first is the most northern, and has an opening on the northwest for small vessels and boats. There is a channel of a mile wide between them, but no soundings. The islands have a north-northwest and south-southeast direction. They are each about ten miles long and three wide. Dawhaida on the north is for the most part well wooded, but the southern part is a bare reef, with some few cocoanut trees on its southeast end. Manaka has a grove of cocoanut palms on the south end. Its east and west sides are nearly bare, and in places awash. The coral reef of Manaka is continuous. These islands are inhabited.

CHAPTER V.

SOCIETY ISLANDS.

The prevailing winds among these islands are from the east-southeast to east-northeast during good weather; from any other quarter the weather is usually unsettled, cloudy, and rainy, with occasional gales from the southwest, north, and northwest. The months of December, January, February, and March, may be termed the bad season: it is then that the north and northwest winds prevail. The rest of the year the weather is fine, although occasional southwest winds are experienced, bringing rain; these are usually followed by light westerly breezes; during their prevalence the weather is extremely sultry and warm.

The Society Group include all the high islands in the neighborhood, in other words, they comprehend both the Society and Georgian Islands, and embrace Tahiti, Ulieta, Huahine, Otaha, Borobora, Maurua, Matia, Eimeo, Tapamanoa, Tetuaroa, and Tubai; these are all, with the exception of the last two, high volcanic islands, and differ from those of the Low Archipelago. The reasons given by some for uniting them under one head is, that they are subject to one rule; but this would equally apply to most of the Paumotu Group. It seems much more reasonable that all those that can be combined within distinct geographical limits should form a group, whether they are of the same description or not; high or low islands, of volcanic or coral formation.

TAHITI.

Tahiti was no doubt discovered by Quiros, in 1606, who gave it the name of Sagittaria; Captain Wallis saw it in 1767, and called it King George's Island; Bougainville again named it in 1768, Nouvelle Cythera; and again, in 1772, it was called by Boccheno, Amat; but these names have long since given place to that of the native, Tahiti.

The island is almost divided into two parts or peninsulas; the largest, Tahiti, is 90 miles in circumference and nearly circular: it lies to the west; the smaller one, known by the name of Taiarabu, is of oblong shape and about 30 miles in circumference: they are both mountainous, and rise in lofty and sharp ridges, Tahiti, next to Hawaii, being the highest island in the Pacific,—the altitude of Pitohiti and Orohena being between 9,000 and 10,000 feet. It is volcanic, and surrounded by an extensive coral-reef. In clear weather it may be seen at the distance of 50 miles; but ordinarily the highest peaks are hidden by clouds, when it is not visible over half that distance.

Tahiti is indebted for its fine harbors to the coral reefs, and only where these are detached from the shore are they found. The south side has no harbors, the reef being in some places wanting, while in others it is attached to the shore. On the north, however, the harbors are continuous, viz., Matavai, Papaoa, Toanoa, and Papeiti, extending from Point Venus to the west 8 miles. There are other harbors, on the east and southwest sides, but they are more or less exposed to the influence of the easterly and southwesterly winds; those on the northwest and west sides, with the exception of Matavai Bay, are at all seasons quite secure.

Matavai Bay is protected to the north and east by Point Venus and the projecting reefs off it, as well as somewhat by the Dolphin Bank to the northwest. With the trade winds it is a convenient harbor for a vessel to seek, as there is no difficulty whatever in entering or departing from it. The least depth of water found on the Dolphin Shoal was 13 feet 6 inches. It may be passed on either side; if to the eastward, the reef ought to be kept close aboard and a lookout from aloft; intending to anchor, it is better to turn short around the reef and pass through this passage, as a vessel thereby avoids any necessity of beating up. The bay is entirely clear, with the exception of two small shoals lying to the north of One Tree Hill, on which there is not over 3½ fathoms water: the depth in the bay varies from 6 to 18 fathoms. The anchorage is good in any part of the bay, but it is better to anchor well up towards Point Venus; the bottom black sand with mud.

Water is to be had without difficulty from the river that empties behind Point Venus, and can be obtained by passing over the sand-beach, where the stream has the appearance of having formerly

flowed. Natives may be employed to fill the casks, being expert and faithful in their labor; it is necessary, however, for an officer to superintend them. Wood can be purchased here for four dollars a cord, of the chief, who brings it to the beach, and there piles it.

The bay is surrounded by a beautiful beach, extending from Point Venus to the foot of One Tree Hill. A boat, in the fine season, may land on any part of it without difficulty, but from December to March it becomes difficult at times to communicate with the shore.

The harbor of Papaoa lies next to Matavai Bay on the west. It is formed by coral reefs, and though small is well sheltered; the entrance lies on the east. There is plenty of water for a large vessel, but the passages, though not intricate, are narrow. The only way to navigate through them is to choose a moderate breeze, and have a good look-out from aloft. The best anchorage is off Queen Pomare's house, in from 7 to 12 fathoms water, which is near the watering-place. The reefs afford the harbor all the protection from the sea that could be desired. There is a passage through to the harbor of Toanoa, lying to the west, but the turn through the reefs off Alaheda Point is very short, narrow, and difficult to pass. The chart of this harbor shows the channel more clearly than any description.

The fine harbor of Toanoa has an entrance of much greater width, and is consequently much safer than that of Papaoa. There are some coral rocks lying off the east point of the reef at the entrance: care must be taken to avoid these; and vessels bound in, after opening the mouth of the harbor, have only to haul up for the houses on the beach, on a south-southeast course, where they can anchor in from 6 to 10 fathoms water. Toanoa is more exposed to the north than Papaoa, and a heavy sea rolls in, which renders it uncomfortable for a vessel in the bad season. The bottom is good holding-ground, black sand, with mud. The watering-place is convenient, though attended with some difficulty in consequence of the coral which forms the beach. There is a deep and broad passage between this harbor and that of Papeiti, a mile and a half in length; and suitable for any class of vessels, though all navigation among coral islands and shoals requires great attention: it is not to be disregarded in this case. The entrance into the channel from Toanoa is narrow, but the passage between the coral shoals is readily perceived. The best course is to keep close to the outer reef, whose edge is for the most part well defined; but this passage should not be attempted in the afternoon,

when the rays of the sun make it impossible to see the coral shoals that are to be avoided. As soon as the harbor of Papeiti opens, the Government Wharf may be steered for, and when to the southward of the middle coral shoal, the anchor may be dropped in 8 and 9 fathoms water.

In approaching Papeiti Harbor from the north, its position is well pointed out by the Red Hill and Crown, which lie immediately behind it, but as vessels seldom make the island otherwise than from to windward, it is not deemed necessary to give any particular marks for entering by the north, as they would or might tend to mislead; the whole attention is to be given to the reefs along which the ship will be making rapid way, and the distance being short, there is but little time even to make preparations. Tow-lines and boats should be ready, as, in the event of being obliged to anchor near the entrance, it becomes necessary to either tow or kedge to a suitable berth. If any vessels are lying in port, aid from them in the way of boats may be confidently relied upon.

The north entrance is somewhat dangerous: the current setting obliquely across it, is very apt to throw a vessel on the sea or western reef, if due attention is not paid to turning short round the eastern point, giving the ship all the way possible, in order to shoot her well into the harbor. Every sail ought to be ready to clew up and hand, and the anchor to let go, before the attempt is made, as in all probability the moment the vessel hauls up with yards braced sharp, she may meet a light breeze off the land, which taking her aback, would endanger her being driven out, or on the lee reef: this is more particularly the case when the trade winds are strong, as then the wind is apt to draw off the land. The entrance from the north is the usual one, but I feel satisfied myself that the one by Toanoa Harbor is the safest and least objectionable.

I have not spoken of the native pilots, who are in attendance, but they are not to be relied upon, except to point out the channel, and all masters of vessels must attend to the working of their ships.

The harbor of Papeiti is one of the best ports of the Pacific. It is perfectly sheltered from winds, for picturesque beauty cannot be excelled, and has sufficient depth of water for any class of vessels, and, as far as the Islands can have, under the present government, every facility for making repairs. Water may be had in abundance

and without difficulty, and supplies of all kinds are readily procured. Being the residence of the Queen and foreign consuls, all the trade centres here.

At Papeiti there are many supplies to be had in the way of repairs, and what the place does not itself afford may, in all probability, be obtained from whalers, or the men-of-war that are met with in the port. It has, however, one great disadvantage, in being deprived of the trade-wind, being too far under the lee of the island to be benefited by it; the heat consequently is at times intolerable and very enervating, while in the harbors to windward the temperature is very much modified, and in comparison invigorating; on this account I should advise vessels merely stopping to refresh their crews, and not requiring repairs, to visit one of the windward harbors: of these, I should prefer Toanoa.

The position of the small island of Motuutu, on which there is a small fort, renders the harbor of Papeiti susceptible of being well defended from an attack by sea, but the place is not tenable from an assault by land.

There is an extensive shoal to the eastward of Point Venus, on which the French frigate Artemise struck.

This northeastern reef extends from 1½ miles east half north, of Point Venus to abreast of the Valley of Hapaino, which is distant about 10 miles from Point Venus. It is detached from the land, and for the most part lies parallel with the shore, except near its centre, where it deviates to the north-northeast, for about a quarter or half a mile. The soundings on it decrease very regularly; the centre is the shoalest part; from thence they gradually increase from 3 to 12 fathoms, all coral bottom. On or near the centre, which lies directly off a remarkable table-land, it has for a considerable distance from 3 to 4½ fathoms. On the eastern side the shoal trends for a short distance to the south-southeast, south, and southwest. The outer part of the reef is about 3 miles from the shore. When on its centre Point Venus will just be on with the high peak of Eimeo, bearing west-by-south three-quarters south. To avoid this shoal, all that is necessary is to keep the bearing of Point Venus to the south of west-southwest. The passage inside leads to no shelter or harbor; and every precaution ought to be taken to avoid getting within it. If, however, a vessel should by any chance find herself there, she may continue her course to the westward, as the passage is perfectly safe and free from

danger, until deep water is found, which is said to exist at the western end of the shoal, in the proximity of Point Venus. I should deem it better, however, if the sea is not high, to cross the shoal at any point some distance from its centre, as the water, for an ordinary sized ship, will be found sufficient. The reef is from half to three-quarters of a mile wide, and as the sea seldom breaks on it, is particularly dangerous to vessels running along for Point Venus, when they have closed with the land to the eastward.

There is another shoal, called Tecalai, lying off the Valley of Tecalai, which, though more dangerous, is at the same time more out of the track of vessels. It becomes necessary to notice it, as vessels sometimes make the land to the eastward, in thick and cloudy weather. This shoal, like the former, lies parallel with and about 3 miles from the shore, with a clear passage inside: there is a good channel between the two. On its shoalest place there is but 2½ fathoms; like the other it seldoms breaks. It is half a mile wide and 5 miles in length. The marks by which the position of the shoalest part may be known are, the high peak on Tiarabu on with the two small islands of Bovulou and Taawirri, bearing south-southeast half east, and a remarkable black mould hill, near the beach, nearly perpendicular, bearing northwest half west. The water is deep at both ends.

In the survey which we made of the harbors of Tahiti, our operations did not go east of Point Venus: my time would not admit of any extension in that direction. Captain Kotzebue, of the Russian Navy, in the year 1824, extended his survey a short distance to the eastward of Matavai Bay, and has named a small harbor on the east side of Point Venus formed by an islet, Port Papeiti: this is liable to lead to error, as the true Port Papeiti is several miles to the westward, and I am satisfied his name was adopted without due consideration; or perhaps the port of Papeiti to the westward was unknown to him. This small port, if it deserves the name, is, when compared with any of those to the westward, totally unfit for anchorage, being more exposed to all the winds than either of the others, and of course less secure.

The tides of Tahiti have little rise or fall, and apparently are not under the usual influences: they are generally affected by the trade-winds, which cause the anomalies that have been noted. They will be noticed in their proper place. I would call the attention of navigators

to the interesting observations that may be made in Matavai Bay, relative to the growth of coral on the Dolphin Shoal, at some future time. Of this an account has been given in the Narrative, Vol. II, to which I would here refer.

EIMEO.

Eimeo, discovered by Wallis, in 1767, who gave it the name of Duke of York, is a high volcanic island, extremely picturesque. The distance from the reef off Papeiti Harbor to the nearest point of its reef is 10 miles. It is 15 miles from north to south, and 20 miles from east to west. It possesses two fine harbors, Taloo and Papoa, or Cook's Harbor, which bear a strong resemblance to each other. The former is the largest. The harbor of Papoa or Cook's lies to the eastward of Taloo. Wood and water can be procured here, also cocoanuts, but vegetables must be brought from Taloo. Both lie on the north side of the island, and afford shelter and supplies for a few vessels. They are not so safe during the summer months as those of Tahiti, the north wind drawing through them with great violence, and the sea rolling in with some force, and unless a vessel is anchored near the head of the harbor, she would be much annoyed both by the sea and wind.

Taloo is very easy of access: all that is necessary, is to run down the reef until the harbor opens to view, and steer through the opening, when a vessel may anchor under the high land on its south shore in 15 fathoms of water.

Provisions may be obtained here in considerable quantities, as well as wood and water; but all the small articles that can be transported to Tahiti are held at the same prices as they are sold at that island: other supplies are much cheaper.

The harbor of Papoa cannot be recommended for vessels to stop at, when that of Taloo is so near at hand, more easy of entrance, and where everything may be obtained with convenience.

CHAPTER VI.

PHŒNIX GROUP.

The Phœnix Group consists of five small islands, lying between 2° 30′ and 5° south latitude, and longitude 170° and 175° west. I have thought proper to embrace them in a distinct group. They are low and very dangerous, and being situated in the track of vessels from the Sandwich Islands to the southwestern groups, as well as to New South Wales, ought to be well known, in order that they may be passed with safety. Many of these islands were considered doubtful, until they were examined by the Expedition; and their positions had been so much misrepresented that several names were applied to the same island. The islands included in this group are all of the low coral formation, and bear marks of being at times inundated. Their names are Mary Balcouts, Enderbury's, Birnie, Hull's, and Sidney. They have been resorted to for taking turtle, but without much success.

MARY BALCOUTS.

The discoverer of Mary Balcouts is doubtful. It is a low coral lagoon island, 13 miles in length by 5 in width. The lagoon is extensive, and has an opening on its south side; there is good anchorage within it, and but little inducement to seek it. No inhabitants.

ENDERBURY'S ISLAND.

Enderbury's Island is a parallelogram in shape. Having been detained a whole day on it, we were enabled to make a particular survey of it. It is a coral island, with a small lagoon, which was quite dry during our visit, and can only be filled by the sea washing over it in storms, or by rain. The lowest part of the island is towards the south, where it is 6 feet above high water mark. On the north it

rises 18 feet, presenting nearly a level ridge for half its length on the west side. Its greatest length is 2¾ miles north and south, and width 1¼ miles. On the south side there is some vegetation, but the growth appears stunted, and I am warranted in saying that there are times at which it is nearly submerged, for on the high ridge was found a very large tree, that could not have been deposited where it lies, unless the rest of the island had been covered by water. The coral reef surrounds it, but is attached to the shore, from 30 to 150 feet wide. The material which composed the ridge was formed of coral slabs, some 3 to 4 inches in thickness, and as many feet square. Landing on the lee side was not difficult. Turtles are at times to be found on this island.

BIRNIE ISLAND.

Birnie Island lies southwest from Enderbury's. It is but a strip of coral, about a mile long, by half a mile wide, trending northwest and southeast. Its elevation above the sea is about 6 feet, and it has nothing but a little grass upon it. It is extremely dangerous to vessels, as it would scarcely be discovered in time to be avoided, and there must be times when it is submerged entirely.

HULL'S ISLAND.

Hull's Island was discovered by the Vincennes, in 1840, and named after a distinguished officer of our navy. It is a low coral island, with a lagoon, and several openings for boats. It is well covered with vegetation. This island I was first led to believe was identical with that of Sidney, from its being in the same latitude and but a degree to the westward; but a party of natives from Tahiti who were on it, assured me that there was another island, very like it, to the eastward, on which they had been to catch turtle. There are a few cocoanut palms, and water may be procured in small quantities.

SIDNEY ISLAND.

Sidney Island is reported as the discovery of Captain Emmet, of the Ship Sidney; it has been also seen by Captain Tromelin. It is a

low coral island, with a lagoon 3 miles in its greatest diameter. I had entertained some doubts as to its existence; but from the report of the natives, together with the observations of Captain Tromelin, which I think ought to be relied upon, I am constrained to the belief in its existence. His observations at other islands I have found correct, and I have little doubt of their being so in this instance. This island he places some 60 miles to the eastward of Hull's. In my endeavors to sight it, I was disappointed. We approached its position during a very dark night, and every evidence of the existence of an island was manifested by the appearances around us; but lying off in hopes of holding our own to sight it when daylight appeared, we found that the ship had been set by a strong current to the westward, and the shortness of our provisions, with the delays incident on attempting to get to windward, compelled me to abandon the search for it.

CHAPTER VII.

UNION GROUP.

The Union Group comprises Oatafu, Nukunono, and Fakaafo Islands. These are all of coral formation. A long time had elapsed since they had been visited by any vessel. The first two were discovered by Byron, who named them Duke of York and Duke of Clarence Islands; the last was discovered by the Peacock, in 1841, and was called Bowditch Island, in honor of our great mathematician. During the rainy season, December, January, February, and March, they are subject to sudden squalls from the west, and very heavy rains. The currents in this part of the ocean are weak and variable: they will generally be found to set to the westward. These islands trend west-northwest and east-southeast from each other. They produce nothing but some tortoise-shell and cocoanuts. The inhabitants were found to be a docile, harmless people, but strongly addicted to theft.

OATAFU, OR DUKE OF YORK'S ISLAND.

Oatafu was discovered by Lord Byron, in 1765. It is a low coral lagoon island. Its length, north and south, is 4 miles, and its width 2½ miles east and west. There are several islets formed on various parts of the reef, which are from 8 to 10 feet above the water, and well covered with trees, some of them of large size; among them are many cocoanut palms. The vegetation corresponds to that of the large islands of Polynesia. On the reef the sea breaks with great violence, but at high water there is sufficient depth to float a boat over into the lagoon: there are no openings. This island is inhabited, and the natives use double canoes.

NUKUNONO, OR DUKE OF CLARENCE ISLAND.

Nukunono was also discovered by Byron, in 1765. It is a low coral lagoon island, of a triangular shape, with its apex to the north. It is 7½ miles long, north and south, and 5 miles wide, east and west. The northwest side is a bare reef, awash, on which the sea breaks heavily; the other sides have islets upon them. There is no opening into the lagoon. This island is inhabited, and cocoanut palms and other trees are growing upon it.

FAKAAFO, OR BOWDITCH ISLAND.

Fakaafo was discovered by the Peacock, Captain Hudson, belonging to the Exploring Expedition, 1841. It is a low coral lagoon island, its shape that of a triangle, with the apex to the south. It is 8 miles long, from north to south, and 4 miles in width. On its southwest and north points the land is considerably elevated, and these are connected by an extensive coral reef, which is awash. On the east side the land is more contiguous, and in places there are extensive groves of cocoanut trees and shrubbery. From appearance, the lagoon is believed to be of little depth. The canoes here were single, with outriggers, resembling those of Samoa. On this island the king or chief of the group resides. These islanders have no knowledge of any other islands but there own three, and showed great astonishment at our visit. Water is very scarce, and the small supply necessary for them is ingeniously obtained from small reservoirs cut in the cocoanut trees, to catch the rain.

CHAPTER VIII.

SAMOAN GROUP.

The Samoan Group was believed to be a discovery of Roggewein, in 1590, who named them the Bauman Isles; but as the whole group did not agree in size, shape, or form, with his description, it has been discarded, and they have become known, since they were seen by Bougainville, as the Navigators' Group. The first intercourse with these islands, and particularly that of La Perouse, produced the impression that these islanders were warlike savages: their bad name caused them to be seldom visited, and little has been known about them until within a few years back, since which they have assumed their native name, and their characters are better understood.

This fine group consists of eight islands, viz., Savaii, Upolu, Tutuila, Manua, Oloosinga, Ofoo, Manono, Apolima, and Rose Island. They are all volcanic, except the last, which is a small coral island, with a lagoon. Savaii is the most western and largest, and Rose Island the most eastern and smallest. They are embraced within the longitude of 168° and 173° west, and between the latitude of 13° 30′ and 14° 30′ south.

All are inhabited except Rose Island. The two most important are Upolu and Tutuila, both as regards their productions, as well as the number of fine harbors they offer for vessels; for these they are, with but one exception, indebted to the coral reefs: this exception is that of Pago-pago, in the Island of Tutuila, which is completely land-locked, and will be described in its proper place.

These islands afford all kinds of refreshments in abundance, particularly those that are the productions of Polynesia, and since the establishment of the missionaries, the attempt to introduce neat cattle has been so successful, that they will be shortly able to supply beef at a reasonable price.

The weather from April to December is generally fine, but from

December till the end of March, long and heavy rains prevail, and the gales are frequent from the northwest and west, with much bad weather. The climate may be termed variable; the mean temperature is between 75° and 82°, and the mean height of the barometer 30·128 inches. Destructive hurricanes are at times experienced on these islands, as well as in the neighborhood of the group.

SAVAII.

Savaii is the largest island of the group, was known by the first discoverers under the name of Pola, and since then it has been called Chatham Island, Shaore, and Otuwhy. Its length lies east and west 40 miles, and its width north and south 20 miles. The surface of the island is much broken by numerous cone craters, which appear on all sides. The land gradually rises towards the centre, until it reaches an elevation of not less than 4000 feet, apparently terminated by a large crater. The natives describe it as a mass of stone; and, if we may judge from appearances, it is mostly covered with volcanic eruptions proceeding from a terminal crater.

Savaii is devoid of harbors; the whole southern and western portion being an iron-bound shore, alternating with small sandy beaches, on which the sea breaks with much violence.

The eastern end, though having extensive outlying reefs, has no opening, except for boats, and the area within is filled up by extensive coral patches.

Near the southeast end there is a large bay, called Paluale; the reef, however, extends across it and closes it from the sea: the shore can only be approached through the narrow boat-openings which lie on its western side. The village at this place is prettily situated, and is the residence of a missionary. Here a vessel may lie off and on till a boat can be sent in for supplies. Formerly, those who attempted to land for supplies found it necessary to take every precaution to prevent being cut off, by a noted chief, called Opotuno; the officers and crews were oftentimes maltreated, and even murdered. The change that has been wrought among this people by the missionaries is so great, that there is little or no danger at the present time.

From this bay the coast trends west 14 miles, then northwest 6 miles, until the deep bight, forming the Bay of Salealoua, is reached. The village of Salealoua is situated at the head of the bay, on a con-

siderable plain, surrounded by groves of cocoanut and bread-fruit trees; there is, however, no shelter in it for vessels. The shore is skirted with coral, except near the west side, where boats may land on a sandy beach. Native missionaries are located here, and the inhabitants are friendly and desirous of trading.

Near the western point of the island is a small cove for boats to land, and in it the site of the large and beautiful village of Felialupo. Here also supplies may be had in abundance: the natives are friendly, and willing to exchange their poultry and fruit for cloth, tools, and other articles. A native missionary resides here.

Turning the western point, Asau is the next town on the north side: it is situated in a deep bay, which has the appearance of being a good harbor, but is closed up by a coral reef, and has only a small and shallow boat-entrance on the western side. The town is very populous, and the natives readily visit, in their canoes, vessels that are lying off and on, with articles for trade.

One of the natives committed a theft here, from the Porpoise, but on its being represented to the chief, the articles were promptly restored. The Bay of Asau contains the only coral that is to be met with on this side of the island.

The next harbor, or rather roadstead, is Mataatu: it is situated at the extreme north point of the island; but one mile in length and a little over half a mile deep: it is exposed to the sea from the north to the west. The eastern point projects but a short distance beyond the reef. The shore is skirted by a fringe of coral, 1000 yards wide, on which the sea breaks at all times, and frequently very heavily. There are two boat-openings through it to the shore, which are at times difficult to pass into when there is much surf, as the sea when retreating leaves them nearly dry, particularly at low water; making it impossible to get off either wood or water, except between half tide and high water. The soundings in the roadstead are very regular, varying from 8 to 10 fathoms, which depth is carried to near the shore reef: the bottom is hard black sand.

The best landing is near the northeast point of the bay, in a bight formed by the reef, where a small vessel might find protection and anchorage. This is convenient in the fine season, but during that portion of the year (from December to March) when the north and northwest winds blow, becomes extremely dangerous, as the sea

would in all probability make a complete sweep of the reef, and probably over the point.

A swell usually sets into the bay, which makes the anchorage disagreeable; yet it is safe when the southeast winds prevail, as the island then forms a lee. Wood and water can be obtained in plenty, as also the usual fruits and vegetables.

To seaward of this roadstead there is an extensive bank or bar, about 1¼ miles outside the points forming the bay, on which the least depth of water is 6½ fathoms, with hard bottom: it may be readily known by the long groundswell upon it; but a vessel can cross it without danger.

The town of Mataatu is beautifully located around the bay, in an extensive cocoanut grove: it contains about 2000 inhabitants, and is the residence of a missionary. A small rivulet, which flows from the Lusva Hills, behind the town, is lost, percolating through the sand-beach into the sea.

From the Point of Mataatu the coral reef extends 2 miles to the eastward, where it is again interrupted for 5 miles, the whole being iron-bound; thence it is continuous to the southeast point, and has no opening, except four passages for boats, one at Amoa, another at Sapapale, and the others near the southeast point of the island. The reef off Sapapale, which is the most important town on the island, is upwards of a mile from the shore, affording a great protection to the canoes of the natives. This portion of the island is the most thickly settled, and has constant intercourse with Upolu, from which it is distant 6 miles, the small islands of Apolima and Manono lying between Savaii and Upolu.

The part of Savaii that is cultivated is very productive. It has no rivers like the other islands of the group, but copious springs are found everywhere near the shore; the cause assigned for this is, that the rains are rapidly absorbed by the vesicular lava, and again given out at the base or along the shore.

In its having no harbors, nature seems to have placed an insuperable obstacle to its ever becoming of the importance its size and population would at first view indicate. The intercourse with foreigners, and the advantages to be derived from commerce, must always be in the possession of the more fortunate islands, that have been blessed by nature with fine harbors.

UPOLU.

Upolu is without doubt the finest island of this group. It occupies almost a central position, is much diversified by hills and valleys, and has many streams that irrigate and render fertile a luxuriant soil, composed of volcanic and decayed vegetable matter. It has safe and commodious harbors, though of no great size, formed by its surrounding reef, which seems by nature to have been intended to facilitate commerce as well as the safety of the ships that are destined at no great period of time to frequent its ports, and carry away to distant countries its valuable products. Upolu lies nearly east-by-south and west-by-north. It is 40 miles long. Its greatest breadth is 10 miles, which is about one-third from its western end. At both ends there are several islands, Manono and Cockscomb on the west, Fanuatapu, Namua, Nuutele, and Nuulua on the east; these, except the last two, are enclosed within its reef.

There are two harbors on the south side, Falealili and Sanaapu; while on the north side there are six, viz., Apia, Saluafata, Falifa, Fangaloa, Uafato, Latonga, and Laulii roadstead.

The shores of the whole island are covered with a succession of villages, which occupy the level spots of ground: these are more extensive on the western end; towards the eastern, the land becomes more abrupt, the width of the mountain range extending from shore to shore, and rising to the height of 2700 feet; along this range there are several extinct craters of volcanoes, exhibiting extensive volcanic action. The localities of these are seen better on the chart of the island than they can be described; the most remarkable one is that of Tofua, near the west end. These peaks form excellent landmarks, and in sailing towards the island, they cannot well be mistaken, and afford facilities of making the desired port without loss of time. On the charts are sketches of the land.

The harbor of Apia, though small, from its central position as well as its accessibility, is the most convenient to resort to: there all supplies for a vessel may be readily obtained, and from its having been selected as the first residence of the missionaries, it has become the focus of civilization, and is now the abode of the consuls of the foreign powers.

Apia Harbor requires few directions for entering. In coming from the eastward, Matafongatele Point will be readily known by its extensive grove of cocoanut trees, resembling that of Point Venus, Tahiti. If there should be any vessels in the harbor, their masts will be seen above the grove. When abreast of the town, Apia Hill, having the appearance of a double crater, will bear south (true), then haul close around the eastern reef, and stand in for the big tree, near the Fale-tele or council-house, which will carry you along the edge of the reef until it turns abruptly to the east; by clewing up all before reaching it, a vessel will have headway enough to fetch a berth in 5½ fathoms water (sand and mud), convenient for getting wood and filling with water; the reef protects a vessel partially from the swell of the sea.

From April to December the anchorage in Apia Harbor is quite safe, and will accommodate several vessels conveniently; but from December to March, vessels are very much exposed to the prevailing winds from the north, often blowing strong, and accompanied by a heavy sea, from which the reef offers little or no protection. Owing to the quantity of water discharged by the creek, and the current setting round the bay from west to east, a vessel is kept riding head to the stream and in the trough of the sea, rendering her situation extremely unpleasant from heavy rolling. She will seldom swing to her anchors, unless during heavy puffs of wind, and rides with little strain upon the cables.

The harbor of Apia is about a mile in length, northwest and southeast, by a third of a mile wide, and the depth of water varies from 5½ to 12 fathoms. The position of our observatory was near the mouth of the creek, for which the longitude is given.

The roadstead between Laulii and Latonga is the next anchorage to the east, 3½ miles distant from Apia, which offers protection to a vessel. It may be known by the rocky bluff which separates the two towns, for which it is necessary to steer when entering, and on discovering the town of Laulii, a vessel may bring it to bear south, and steer in for it, passing along the western edge of the sea-reef, and to the westward of the two coral patches, behind which there is good anchoring ground in the fine season, in from 7 to 11 fathoms water, coral sand; but during the bad season, it would be advisable to anchor as far up the bight of the reef as possible, in 5 to 7½ fathoms. Wood and water can be obtained at either town, though the landing at

Latonga is more sheltered. I would not, however, advise a vessel to seek so exposed an anchorage, when a much better one is to be found within so short a distance as Apia or Saluafata.

The harbor of Saluafata, situated 7½ miles to the east of Apia, is the best harbor of the island during the stormy season. It is in extent three-fourths of a mile east and west, and the same distance north and south. The sea-reef to the westward forms almost a complete protection from the north and northwest winds, while that to the east in like manner shields it from northeast to east. The depth of water varies, after passing within the line of the reefs, from 12 to 4 fathoms. The bottom under 8 fathoms is sand and mud, and good holding-ground; over that depth it is sand. The best anchorage is near the centre of the bay, in 8 fathoms, with the village of Saluafata east, and that of Fouci bearing south.

The harbor of Saluafata lies, to appearance, under the highest peak on Upolu, bearing south 22° west, for which it is necessary to steer. On coming up with the reef, care must be taken to avoid a shoal, that lies nearer the eastern side of the entrance than the western: this may be avoided, by keeping the reef on either side close aboard. At half tide and low water the sea frequently breaks on this shoal. It has at low water but a quarter less 3 fathoms. The small island nearly at the head of the harbor bears from the shoalest part south half west. Captain Hudson remarks that it is difficult to distinguish this island from the main land when outside the harbor. The best course in is to avoid bringing the eastern point of the western reef to bear to the westward of south-southwest, running to pass close by it, and reaching the anchorage on a south or south-by-west course. Between the west reef and the shore, there is a good boat-passage, leading by the town of Salelese and Eva to sea.

Five towns are situated around the shores of the Bay of Saluafata, all embosomed in groves of cocoanut trees; they are, Saluafata, Fouci, Salelese, Eva, and one between Saluafata and Fouci, whose native name we did not obtain. Wood, water, and provisions may be obtained here in abundance, and got off without injury to the men or boats. The chiefs of these towns, at the time of the visit of the Expedition, were disposed to be unfriendly to the whites. The murder of an American sailor, and the refusal of the town to give up the murderer, caused Captain Hudson, in the Peacock, to burn two towns, Saluafata and Salelese, to which the guilty chiefs belonged. It is

believed that this punishment has had the desired effect, of making them more cautious how they molest those who are protected by our flag.

The harbor of Falifa is 3 miles east of that of Saluafata: its situation is readily known by the only gap in the high ridge of the island, and the plains of Falifa, both of which lie immediately behind it, and are too remarkable not to attract notice. The small bay which forms the harbor is nearly one mile wide and half a mile deep; the eastern point (Naneivi) is a rocky bluff, and its western (Sandy) is low. The town of Falifa is situated at the head of the bay, at the mouth of a fine stream of water, which may be approached by boats. On the eastern side of the harbor, under the high land, is the town of Naneivi. The bay is skirted with coral on its western, as well as eastern sides, with the exception of Point Naneivi, and in the immediate neighborhood of the fresh-water stream. On the eastern side the land is high, and very much broken, but to the west it is low, and covered with groves of cocoanut palms. Off the western point of the reef there is a sunken coral patch, on which the least water is 3 fathoms: to avoid this, in entering the harbor, it will be better to keep near Naneivi Point. Falifa Harbor is exposed to the northeast and east winds, but good protection may be found from the north and northwest winds by anchoring well up in the bight towards Sandy Point. The depth of water in the harbor varies from 11 to 5 fathoms: the bottom is sand. Wood and water may be obtained here without any difficulty.

Fangaloa Harbor is a remarkable indentation of the island, 3 miles deep by a mile wide, between its two points, and gradually converging until it forms almost an acute angle at its head. The course in is south-southwest, on which bearing there is a very remarkable pointed peak (Malata). The two outer points (Eld and Emmons) are sharp bluffs, and free from coral; off the former (Eld's Point) there are several black rocks, which project seaward. There are no other dangers near the entrance, and the shores are bold. Within both points the coral reef is seen; as you advance towards the head of the harbor, it continues to increase in width, until in some places it reaches to upwards of 1000 feet, the edges of which are dry at low water. At the head of the bay it is free, and here is found an excellent stream of water, that is very convenient to fill casks, and remarkably pure.

Both sides of the harbor rise very rapidly. There is a small plain of level land extending around, on which the villages are situated, in groves of cocoanut palms. These villages are separated from each other by rocky points, serving as natural divisions to the limits of each; they are seven in number: on the left entering is Samamea, Lena, Masina, and Oluna; on the right, Musumusu and Atoe; while at the head of the harbor lies Tirefanga.

In the centre, between the points, there is 56 fathoms water: this decreases towards each point, as well as in proceeding up the harbor, until, on reaching the head, there is but 5 fathoms; the bottom is sandy.

This harbor cannot be recommended. The wind, when it blows a fresh trade, draws down over the high land with some violence, and in stormy weather smart squalls are experienced. Though protected somewhat in the bad season from the north and northwest winds, yet it is very subject to rain, and severe squalls oftentimes come down the sides of the mountains.

Supplies may be had here in quantities. The natives are inclined to be peaceable and friendly. Few ships have as yet visited this picturesque harbor. In point of scenery it is scarcely to be equalled. Its jutting peaks, of bold and fantastic outline, are agreeably contrasted with the peaceful and quiet villages embosomed in the luxuriant foliage. The position of Fangaloa cannot well be mistaken; the remarkable Peak of Fao, which rises to a great height on the west side of the harbor, is a conspicuous guide to point it out.

Uafato is a small bay, that lies 2 miles to the east of Fangaloa. It is not over half a mile deep, surrounded by a shore-reef of coral, and from the head of the bay there is a long strip of coral, which projects one-fifth of a mile into the bay, forming a considerable obstruction. The bay is entirely open to the east and northeast winds, but is somewhat sheltered from those from the north and northwest. Uafato is a large town, surrounding the head of the bay, and at a short distance back of it is a lake of fresh water, from which there is a small stream emptying into the bay at the town, and where water-casks may be readily filled. The natives report that the lake is filled with large eels, and many other fish; but I think this wants confirmation.

The best anchorage is with Rocky Point bearing north-northeast true, in 15 and 16 fathoms water, sandy bottom. At times there is considerable surf and much swell in the bay. The scenery around

this bay partakes very much of the striking features of that of Fangaloa, and the shores are covered by one continued grove of cocoanut palms.

Tiavea is a small bay, much resembling Uafato, and about the same size; the anchorage is not, however, so good, nor the facilities for obtaining water so great: it is entirely surrounded by a shore-reef. Vessels may anchor in it, in from 8 to 10 fathoms water. The village of Tiavea is situated at the bottom of the bay, and has an inviting appearance from off the harbor. The point to the eastward of Tiavea Bay forms the northeastern point of the island: it is high and rocky, and may be closely approached. The coast then turns nearly at right angles to the south, and after passing the town of Samusu, the coral reef again is met with, which extends off and includes the two small islets of Fanuatapu and Namua, and stretches as far as Tapanga Point. This reef protects the east end of the island from the prevailing winds (east and southeast) and sea; through it there are many boat-openings, leading to the towns of Saleaaumua, Mutiatele, Satitoa, Ulutongia, and Vailoa.

Tapanga is a rocky point, off which the coral reef extends to within a short distance of the small islet of Nuutele, but there is a passage between. This islet is nearly circular, half a mile in diameter, and evidently of volcanic formation, still preserving its crater appearance: it is moderately high on the west side, gradually inclining to the east, where it forms a small cove, and on it is a small village of fishermen.

Nuulua is another small rocky islet, a quarter of a mile southeast of Nuutele: off its eastern end are two small rocks. Both of these islets may be closely approached, and the passage between them is clear.

The south side of Upolu is exposed to the whole force of the southeast trades, and the sea or swell is from that quarter for eight or nine months during the year: it has fewer harbors than the north side, which are by no means desirable for vessels to seek, and ought to be avoided, except under very pressing circumstances; the openings through the reef, however, offer many safe and convenient harbors for boats. Upon the coast there are several villages and some considerable towns, the principal of which are Lepa, Anfanga, Lotofanga, Toupii, Salani, and Falealili. At Salani there is shelter for small vessels, and two fine streams come down from the mountains, empty-

ing into the sea. The town of Salani is situated on a fertile plain, with extensive groves of cocoanut trees. Supplies of wood and water, fruit and vegetables, may be procured.

The position of Falealili may be known by the small cocoanut island lying off the town on the reef, which is a very conspicuous object. This is the best harbor for vessels on the south side, and is the only one where the ingress and egress is not attended with difficulty or danger. Falealili is indebted for its shelter to the coral reef above mentioned, which covers the openings or indentations in the shore-reef. The eastern channel is the best to enter by, and the western to depart from. The prevailing wind is fair in both channels, but as the channel is narrow, it is entered with some difficulty, requiring great attention in steering, and the quick action of the helm. The direction for entering is to run for the large church when it bears north-northwest (true), taking care not to be under too much headway. The sunken coral patches at the entrance of the channel may be easily avoided by keeping a good look-out, as they are plainly to be seen. When Cocoanut Island bears southwest (true), keep away to the westward, passing through the channel between the reefs, and when the island bears south-southeast (true), anchor in 15 to 19 fathoms water. The reef and island shield vessels from the force of the sea, as well as the wind, but the eastern opening of the reef affords the best boat-landing; there water can be easily procured from two streams, that pass through the town, giving a large and constant supply. Falealili is a large town, extending along the shore upwards of a mile. The plain is well covered with cocoanut palms and other trees of the island, exhibiting a very luxuriant prospect. Wood may be obtained, as well as fruit and provisions. The chiefs are friendly and hospitable; by arranging with them for supplies, they will be procured better and with the least trouble.

To the west of Falealili the coast becomes bold and iron-bound for the distance of 3½ miles, when the coral reef is again met with, and continues to the harbor of Sanaapu: through this reef there are several boat-openings. From Sanaapu to the west end of the island the land is generally low, except here and there a rocky point, and between Lafanga and Falilati the shore has steep rocks and is iron-bound. The principal towns are Sanaapu, Lafanga, Falilati, Samatou, and Faluasofia.

The harbor of Sanaapu is about a mile in length by half a mile in

breadth : it is formed by the coral reef. At its entrance there is a coral patch of half a mile in circumference, which serves as an additional protection to its anchorage from the southeast swell. The course in is due north (true), and if Suisigna Peak can be seen, a course direct for it will lead off the harbor; in the absence of other marks, the reef on the eastern side of the harbor can be followed, and the anchorage sought within the coral patch : the best place to drop the anchor is in from 7 to 9 fathoms; the bottom sand and mud, and good holding-ground. The prevailing wind on this side of the island enables a vessel to sail in and out with a free wind. Water may be had here without difficulty, at either of the streams, and wood, with all the supplies of the island. Sanaapu lies nearly opposite to Apia, and there is a good path leading across the island at this place, so that the foreign consuls may be consulted if required in a few hours.

Although there are no harbors for vessels on the south side, towards the western end, yet there are many safe ones for boats, which the chart of the island, by the Exploring Expedition, will point out. The reef here encloses Manono, whose situation and connection with Upolu is spoken of hereafter. Though the channel between the island and reef affords no facilities to large vessels, yet for the native canoes and boats it is everything that could be desired, giving them protection and the natives opportunities for fishing, from Falilati to Apia, which is upwards of 20 miles, a district comprising some of the most fertile lands and most populous towns of this island; though but a few years before, at the time of the arrival of the missionaries, it is said to have been depopulated. Salafuata, Sasava, Faleatii, Fasetoolai, Nafavalii, Tooanea, Salamoa, Sangana, Falooloo, Vaialasa, and Vailela, are the chief towns. All of them afford ample supplies, which can be readily brought to Apia, and at short notice within the waters protected by the reef.

Upolu has, both on the north and south sides, soundings extending off some distance from its shores, and off Falooloo Point there are several patches of coral, with but 2 and 3 fathoms on them : it is requisite to avoid these when vessels are lying off and on.

There are few finer islands, and none where supplies can be obtained so readily as at Upolu. Being the seat of the supreme or governing power of the group, the natives are under better control, and in cases of accident or injury the reparation would be more easily

obtained here than elsewhere. The ruling chiefs of this group are extremely well-disposed towards foreigners, and are for the most part professing Christians. From the exertions and perseverance of the missionaries, the natives are advancing rapidly in civilization.

APOLIMA.

Apolima lies east from the east end of Savaii 3¼ miles. It is evidently an extinct crater of a volcano. The southern side or ridge is elevated 470 feet above the level of the sea, gradually descending towards the north, on which side there is an opening, through which the sea rushes with violence: after it is entered it forms a safe harbor for boats. A village is situated at the head of the harbor, surrounded by groves of cocoanut trees. The island is 1½ miles in circumference. This is the stronghold of the natives, requiring to be defended only at the narrow entrance, which passes between dangerous rocks, and has been the resort of the people of the island of Savaii, as well as those of the western end of Upolu and Manono, when hard pressed by their enemies. One-eighth of a mile to the north is Calinape Rock, which shows above water.

Soundings are to be had between this island and Savaii, and also between it and Manono. Both channels are free from dangers, and a vessel may pass through either without difficulty. This island has been named by some navigators Calinape, but it is more appropriate to the Rock.

MANONO.

Manono properly belongs to Upolu, being enclosed in the same coral reef; otherwise it is distinct, and in political interest as well as relationship it is closely allied to Savaii. Manono is of an oval shape, 3 miles in circumference, and covered with forest; it contains 1100 inhabitants. There is but one opening on the southeast side through the reef, and this will only admit of the passage of boats; the reef, however, forms a great protection for the canoes of the natives, rendering the water smooth, and at all times safe for them to proceed between Manono and Upolu. To the west of Manono is a black rock, called Cockscomb Islet, situated within the reef. On some charts Manono has been called Floe Island. Wood and water are to be procured here, but it is better to resort to one of the harbors on the north side of Upolu.

TUTUILA.

Tutuila is the next island in importance of this group to Upolu, and lies south 60° east, distant 40 miles. It is 17 miles in length, and 4½ miles at its greatest breadth. Its surface is very much broken, and exclusively of volcanic formation. It has many good harbors, and one, without a parallel in the Pacific, Pago-pago, which is entirely land-locked; its entrance is on the south side of the island, and so deep as almost to divide the island into two parts. The only objection to it is the great depth of water, and the necessity of beating out, which is sometimes attended with danger, although I am not aware that any disaster has yet occurred to the numerous vessels that now seek its shelter. Its form is that of a retort, with high land, nearly perpendicular, on either side. The town of Pago-pago lies at the head of the harbor, and gives it its name. The situation of this harbor is readily known by the Peak of Matafao, 2327 feet high, which rises just westward of the entrance. The Tower Rock, on the left side, and the Devil's-own Point, will be readily distinguished as the entrance is approached; the first by its square and detached appearance, rising from the reef, and the latter by the blackness of the rocks, contrasted with the green foliage in the rear.

To the southward of the entrance there is a coral bank, of nearly 2 miles in length, trending east-northeast and west-southwest, on which the least depth of water is 4½ fathoms: it is about a quarter of a mile wide. It is well to avoid passing over it, the swell being usually heavy, though I am not aware that it actually breaks, except during a storm. There are no dangers after this until within the Devil's-own or Breaker Point. On the opposite side, off Blunt's Point, is the Whale Rock: this should be carefully avoided; there is only 8 feet on it at low water. The sea breaking every few minutes, points out its situation, and it can be easily avoided in going in, the wind being fair and generally fresh. Grampus Rock lies a little within the Whale Rock, but on the opposite shore: it is but 600 feet from the reef. After passing Breaker Point, by keeping Goat Island a little open on the larboard bow, you will clear both the dangers. When up with Goat Island, the harbor will be open, and a berth may be chosen, either between Trading and Swimming Points, in 20 fathoms, or farther up, in less water. It is advisable to moor here with open hawse to the eastward, as the wind not unfrequently blows fresh from that quarter

The holding-ground is good, being mud and sand. Wood and water are of the best kinds, and all provisions can be had, though at times it is very difficult to trade with the natives, for they frequently come with the intention of obtaining a certain article which they have taken a fancy to, and will for no consideration exchange for another, although it may be ten times more valuable; for men-of-war I would recommend the establishing of a trading-post or market on shore, under a proper officer, and that he should make all the purchases for the ship's crew; in this way much difficulty is prevented, and the natives obtain a fair valuation for their products, and all are satisfied.

Pago-pago is one of the best regulated places in Polynesia. The chief, Pomare, has very great influence among his people, and bears a high character for morals, as well as friendliness towards the whites. The products of the island are brought from all parts of it to Pago-pago, when there are vessels lying there. No better port could be found for repairs to be made in or to recruit a crew. From the shape of the harbor, and lying as it does among hills, there is a constant breeze, both by day and night, moderating the heat of the climate, and very much tending to obviate that lassitude which the tropical climate produces on a crew.

This harbor has a shore-reef of from 500 to 1000 feet in width, which is for the most part dry at low water; the shore in places is sandy, affording ample room for the villages and groves of cocoanut palms and other trees. Most of the hills are covered with forest and undergrowth. Fish are abundant and pigeons in numbers.

It will be necessary to offer a few remarks before leaving this harbor relative to the egress, which there is much difficulty and some danger in effecting, as it is necessary to beat out, with the wind at times light and flawy, especially at the entrance, where the water is so deep as not to admit of anchoring in case of missing stays on either tack, by which a vessel would be set on shore. Although the distance is short, it is a dead beat, and unless a vessel works remarkably well, it will require a long time to accomplish, and is attended with danger. It would seem of little consequence in a harbor so confined and land-locked to regard the tides; it becomes, however, of great consequence to take advantage of them. When getting under way, it is better to wait till the ebb has made; it should never be done on the flood. I would farther observe, that the reef near the Tower ought not to be approached too close, or to leave any doubt that there is room to stay.

Devil's-own Point is the weather shore, and ought by all means to be hugged as much as possible; the flood tide sets on to Point Distress and the Tower, and there divides, part running out of the harbor; the ebb, on the contrary, flows directly out, and a little to the eastward: therefore, it will be seen that in a vessel attempting to beat out, when in the jaws or entrance between the points, with the flood, she will have the influence of the tide on her weather-bow, and consequently is liable to miss stays, and as the wind is here very apt to fall light and variable, a vessel may be placed in an awkward situation, if not in a very dangerous one. With proper precautions and a vessel that works tolerably well, with the *ebb* tide, and during the continuance of a fresh trade, these difficulties are readily overcome.

The approach to this island is generally made from the eastward. Matafao Peak is the first land made. On a nearer approach a small island off the southeast point is made, called Anuu: it is of moderate elevation. Here canoes come off to vessels with white men, who act as interpreters. The class of vagabonds, so denominated, it is perhaps needless for me to warn the navigator against, as his experience must have taught him, before reaching these islands, that very little confidence is to be placed in them as a class.

Anuu is surrounded by a shore-reef; there is a good passage, of three-fourths of a mile wide, between it and Red Point.

On the east end of Tutuila there are two towns, Alao and Tula; between them the shore is sandy, and fringed with coral. The coast trends north and south 2 miles. Near Tula there are two remarkable black rocks.

In proceeding westward from Red Point, until reaching Fagaitua Bay, the coast trends west-southwest, and is steep and iron-bound.

Fagaitua Bay is bounded on the east by Round Bluff, and on the west by the Lion's Head, a distance of 1½ miles asunder. In this bay are situated three towns, Fagaitua, Pougai, and Rofao, which are built in groves of cocoanut palms and separated by rocky points. Near the centre of the bay there is a sunken coral patch, the least water on which is 3 fathoms. The anchorage in the bay cannot be recommended, not being sufficiently protected from the southeast quarter; the best berth is well up in the bight, towards Rofao, where the depth of water is from 14 to 18 fathoms. These towns offer refreshments, but Fagaitua is the largest, and there supplies of both wood and water can be most readily obtained. At Fagaitua there is a good boat-

passage through the coral reef, which fringes the shore. Beyond the Lion's Head, the coast again assumes an abrupt and rocky character. 3 miles to the west of this point is situated a remarkable rock, called Pyramid Rock; thence to the Devil's-own or Breaker Point, off the harbor of Pago-pago, are two sandy beaches, continuing to the west from Pago-pago; the shore is lined with coral, which completely closes Black's Bay, and affords no protection whatever either for vessels or boats, and the sea beats violently on the whole extent to Sail Rock Point, which is the southernmost point of the island; round to Leone Bay, the coast is high and rocky. Leone, though entirely destitute of a harbor for vessels, and its shore fringed with coral, is one of the most productive and populous towns of the island. It is situated in a most luxuriant valley, in which cultivation by the natives is carried to as great an extent as in any part of this group. The inhabitants of the bay also engage in fishing, and their canoes are seen in great numbers during the prevalence of fine weather off the coast.

From Leone to West Cape the shore is rocky and much broken, and offers no shelter. Off West Cape are some large black rocks. To the northward of this cape, and between it and Leopard Point, is situated the town of Susua; but the bay offers no shelter; it is choked up with coral, yet with care boats may land. A distance of 3½ miles brings us to Aluau, the coast being rough and rocky, with the exception of the small bay in which it is situated; but like Susua there is no anchorage, and the beach is skirted with coral.

Aluau Bay is one-third of a mile wide, and the same in depth; at the head of it is a fine town, where supplies may be procured. The anchorage is in from 12 to 15 fathoms, fine gray sand; during the fine months it is perfectly safe for a vessel. A mile to the east, separated only by a rocky point, is Massacre Bay, where La Perouse's expedition met with so melancholy a fate; it affords no protection, the bay being nearly filled with coral, which at low water is in many parts entirely bare. One mile to the eastward is the harbor of Fungasar. This is the best harbor on the north side of the island, and during the fine season one of safety and of easy access. Though not large, it affords all that could be required for a few vessels that may stop for supplies. Wood, water, and all the productions of the island may be had here. The best anchorage is between East and Cocoanut Points, in 14 fathoms water, over a black and white sand and shell bottom.

Besides the village of Fungasar, there are Fusi and Alfoo in the West Cove. The inhabitants and chiefs are all kind and attentive; schools are established, and they have all become Christians.

From Fungasar Harbor the coast trends east-northeast for 5 miles to the most northern point of the island, Cockscomb Point, which is a singular insulated rock, much jagged and having much resemblance to the name that has been given it. It is of considerable height and quite abrupt; there is a passage between it and the rocks of the island. To the eastward is Vatia Bay, but it affords no anchorage, and is broken up with coral.

The next harbor is that of Oafonu: this is 1½ miles beyond Vatia, the coast between being a series of abrupt rocky crags. It is half a mile in depth and one-third wide, and good anchorage in the fine season, from April to December, may be found there: the best berth is near the centre, in 14 fathoms, on a fine gray sandy bottom. The town of Oafonu is situated at the head of the bay, and is embosomed in cocoanut palms; the fresh-water streams near the town cause a break through the coral, and admit the approach of a boat to the beach. To the west, just round Craggy Point, there is another town, called Amalao.

Massefao Bay is 3 miles east of Oafonu Harbor: the intermediate shore partakes of the usual character of the coast of the island. The entrance to the bay is between Bartlett's Point on the west, and Butt Point on the east, bearing from each other northwest-by-west and southeast-by-east, half a mile asunder; the direction toward the head of the bay is west-southwest. It is very much protected from the north and northwest winds, but exposed to those of the northeast. The depth in the bay is not less than 18 fathoms, over a sandy bottom; the head of the bay is lined with a coral reef, which has the usual break in it consequent upon there being an outlet of fresh water. The town of Massefao is one of the largest on the island, but the people are not so well-disposed or accustomed to deal with foreigners as the towns nearer to the vicinity of Pago-pago. The village of Masaosh is situated just beyond Butt Point.

The harbor of Aur is the most eastern, on the north side of the Island of Tutuila; its width is half a mile and its depth somewhat less. There is little room for anchorage within the points of the bay, as it is almost entirely occupied by coral, excepting a narrow channel, which leads up to the town, affording facilities of approaching with a

boat, that could not otherwise be done at low water. Aur is a very considerable town, and being remote from the operations of the missionaries, has not yet derived much benefit from their instructions. The best anchorage is with Point Protection bearing northeast-by-east, in 9 fathoms, gray sand, Musquito Point west-by-south.

From Aur to Cape Matutula the coast is high and rocky, with several outlying rocks; the cape is high, and projects in a long rocky point to the northeast.

OFOO AND OLOOSINGA.

These two islands are in such close proximity that they may be described as one: they lie north 85° east of Tutuila 54 miles. Ofoo and Oloosinga together are 4 miles in length; they trend east and west, one mile wide; they may be termed spurs or ridges, for they have little level ground to boast of, their basaltic walls rising almost perpendicular from the water to the height of 1200 feet. Oloosinga is about one-third the size of Ofoo, but it has more inhabitants. The settlement on Ofoo is on the western end; the strip which is cultivated is some hundred yards in width, including the coral, which fringes the island on the west side; the eastern side being little more than an escarpment of rocks, which renders it almost as impregnable as a fortress. The king or chief of Manua resides on Oloosinga, to secure his safety during troubles on Manua. This island usually affords enough provisions for its few inhabitants. At the west end, under Ofoo, there is anchorage in 10 fathoms water, but no supplies can be obtained there.

To the southeast of Oloosinga lies Manua, separated by a channel of 3½ miles in width. Manua is a much larger island, rising in a dome shape to the height of 2500 feet; it is nearly circular, and 4½ miles in diameter; the whole is covered with luxuriant foliage. On the north side the cliffs are somewhat precipitous, bounded by a sandy beach, where the landing is not difficult; at the northwest corner there is a pretty cove, in which boats can land without surf, and at this point and a sandy beach adjoining it, the principal town on the island is situated. Native missionaries have been established here, and have done much good by their example. Wood and water may be obtained at Manua, but very few if any supplies except cocoanuts.

On all the eastern, southern, and western parts of the island a heavy surf beats. The island, like that of Ofoo and Oloosinga, is of volcanic formation, and there are but few patches of coral around its shores, and what is perceptible is only sunken reefs.

ROSE ISLAND.

Rose Island is the most eastern of this interesting group. It was discovered by Captain Freycinet; it lies south 80° east from Manua, distant 74 miles. It is a low coral island, with a lagoon. On its eastern end there is a clump of large trees, which can be seen at some 10 miles distance. It is nearly 2 miles in diameter, and of a circular form. The greatest part of it is submerged at high water; and during storms it is, with the exception of the small space on which the trees are growing, an entire breaker. There is an opening into the lagoon on the northwest side, where a small vessel might enter and find protection. Vast quantities of birds are on this island, and some fish in the lagoon, which has here and there large masses of coral growing up in it.

CHAPTER IX.

TONGA ISLES.

The Tonga Islands were discovered by Tasman in 1643. They have, however, been generally known by the name which Captain Cook gave them,—the Friendly Isles. They are said to be as many as 150, but this is a great exaggeration, for many of these are merely islets, situated on the same reef, and therefore instead of being separated should be counted as one; 15 of them are high and volcanic, and the rest low, and 40 of them are of considerable size, and inhabited.

This group is situated between the latitudes of 18° and 23° south, and 173° and 176° west longitude. It may be said to embrace three small clusters, that of Tonga, Haabai, and Vavao, of which Tonga being the most important and largest, besides holding sway, gives its name to the whole. The three clusters offer some good harbors, and afford all the supplies that can be obtained among the Pacific Islands. Since the missionaries have been established, they have become more entitled to the designation given by Cook, the *Friendly Isles;* but yet they are inclined to be somewhat lawless, and use the power that force will give them over an unprotected vessel, seizing whatever they can lay their hands on belonging to strangers, whether of the crew or vessel, regardless of the inconveniences they may put others to. It is as well, therefore, for the masters of vessels to avoid all kinds of disputes or differences in trading, and particularly to prevent any infringement of their Sabbath laws, as the chiefs border on fanaticism in their observance of them.

The Tonga cluster comprises the islands of Tongatabou, Eoa, Evaitihe, Katoo, and 19 islets situated on the reef attached to Tongatabou. Of these Tongatabou is the largest, including the coral reef attached to it, on which the islets are situated; it has the form of a triangle, each side being nearly 20 miles in length, and of this area a little more than half is land. Within the space between the

island and the reefs is embraced a fine roadstead, containing many safe anchorages. It has two entrances, one on the north, and the other on the east; both of these are difficult and somewhat dangerous; the first is the northern outlet, and the last the Astrolabe Gut, nine miles in length, and two miles at its eastern entrance, but narrowing down at its western end to less than half a mile, where is situated the island of Mahonga with its reef, the channel turning to the north and south of it through narrow passages, infested with coral-knolls. In the Astrolabe Gut there is no anchorage, and the tide runs with much velocity through it. Vessels should not think of taking this channel late in the day, and at any time without a steady breeze or trade wind, as they may be subject to long calms and head winds, and if detained over night incur much risk of loss. With a steady breeze and fine weather there is little or no danger. It requires a good look-out from the mast-head when sailing through the Mahonga Passage, to avoid the coral lumps and projections from the main reef. The Pangaimotu Passage, to the left or south of Mahonga, though narrow, is safe, and leads at once to the anchorage west of Pangaimotu, which is the most sheltered berth in Mariner's Bay. There are several northern passages through the reefs; these are narrow and a good deal obstructed with sunken patches. An examination of these proved that it was impossible to make a careful and minute survey of them. With a good look-out from aloft there are many places where a vessel may pass through this broken reef; the two best passages, however, are those near Alata Islet, and the other bearing north-north-west from the anchorage at Pangaimotu. The depth of water in Mariner's Bay varies; in most places it will be found greater than 10 fathoms.

The Island of Tonga at its south side has a narrow shore-reef: the land rises perpendicularly from 40 to 80 feet, and gradually declines towards the northern side. Towards the centre is an extensive inlet, forming a shallow lagoon, some twelve miles in circumference: this, with the exception of a narrow channel leading to the town of Moua, is an extensive coral flat, which is dry at low water. The passage into the lagoon communicates with the Astrolabe Gut, to the east of the island of Pangaimotu. I mention this, as it affords facilities of getting supplies from the natives of the island at a much more reasonable rate than can be obtained at the anchorage. Nikualofa is the residence of the chief or king; but the anchorage off it is not so conve-

nient as that at Pangaimotu. The shore in places, except at that island, is skirted by a coral reef, and offers many obstructions to the landing in boats at all times but extreme high-water. Water at the island is obtained from springs, and is scarce. The island is beautifully cultivated, and yields abundantly all kinds of tropical fruits. Besides the harbor of Mariner's Bay, there is anchorage during the fine season in Maria Bay, Van Diemen's Roads, where Tasman first anchored, but they are neither of them secure. The tides at Tongatabou are regular, the springs rising ordinarily 5 feet: the flood sets southeast, and the ebb the contrary way; high-water, full and change, at 7 A.M. It is necessary to pay attention to them in entering and leaving the port, as a contrary tide in the narrow passages renders them more difficult to pass through.

The longitude of this island appears to have had more determination made of it than any other island, except Tahiti, in the Southern Pacific, having been visited by many of the most celebrated navigators and expeditions that have been fitted out.

Cook made the longitude . . .	184° 50′ 18″ W.
D'Entrecasteaux made the longitude . . .	184° 46′ 46″ "
D'Urville " " . . .	184° 47′ 00″ "
The Expedition in	184° 49′ 00″ "

I have given a chart of Mariner's Bay, which is as complete as our time would admit of.

Wood is difficult to be had, and is very dear if obtained from the natives.

This group of islands is frequently visited by severe hurricanes, that do much damage; these occur in the months of November, December, January, February, and March; it is then that the anchorage in Mariner's Bay is much exposed, both to sea and wind; the former is said to beat at times very heavy on the shore. It may be as well to avoid making a visit to these islands during these months. Myriads of mosquitoes are the greatest annoyance in this bay; they infest all parts of the ship, and sleep is absolutely out of the question; the only way to free oneself from them is by anchoring some 3 miles from the land. On the beach to the south of Pangaimotu the seine may be drawn, and at times with great success.

At the mouth of the Astrolabe Gut lies the small and wooded

island of Eooatiahe, which, including its reef, is 1½ miles in length, by half a mile wide; it offers no inducements to visit, and is seldom resorted to by the natives except in the turtle season.

EOA.

The Island of Eoa lies to the east of Tongatabou 10 miles. By its first discoverers it was named Middleburg. There is a small island on its southwest side, called Kaloo, and between it and Eoa there is a clear passage. Eoa is elevated 350 feet above the sea, and is 30 miles in circumference, its length lying nearly north and south; it rises to a central ridge. Owing to its height it can be seen in fair weather at a distance of 30 miles. Eoa, in comparison to Tongatabou, offers but little for the residence of the natives, and very few of them reside upon it. It is of volcanic formation, and has very little space for cultivation. A small village is situated on the northwest side, abreast of which Cook anchored, in what he called English Road. There is considerable intercourse with Tongatabou, by whose chief it is governed. A vessel would, however, be disappointed in obtaining supplies here. It is as well to caution the navigator, that frequently he may meet with severe squalls in the strait between Eoa and Tongatabou; there are no dangers, however, but in case of being too late to make the passage through the Astrolabe Gut, I would advise a long stretch to the southward during the night, rather than experience the flaws and calms that a vessel would be subjected to by too near an approach to Eoa.

HONGA TONGA AND HONGA HAABAI.

The islands of Honga Tonga and Honga Haabai are situated to the northwest of Tongatabou. They are high islands, and almost bare rocks, lying nearly northeast and southwest of each other, and separated by a channel about 3 miles wide, which is free from dangers. These islands have a shore-reef, and are inhabited. There is a small space, at the foot of the high and rocky bluffs, that enables the natives to raise some productions on the easternmost.

To the north of these islands is a reef of 6 miles in extent, trending northwest and southeast: its south point is 10 miles from Honga Tonga. Breakers are generally found on it: at times these are very

high. This reef was discovered by Maurelle, in 1781, who gave it the name of Baxo de Culebras.

VAVAO.

A degree to the north of the Haabai cluster lies that of Vavao. This cluster is formed by Vavao, Panguimotu, Tonga, Hounga, and Telika. Vavao has a circumference of some 30 miles, and has one of the finest ports in the Pacific,—Port Valdes. Maurelle appears to have been the first European who visited these islands, in 1781. Vavao is formed of coral limestone ; its greatest height does not exceed 300 feet. Its surface is remarkably level. The cliffs are perpendicular and to some extent have been washed by the sea, so that they form from overhanging masses an impediment to landing, and none can be effected except where the cliffs have been broken down. Port Valdes has its entrance on the southwest side, among an archipelago of islands, and the channel is some 4 miles northeast between them ; through these a square-rigged vessel may have some difficulty in beating, as there is a leeward set constantly making out. The water is so deep, that an anchor cannot conveniently be let go in the channel. The inner harbor is perfectly safe and land-locked, but it requires a well-appointed vessel to reach it. The entrance may be readily known by White Point, which lies on the left of the entrance, and which is nearest to what is called Ninepin Island, and south of Refuge Road, where vessels ordinarily anchor to obtain supplies. There is another anchorage to the south, called Port Maurelle, which is tolerably secure, except from the northwest. The narrows leading into Port Valdes is over half a mile wide. A vessel may proceed farther up the harbor and anchor in less water; but the coral patches and the broken ground should claim attention.

The only objection to this port seems to be the great depth of water in the outer roads and anchorages, and the unevenness of the bottom, varying in a cast of the lead from 10 to 15 fathoms. Supplies may be had in abundance, and fish are procured in considerable quantities by the natives. Vavao is one of the principal establishments of the missionaries in the South Seas.

CHAPTER X.

VITI GROUP, OR FEEJEE ISLANDS.

THE Feejee Islands form one of the largest, as well as most important groups of the Pacific. This group of islands was first seen by Tásman, in 1643. The islands discovered by him were those lying at the northeast part of the group, some twenty in number, which he designated as Prince William's Isles, and on account of the numerous shoals and reefs, he called them the Basses de Hemskirk.

The Duff missionary ship and Captain Bligh, of the Bounty, visited this group, and they were frequented, some thirty years ago, by Americans in search of sandalwood, and lately by others to obtain cargoes of biche de mar, for the China market. The chart of Arrowsmith of these islands was found quite erroneous, little beyond guesswork: it is impossible to conceive from what sources it was derived.

Captain D'Urville, in the Astrolabe, visited the group in 1827, and in 1838; but his stay was short, and resulted only in the surveys of a few points, so that the whole field was open to us on our arrival.

The examination of this group was one of the duties assigned the Expedition, and proved one of no common labor. The surveys made by the Expedition have rendered its intricate navigation safe, and have removed the apprehensions of its many dangers to seamen; it may now be considered as one of the most thoroughly surveyed groups in the Pacific.

The Viti Group consists of 154 islands and 80 reefs, lying between the latitude of 15° 30′ and 21° south, and longitude 178° west, and 176° 30′ east, several outlying islands to the south being included, though not properly within the limits of the group. Yet I have thought they ought to be embraced, particularly as they are inhabited by Feejeeans, and are under the control of the chiefs of the Eastern

group, and are occasionally visited by them. The whole embrace an area of about 95,000 square miles.

As the group is very extensive, and its islands situated so as to form somewhat detached clusters, I have separated them into three groups, viz., Eastern, Centre, and Western. Those lying in the Eastern range, and trending north and south, are Vatoa (or Turtle Island), Fulanga, Moramba, Kambara, Enkaba, Tubanielli, and Ono; Ongea Levu and Riki, Angasa, Namuka, Komo, Karoni, Motha, and Ularua, and fourteen reefs; Oneata, Aiva, Lakemba, Bacon's and Reid's Isles; Naiau, Chichia, Tabutha, Aro, Vekai, Katafanga, Mango, Vaturera, Ythata, Kanathia, Munia, Susui, Vanua Valavo, Avia, Osubo; Naitamba, Okimbo, Veterara, Yalangalala, Namoku, and eleven reefs; of which Lakemba is the principal. The Centre group includes the large and most important islands, viz., Viti Levu, Vanua Levu, Chicobia, Korutuna, Rambe, Kea, Vuna, Kamia, Lauthala, Goro, Mokingai, Yendua, Wakaia, Ovolau, Ambatiki, Nairai, Angau, Moala, Tova reef, Totoia, Matuku, Mbenga, Vatulele, Kantavu, Ono, and several others, lying near the larger islands, and partly joined to them by coral reefs. The Western range embrace the Asua Group; viz., Awakala, Timboor, Kinsick, Asaua, Ya-asua, Kawakawa, Asaua-ilau Androna, Otovawa, Nanuia, Nangati, Matathoni Levu, Naviti, Eld, Fox, Agate, Sinclair, Waia, Waia-lailai, Waia-lailai-thaké, Biva, Knox, Baldwin, Davis, Totten, Vomo, Carr, Johnson, Alden, Walker, Emmons, Perry, Palmer, Malolo, Malolo-lailai, Waldron, and Speiden.

These will be described in their order from east to west, which is believed to be the most useful, as the islands are usually approached by navigators from the east. Before entering upon the hydrographical description, I will give some general information, that those who may visit this group would most desire.

The fine season in the Viti Group is from April till November, during which time the winds generally prevail from the east-northeast to southeast; they sometimes blow fresh, but usually a moderate trade prevails, increasing towards the afternoon, and moderating towards night, and continuing during the night hours light and calm. In the harbors and along the larger islands, a gentle land breeze is frequently felt a short time before and after daylight, but is never of long duration, yet it affords facilities of passing outside of the reefs, which obviates much anxiety, as well as the risk of accident. In navigating among the islands, the tides should claim particular attention: the course of

the flood and ebb are shown on the chart; but there are times of tide in which the current is often found to set stronger in some places than in others, from the water being forced through the narrow passages between the reefs. Those navigating within the reefs can very readily perceive when this is likely to be the case. After the reefs become visible the current through the passages is much stronger, and at times it flows almost as rapidly as a sluice; at such times it is not advisable to attempt to pass. Against this current it is next to impossible to make headway except with a very strong wind.

From November to March northerly winds for the most part prevail, which blow from the northwest with great violence. The heaviest gales come from this quarter, during February and March. In these months the weather is very wet and unpleasant. At this time of year, vessels visiting this group would do well to seek those harbors that are the best protected or least exposed to the northwest. If bad weather occurs between April and November, the wind will prevail from the east to southeast; it blows very strong, accompanied by a mist that renders everything obscure: this generally continues for three or four days, but there are no sudden changes of wind, or tornado storms, as experienced in the bad season.

It is unnecessary in this place to offer any remarks upon the intercourse with the natives, their character, customs, &c.: these have been fully detailed in the third volume of the Narrative of the Exploring Expedition, and it is presumed that no navigator will visit this interesting group without possessing that work, which contains a full account of our intercourse with them, and which, it is believed, will afford an accurate view of the facilities as well as the difficulties which are to be expected from intercourse with them: they are daily making much progress in civilization.

VATOA OR TURTLE ISLAND.

Vatoa or Turtle Island, is the most southeastern island of the Feejee Group. When first seen, it appears as a rounded hummock, somewhat flattened on the top. Its form is oval; the longest axis trending north-northeast and south-southwest, 3 miles, while it is but 1¼ miles wide. It is surrounded by a shore-reef, half a mile in width, through which there is a break for boats on the west side. 2½ miles to the south-southwest is the Shylock Reef, 6 miles in length by 3½ its greatest width. The passage between the island and reef is clear,

and there are no soundings. The south and southwest portion of the reef breaks heavily, while that on the north and northeast shows at times but a rip. There appears to be a constant set of the current to the northeast near this island, articles from vessels wrecked here having been found deposited on the southern islands of the Eastern Group of the Feejees.

The island has about 50 inhabitants, who have native missionaries among them; but they have a very scanty supply of food, and no water is to be found except by digging pits near the beach. The island is of volcanic formation. There is a small opening through the reef on the southwest side, near to where the Ship Shylock was wrecked, but it can only be used for boats.

This dangerous reef should be avoided, and in passing the island to the southward it should be given a good berth.

ONO ISLAND AND BEREGHIS REEF.

Ono Island was discovered by Bellinghausen, in 1820. It consists of several islets, surrounded by a coral reef 7 miles in length, trending northeast and southwest. The largest islet is 3 miles long by 1½ wide. There is an entrance through the reef, but I am not informed whether it is practicable for vessels. The island is inhabited, and produces the fruits and vegetables of the neighboring islands. To the southwest, 19 miles, lies Bereghis Reef, a bank of coral; this was also discovered by Bellinghausen, in 1820. It is 4 miles long, in an east and west direction, by 2 miles wide.

FULANGA.

Fulanga is 4½ miles in length by 2¾ wide: it is surrounded by a shore-reef of some width; the north bluff of the island is 150 feet in height. On the northeast side there is an opening for small vessels into an extensive bay, at the head of which there is a village with a small population, principally engaged in building canoes, for which the timber growing on the island is large and well adapted. Supplies can be obtained, and water also, but with some difficulty, on the southeast end. Fulanga forms the first island on the left of the passage of the same name, and is separated from Ongea 8 miles, which is the width of the channel.

ONGEA.

Ongea is formed of two islands, called Levu and Riki, which are enclosed in the same reef: these are both barren and destitute of water; they are some 200 feet high, round or dome-shaped, and both together 4½ miles long, north and south, and one mile wide: there are three entrances for small vessels, two at the north, and the third at the western side; the latter leads to Port Refuge. To the southeast of the south island, three miles distant, lies a dangerous sandbank and coral reef, called Nugu Ongea: this must claim the attention of navigators when approaching this extremity of the group. Due regard should be paid to the current, which sets with some force to the northward and eastward.

To the north of Ongea there are three coral reefs, viz., Teteka, Nisukisuki, and Revareva, which the charts show, rendering the passage between it and Angasa extremely dangerous.

ANGASA.

Within the reef which surrounds this island there are three smaller ones, Abutolema, Abutuena, and Abuda. Angasa is the most eastern and largest; it is remarkable for its regular ridges, of volcanic formation. The reef encompassing these islands is 8 miles northwest and southeast, and 5 northeast and southwest: there are no openings through it, and no permanent inhabitants on either of the islands. To the north-northeast of Angasa lies the Levu Reef, distant three miles from the reef of Angasa; and to the east Chicondua and Konaivo, the latter including an islet. Angasa forms nearly an equilateral triangle with Fulanga and Ongea, of which the sides are about 8 miles.

MORAMBA.

Moramba lies northwest of Fulanga, 9 miles distant; it is but half a mile in diameter, high and well wooded, with a shore-reef; it has no convenient landing.

NAMUKA.

Namuka rises to the usual height of these islands, is of the same formation, and lies north of Fulanga 15 miles. It is three miles in

length, east and west, by 1½ wide; the reef surrounds it on all sides. The natives visit it, but do not make it their permanent abode. Three miles to the north-northeast of it lies the Taluno Reef.

KAMBARA.

Kambara is nearly rectangular in form, 3½ miles long by two wide, the direction of its length being north and south; with the exception of the small island of Tubanielli, it is the most western of the southern part of the Eastern Group. A shore coral reef extends on all sides. On the northwest there is no anchorage for large vessels, but small ones and boats may find protection in the fine season. Soundings close to the reef are had from one to four fathoms. This island may be known by a remarkable bill-shaped peak on its northwest end, which was called Vermont Peak, and forms a good landmark; its height is 350 feet above the level of the sea.

The island is densely covered with rich verdure, and has groves of cocoanut palms on its shores; its timber is esteemed for building canoes, and there is more of it than on any other island of the group. It has a population of 350.

ENKABA.

Enkaba is a small island, lying north-northeast of Kambara, 3 miles distant, the channel between them being free from danger. It is two miles long by one mile wide, and well wooded, has a few inhabitants, but offers no supplies for shipping; the coral reef which surrounds it has a break in its western side, which admits the landing of boats.

TUBANIELLI.

Tubanielli is a small uninhabited isle, of half a mile in diameter, lying on the western side of the Eastern Group, and rises to an elevation of 150 feet.

ULARUA OR OLENEA.

Ularua is high, desolate, and surrounded by an extensive reef, through which there is no opening. It lies at the junction of the Oneata with the

Fulanga Passage; to the south-southeast of it lies Tavunuku and Chicks reefs, on which the sea usually breaks. Both Komo and Ularua are in sight from these dangers: they may be easily perceived during daylight, but ought to be studiously avoided at night; the set of the current is to the eastward at this part of the Eastern Group.

KOMO AND KOMO-RIKI.

Komo and Komo-Riki are two small islands surrounded by a reef, with an opening on the northeast side. Anchorage may be found within the reef, but it is exposed in northeast winds. Komo is high, about three miles in circumference, and inhabited. But few articles of provision can be obtained.

MOTHA AND KARONI.

Motha and Karoni are situated in the same reef, which extends in a north-northwest and south-southeast direction, 8 miles in length, and has a breadth of 4½ miles; there is only a boat-entrance on the north end. Motha is situated in the northern part, is two miles in diameter, with a surface much broken, but rises to a considerable height, and on its sloping sides are many elevations divided by ravines; these are but partially covered with trees. The soil is rich, but the population is small. This island can be seen from a great distance; it has a rounded form, and is the southern landmark for the Oneata Passage. Karoni is but a small island, in the southern bight of the reef; it offers nothing of interest, but serves to identify Motha. One mile from the southeast end of Motha Reef, lies Konapotu Reef, 6 miles in circumference: the sea usually breaks on it with violence. To the east of the northern end of Motha Reef, 3 miles distant, is Matau Reef; it is of an irregular shape, nearly 2 miles in length, northeast and southwest, by 1½ wide; and 4 miles beyond this, to the east-southeast, lies Vao Reef, which is 3 miles in length, northwest and southeast, and but 1 mile wide. The most dangerous reef, lying more immediately in the Oneata Channel, is Like-like; it is about 1½ miles square, and rather nearer the Motha side of the channel: this is also known as the Active Reef, on which a vessel of that name was lost.

ONEATA.

Oneata Island, with its two islets, one named Observatory Isle, lies in an extensive reef, 8 miles in length, east and west, by 3½ wide, its eastern end forming a point. There is one good entrance on its northeast side, and two on the northwest. Good anchorage may be found under Observatory Isle, and also abreast of a sandy bay on the west side of Oneata, where there is a village. The northeast entrance is marked by two rocks, which are readily perceived on approaching it. All the entrances into the reef are bold; those on the northeast are most suitable to enter at, the wind being fair, which is also the case with those on the west to depart by.

Observatory Isle is 250 feet high, and well marked by a few trees on its top; it is not seen on the approach from the east. An abundance of vegetables, with poultry, &c. &c., can be obtained at Oneata. The natives are considered to be sharp traders, notwithstanding they are mostly Christians. There has been two native missionaries for some years residing among them. Good pilots for the Eastern Group may be obtained here, and the natives of this island have done many humane and kind acts to those who have been shipwrecked.

The length of Oneata is 3 miles, and its greatest width 1½ miles. There is no water to be had, except from wells, and that at times is brackish.

The current through the Oneata Passage generally sets to the eastward. The tide rises 5½ feet, and it is high water, full and change, at 11 o'clock. The principal village is situated on the south side of the island, in a grove of luxuriant cocoanut palms. This island is very much covered with scoriæ and lava, with many deep chasms. The shores are covered with mangrove bushes.

AIVA.

Aiva-va and Aiva-thaki (high and low), are two uninhabited islands, enclosed within the same reef, which is 9 miles in length, west-by-north and east-by-south, and 3½ wide, having an extensive break on the north side, which affords an entrance and good anchorage within. There are some patches of coral that show themselves, but are easily avoided by a careful look-out from aloft; there is, however,

nothing to tempt vessels to enter. With northeast winds the anchorage is somewhat exposed. These islands and reef lie nearly half way between Lakemba and Oneata.

LAKEMBA.

Lakemba, the most important island of the Eastern Group, occupies nearly a central position, and is the seat of the political power; it is of a circular form, 31 miles in circumference, and rises towards a central peak, called Kendikendi, the apex of which is 900 feet above the level of the sea. This island has many fertile valleys, and extensive groves of cocoanut palms and breadfruit, the rich soil producing all the necessaries of life in abundance, and supplies may be had here in great quantities.

Lakemba is surrounded by a reef, which extends to the eastward of the island 7 miles, forming a point to the northeast. On the north, south, and west sides of the island, the reef extends but a short distance; it has two openings, one on the east, narrow, though deep enough for large vessels, but the channel is very tortuous and dangerous, from the many shoals that stud its passage; that on the south side is only available for small vessels. In consequence of the confined space within the reef, none but a small vessel could find shelter, and only by mooring head and stern. The principal settlement is on the south side. Water is obtained here from wells, but on the northeast side of the island, several streamlets flow down to the beach. Lakemba has some 1500 inhabitants, and is the residence of the king of the Eastern range. Some 4 or 500 of the inhabitants are Tongamen, and nominally Christians. The Wesleyan Missionary Society has an establishment here, which has now been in operation for some years.

BOCATATANOA, OR ARGO REEF.

On the east of Lakemba lies one of the most extensive reefs in this range, called Bocatatanoa, or the Argo Reef. In shape it resembles a triangle, having a base of 20 miles, trending north-by-west and south-by-east; its apex approaches within two miles of the eastern point of the Lakemba Reef. On its northwest side it is very much broken up in patches, which, though lying in range, towards the northern angle it becomes continuous, in which Bacon's Isles are situated.

The south side of the reef, which trends east and west, is 15 miles in length. The centre of each side is somewhat broken up, and might be passed through in case of necessity. Bacon's Isles are two insulated rocks, and excellent landmarks. To the northeast of the Bocatatanoa, distant two miles, lies the Latti Reef; it embraces an area of 25 square miles. Within it lie three rocky islets, called Reid's: two of them resemble, when first discovered, ships at a distance. They form the southern side of the Lakemba Passage. There is no entrance through this reef, it being continuous all round. At high water it may be passed over easily on its western side in canoes and boats. The sea usually breaks violently on its eastern side.

The sea to the west of Lakemba, for 20 to 25 miles, is free from dangers, and a vessel may safely lie by under its lee during the night.

VANUA VATU.

Twenty-five miles to the west-southwest of Lakemba lies Vanua Vatu. It is 6 miles in circumference, and rises gradually on all sides to the height of 500 feet. This island is encircled by a reef, through which there are two entrances for boats: a small vessel may enter on its west side during the fine season. The island is not inhabited, but the natives resort to it during the turtle season. The reef does not extend beyond a mile from the island: to the north it extends that distance in a point. Wood may be obtained here, but it is difficult to be got off, and vessels would do better to obtain it at one of the islands before named. There is no water except from wells.

NAIAU.

Naiau lies northwest of Lakemba 15 miles; it rises several hundred feet above the level of the sea, is bounded by high basaltic cliffs, and is covered with forest; on its lofty peak there are two villages, which contain about 200 inhabitants. The island is nearly 4 miles in length, by 2½ wide, of lozenge shape; it is surrounded by a reef, conforming very much to the trend, and attached to the shore; there is a break in it on its southwest side, but of no advantage to vessels; another opening is to be found on its northeast side for boats.

CHICHIA.

Chichia is next adjacent to Naiau, and lies in the same direction from Lakemba, and 30 miles from it, which places Naiau half way between the two. Chichia is of an elliptical shape, its longest diameter being 4 miles, while that of its shorter is 3 miles; it is surrounded by a shore-reef, which has a few breaks for canoes. The low points are clothed with groves of cocoanut palms, while the uplands, rising 300 feet, are partially clothed with wood; the soil is rich, and every kind of the productions of these islands is raised in abundance. There are about 300 inhabitants. To the west of the south end of the island lies Kneass Reef, a small coral reef, circular in form, half a mile in diameter. It is separated from the island one and a half miles: there is a clear passage between them. This is not to be considered a dangerous reef; the sea usually breaks upon it, and therefore is well-marked, and there is plenty of room to avoid it.

ARO.

The small island of Aro, with its three outlying reefs, named Gorden, Freeman's, and Hawkins, form the northern side of the Lakemba Passage. It is a very pretty island in appearance, but desolate; lies in the centre of a coral reef, and is only frequented by the natives during the turtle season.

Gorden Reef lies 5 miles to the east-northeast; Freeman's to the southeast, 3 miles; and Hawkins to the south, 3 miles. The first is 2 miles in circumference; the second lies northeast and southwest, 2 miles in length; and the third, north and south, 2 miles. On all of them the sea breaks violently. Between each of them there is a free passage from one to 3 miles wide.

TABUTHA.

Tabutha lies 33 miles north of Lakemba, and can be distinctly seen from the top of the latter island. A high peak on the north end, somewhat resembling a cap, gave it the name of Cap Island, by which it has been known on the charts. It is 3 miles in length, north-northwest and south-southeast, by 1¾ in width. Near its northern end it is surrounded by a reef, having two boat-entrances: one on the northwest, and the other on the southwest sides; the reef

is continuous to the shore. There is no water on the island, except that procured from wells. The island is well wooded, and has some 90 inhabitants. Quinin and Smith's Reefs lie 3 miles south-southwest of this island.

VEKAI.

Vekai Island lies 5 miles north of Tabutha. It is but a small, low islet, with a reef around it, extending 2 miles east and west, and 1½ north and south. It is of volcanic formation, and without fresh water, and is only resorted to during the turtle season.

KATAFANGA.

Katafanga is another small island; it rises to the height of 150 feet, and affords abundance of sugar cane, fruit, and vegetables. On the northeast point of the island there are a few huts, but it is inhabited only during the turtle season. The reef that encompasses it is 3 miles long, east and west, by 1½ miles wide; on its north side there is an opening, which will admit vessels drawing 10 feet water, but it requires great care to enter in consequence of the many coral patches.

Five miles directly to the north of Katafanga is the Malevuvu Reef, 2½ miles long, by one wide; on it the sea breaks heavily.

MANGO.

Mango lies to the north-by-east of Chichia, 18 miles; its diameter is 3 miles, and its elevation, 300 feet. It is remarkable for an open space near its centre, as if it had been artificially cleared. It is surrounded by a reef, which extends nearly a mile to the southward, and has three small islets on it. On the northwest side there is a break in it, but it affords no protection for vessels. The usual productions are found here, but no water except from wells. To the northwest, 3 miles, lies Frost's Reef, which is about a mile in length, and one quarter in width.

VATURERA.

On the same parallel with Mango lies Vaturera, 18 miles dis-

tant from it. It is a high, square-topped, rugged island, with an extensive reef surrounding it, affording no entrance or protection for vessels or boats. The island is 3 miles in length, north and south, by 2 wide. With Chichia and Mango it forms an equilateral triangle.

YTHATA.

Ythata lies 8 miles north of Vaturera. It is a high island, with a bill-shaped peak; its length is 2½ miles, east and west, and but one mile wide; to the east of it and within the same reef are two small low islets. The low grounds of Ythata are covered with extensive cocoanut groves, but it has not more than 20 inhabitants. No water except that procured from wells. There are several boat-entrances through the reef. Ythata is one of the islands that form the boundary of the Nanuku Passage.

NUGUTOBE ISLETS.

The Nugutobe Islets are three in number; they lie west-southwest of Ythata, the two westernmost being joined by the same reef. They trend west-by-south and east-by-north, and are separated by a channel from Ythata of a mile in width: there is also a passage between the eastern and western islets. Two of the islets are composed of white sand and coral, but the other is black lava and stones. The reef is of small extent, and there is a passage through it on the north side. On these islets are some pandanus trees, but they offer little or nothing else.

EXPLORING ISLES.

The Exploring Isles are surrounded by an extensive reef, of a triangular shape; it has many breaks and irregularities in its sides, which are upwards of 20 miles in length. The isles are seven in number, besides many islets; the most important are Vanua Valavo, Malata, Susui, Munia, Ticumbia, Avia, and Osubu. There are six openings through the reef, two on each side, which lead to safe and convenient harbors. The island of Vanua Valavo is serpentine in its form, 14 miles in length, but very irregular in width, being not over 1½ miles at its greatest breadth. Besides its irregularity in form,

it is extremely so in surface, and has a ridge running throughout its whole length, with many high peaks jutting up several hundred feet. It is productive, and has a population of 500. On its west side we found the best harbors. This island, from its length, has been divided into two by the natives, who give the southern portion the name of Somu-Somu, and that of the northern Ava.

There is a good anchorage, protected by a small islet, on the east side of Somu-Somu, but the western side of Vanua Valavo affords several fine anchorages, among them Port Ridgely, which must be reached through the western entrance, as the reefs, both at the north and south end, approach so near to the island, as to close the passage for vessels. The harbors formed by the bays and reefs, are all very secure, and the only difficulty to be apprehended is in entering; the entrance at the northwest angle of the reef may be passed through with the prevailing winds. Fruit, vegetables, and water may be obtained here.

At the southern end of Somu-Somu is Malatta, divided from it by a narrow channel. It is but a small island, 2 miles in length, by one-third of a mile wide. Anchorage is to be found near its eastern end, opposite Susui.

Susui lies next to Malatta on the east; its eastern part is low, while its western rises in broken, basaltic peaks, several hundred feet high; the former is covered with extensive groves of shrubbery, while the latter is thickly wooded. This island is well cultivated, and contains 150 inhabitants, who live in several villages. On the northwest side there is a beautiful harbor, abreast of which is a considerable valley, thickly studded with groves of cocoanut palms, bananas, &c.: through which there is a fine stream of water. Here every security is offered for a vessel to effect repairs. On this island sugar-cane was found growing in great perfection.

The island of Munia lies on the south angle of the reef, 2½ miles east of Susui; under Munia there is a safe harbor, called Discovery Harbor; anchorage in 8½ fathoms, with a sandy bottom. The highest peak of Munia, called Telanicolo, is 1054 feet in height above the sea. It is composed of volcanic rocks, and is of so difficult an ascent, that its top affords a safe retreat to the natives to protect themselves from their enemies. The settlement is on the western side, where water is to be obtained. The island contains 80 inhabitants. It is 2 miles north-by-east and south-by-west in length; its greatest

width being but one mile. From its northern point there is a coral reef, extending to the north 2½ miles.

The Island of Ticumbia lies 2 miles to the northeastward of the southeast entrance, and 5 miles to the northeast of Munia. It resembles Munia in appearance, but is much smaller, and trends west-by-south and east-by-north. It is inhabited by about 70 natives. There is no good anchorage, and water is scarce.

Avia Island lies to the northeast of Vanua Valavo, near the north side of the reef; it is 3 miles in circumference, and has a central peak, which rises some 200 feet: there is a ship channel between it and Vanua Valavo. A few natives reside upon it.

The islets of Osubu are three in number; they lie to the eastward of Avia, and are a good mark for the northern entrance; they are high and rocky, connected by a coral reef; they are not inhabited except during the turtle season. Besides marking the entrance to the reef on the northern side, they serve as a good guide to that on the east, which they are directly west of, and distant 4 miles. This eastern opening is covered by the outlying reef of Nuku Ticumbia, which lies 5 miles to the east of it, trending in a north and south direction 5 miles: it is quite narrow; on it the sea continually breaks.

KANATHIA.

Kanathia is 3 miles long, north-northwest and south-southeast, by 2 wide. A high peak rises from its centre, resembling a watch-tower, formed of basaltic columns; the rest of the island forms rolling hills, which are verdant and fertile, the whole having a picturesque appearance. It is surrounded by an extensive reef, which stretches to the distance of 4½ miles to the northeast, towards the north point of Vanua Valavo, and approaches within 1¼ miles of the reef of the latter; the passage is quite clear, and from the middle both reefs are visible. On the north side of the island there is a break in the reef; there are also various boat-openings on the other sides. Morse's Reef lies one mile off the south end.

Kanathia offers the same kind of supplies that the other islands do. It has 300 inhabitants.

MALINA.

Malina lies north-by-west of Kanathia 6 miles; it is a small low island, situated on the northern end of the reef which encloses it. The reef is 4 miles in length, north-northwest and south-southeast, by 1½ miles wide. This low island is resorted to in the turtle season: there are no breaks in the reef. Off the north end of Malina there is a small islet within the same reef.

NAITAMBA.

Naitamba is high and rugged, nearly of a circular form, and 3 miles in diameter; on its northwest side there are two small islets. The reef does not extend beyond a mile from the shore; it has no openings, and there are but few inhabitants. This island lies on the south side of the Nanuku Passage.

OKIMBO ISLES.

The Okimbo Isles are three small isles, situated in a reef, which lies north of Vanua Valavo. This reef is of an oblong form, its longest side being 4 miles, trending northwest and southeast, while its shortest side is but 2½ miles. There are three reefs in its neighborhood, viz.: Bell's, Dibble's, and Williamson's. To the east of Okimbo Reef and off its eastern angle lies Bell's Reef, 3½ miles in circuit; between it and that of Okimbo there is a passage one-third of a mile wide.

Dibble's Reef lies northeast 4 miles, of triangular shape, with sides of a mile in length; and Williamson's lies northwest, one mile in length, north and south.

To the northeast and having Dibble's Reef nearly in range with the Okimbo Isles 8 miles, lies Lewis's Reef, nearly round, 2 miles in circumference; and to the eastward of it 2 miles, is the extensive *Lookout Reef* or Shoal, stretching to the eastward 5 miles, and having a breadth of 3 miles. On this shoal there is in places from 10 to 14 fathoms; its form is readily distinguished by the discoloration of the water. It would be advisable for vessels to avoid it, as there may be some coral patches, which may have escaped the observation.

YALANGALALA.

Yalangalala is a small island, of moderate height, forming the southern point of the Nanuku Passage. It is situated in the southern bight of a very extensive reef, which surrounds it, extending from the island to the west-northwest 4 miles, when it again turns to the northeast 4½ miles, then to the southeast and around the island; the southeast end is overlapped by the Duff Reef, which trends south-southeast and north-northwest for the distance of 6 miles, to the sandy island of Volerara, which rises from near the southern end.

Yalangalala is uninhabited, and only resorted to in the turtle season. These reefs, notwithstanding they can be distinctly seen by the sea breaking occasionally on them, are very dangerous, particularly in boisterous weather, and from the fact that there is a strong set to the northward, sometimes as much as a mile and an eighth per hour.

NANUKU.

West-northwest of Yalangalala lies the island of Nanuku, which gives the name to the passage between the two; between the nearest points of the reefs surrounding these islands it is 15 miles. The Island of Nanuku lies in the southeast bight of its reef, is low, well covered with trees, and 1½ miles in length, by half a mile wide. The reef which encloses it is one of the most extensive in the group, being 14 miles in length, by 8 miles in width, in shape nearly a parallelogram, and embracing an area of 110 square miles. Throughout this whole extent there is no opening, and the sea within is as blue as the ocean.

NUKUMBASANGA AND NUKUMANU.

Nukumbasanga and Nukumanu are two small islands, lying 10 miles to the north of the reef of Nanuku. They lie in a direction west-by-south and east-by-north from each other, and are surrounded by reefs; the former lies to the east, and has a small islet in the western part of its reef, called Otto; the reef is 2 miles long, by 1½ wide, and nearly a parallelogram in form. That which surrounds Nukumanu is of irregular shape, 2½ miles in length, by 1¾ wide. The Adolphus and Doughty Reefs lie between the two, and nearly

fill up the space; there are narrow passages between these reefs, and those surrounding Nukumanu and Nukumbasanga, but safe to pass through. Brown's Reef lies to the north-northwest of Nukumanu 3 miles. Dye's, Robinson's, Poukeepsie, and Porpoise Reefs, are situated between Nukumanu and Nanuku Reefs; they are detached from each other, and although they have passages between them, yet this part of the group ought to be avoided. These last-described islands and reefs are believed to be the Scylla and Charybdis of the Duff.

RINGGOLD ISLES.

The islands which I have named the Ringgold Isles lie to the west of the before-mentioned reefs. They form a small group of high volcanic islands, which have been named Budd, Maury, North, Holmes, and De Haven, after officers of the Expedition. Budd Island is an extinguished crater; the lip is broken down on the north, and admits the sea. The highest point is 800 feet above the level of the ocean. These islands are surrounded by many outlying reefs to the northeast, concentric with each other, through which there are a few breaks to the southwest; many detached patches of coral extend several miles to the southwest. Under Budd Island, we found anchorage, near the shore, in 7 fathoms, sandy bottom. These islands are not inhabited, and produce nothing but a little wood. The whole of the Ringgold Isles with their reefs form such a labyrinth, that none but a small vessel should venture to navigate among them, and they ought to be avoided if possible.

KOROTUNA AND NUKULEVU.

Korotuna and Nukulevu are the most northeastern islands of the group: they are both situated in the eastern end of extensive reefs which surround them. The former extends to the westward of the island 8 miles, and is from 3 to 5 miles in width; the latter is 9 miles long and 2 miles wide. The reefs are separated 3 miles, the east end of the reef of the former lying due north of the west end of the latter. There are no breaks in these reefs, but the natives pass over them in their canoes. Both of these islands, as well as those of Nukumanu and Nukumbasanga, are thickly inhabited, and covered with fine groves of cocoanut trees. The distance between the reefs of

Korotuna and Nukulevu, and those of Nukumanu and Nukumbasanga is 10 miles; this is clear of any reefs, and may be passed through.

Having described the islands and reefs of the eastern cluster or group, I will say a few words relative to the four passages by which vessels may sail safely through them.

FULANGA PASSAGE.

The Fulanga Passage is the most southern. It is bounded on the east by the islands of Ongea, Angasa, Namuka, and Olenea; on the west by Fulanga, Moramba, Kambara, Enkaba, and Tubanaielli: the course through is north 35° west. The two Ongea Islands are suitable to make for a land-fall, having a care to avoid the coral sandbank of Nuga Ongea, which lies to the southeast of the Ongeas; those intending to enter the Feejee Group at its southeastern extremity would do well to pursue this course, especially if intending to touch at Lakemba, which island affords the best point to gain information as to the condition of the group, from the missionaries. I look upon it as necessary for all vessels upon a trading voyage to obtain a correct knowledge of the political state of the group. Then a friendly reception will always be met with, and vessels may procure either a foreign or native pilot.

On arriving off Ongea, and with daylight, I would advise this passage being taken. The distance to Lakemba is but 60 miles after entering the passage: this passage is 30 miles in length. The wind will generally continue to draw up the passage. When the island of Namuka bears east, and that of Olenea to the eastward of north, a north course may be steered for Lakemba. Due regard must be paid to an easterly set, which is seldom less than half a mile per hour. Should the weather on arrival off Ongea prove bad, or be doubtful in its appearance, and having no intentions of stopping at Lakemba, I would recommend passing to the southward of the Island of Fulanga, and not enter the passage, but steer a course north-by-west, which will lead 10 miles to windward of the Tova Reef, distant 55 miles from Fulanga. If, however, apprehensions should be entertained of passing to windward of so dangerous a shoal at night, I would then recommend a west-northwest course for the Island of Moala, distant 75 miles.

The winds will be found to prevail from the east-northeast to east-southeast, generally from the former, and very seldom from the latter. When the wind has been blowing a strong trade for several days, and has become squally, it will continue from 30 to 40 hours; after this it will change to variable, with rain, shifting to the northwest for a day, then hauling round again to the eastward, with fine weather.

ONEATA PASSAGE.

The Oneata Passage may be recommended if the weather should be fine. It lies between Oneata on the north, and Motha on the south. To enter it, steer a direct west course for Oneata Island, which is high and remarkable. Motha will be seen long before the reefs are discovered. By keeping on the northern side of the passage, the Ickulaka Reef, which lies directly north of Motha, will be avoided. The Oneata is the shortest of the passages, and may be considered the best. Its length is 15 miles, and its width 10 miles; this, however, is partly taken up by the reefs of Ickulaka. If the passage should be reached near nightfall, and the weather prove bad, I would recommend running for a harbor within the reef of Oneata; there is no difficulty in entering while daylight lasts, and the anchorage under Observatory Isle will be found safe. The break in the reef lies north 67° east from the isle. If the weather is fine, after passing Oneata, Lakemba will be in sight, when a course may be steered to round the reefs of the two Aivas, or, with the intention of passing into the group, steer direct for Vanua Vatu, thence for Nairai, through the Sea of Goro.

LAKEMBA PASSAGE.

The Lakemba Passage should not be attempted except in fine weather and by daylight. The reefs will be fallen in with before the islands are seen. The first land made in approaching it from the east will be the Island of Tabutha, with its conical cap. The outlying reefs to the east are distant from it 15 miles: much danger may therefore be incurred before a vessel gets sight of it. If a good lookout is kept from aloft, these reefs will be seen in time to be avoided, as the sea constantly breaks over them, which permits their being distinguished at from two to three miles distance. Reid's Isles lie on the south side of

this channel, situated in the Latte Reef; if these should be made to the westward, no time ought to be lost in hauling up to pass to the northward of them, and after they bear south, the Island of Naiau should be steered for. The direct course through this channel is southwest. It is 46 miles in length, and 16 miles at its narrowest part. Though obstructed by outlying reefs of great extent, yet after these are passed, there is a clear and open sea for vessels to work in, and the islands of Lakemba and Naiau are good marks, being careful not to bring the Island of Lakemba to bear to the west of southwest, on which bearing the northern edge of the Bocatatanoa Reef lies. The wind usually permits a vessel to stand through this passage.

NANUKU PASSAGE.

The Nanuku Passage is the most northern in the Eastern Group. In fine weather it may be approached without danger. The course through this channel is southwest half west. Vessels desirous of passing through it, should endeavor to make the Island of Nanuku. After they have sighted it, the passage will be open, and by steering a southwest course, they will be led into the Sea of Goro, where they will find plenty of room to encounter bad weather. If vessels should be at the entrance of this passage, towards nightfall, without having made either Nanuku or Yalangalala Islands, I would strongly urge them to continue their course, if they are sure of their latitude, as much the safest; by so doing they will avoid the doubt as to their situation, which a few hours lying by would produce, from drift by current; indeed, it is desirable to pursue this course also in making the reefs at the mouth of the Lakemba Passage. It must be constantly borne in mind, when approaching this group, that the reefs, in most cases, and particularly those of great extent, and most dangerous, extend the greatest distance on the windward or eastern side of the islands, and therefore, by getting on the western side, dangers are not only avoided, but smooth water may be found under the lee of the islands.

Vessels entering through the Nanuku Passage and bound for Somu-somu, can haul up to the north-northwest, to pass between the reef of Lauthala and Nanuku, and thence round the north end of Vuna, into the Strait of Somu-somu. This course I deem preferable to passing through Tasman's Strait. Another and a safe route is to stand on to

the southwest, and pass round the south end of Vuna into the Strait of Somu-somu, as the trades will be retained, and the harbors of Somu-somu reached much sooner. If not disposed to proceed beyond Lauthala, advantage may be taken of the harbor at the junction of Kamia and Lauthala Islands, which is well protected by the reef, and easy of access, from the absence of reef to the eastward of Matangi.

These Passages are all suitable for a vessel bound to or through this group, sailing from east to west. I have not imagined that any navigator would have the hardihood to attempt to pass in a contrary direction, surrounded as he would be by so many dangers, and which he had no necessity for encountering, with a certainty of adverse winds.

TOVA REEF.

Tova Reef lies half way between the islands of Totoia and Vanua-vatu, from which latter the distance is 22 miles. It is due east of Moala, 25 miles. It is one of the most dangerous outlying reefs in this group, of circular form, one mile in diameter, and has an opening for boats on its north side. The water inside the reef is quite shoal and irregular in depth, from 2 feet to 2 fathoms. At low water this reef is dry, and then protection for a boat may be had inside. At all times the sea breaks on it, but at high water the breakers are very high and can be seen some distance. Its true bearing from Totoia Peak is northeast-by-north. Moala and Totoia are in sight from it, but Vanua-vatu is not.

TOTOIA.

The Island of Totoia is high and much broken, of volcanic formation, and has many fertile valleys. A coral-reef extends all around the island, except on its north side. It is from 1 to 1¼ miles from the shore; and although here and there a coral patch exists, yet good anchorage may be found within the reef. On the northern side the soundings are very irregular, and the bottom much broken, and only answers for a temporary anchorage. North Bay is more convenient and better adapted for vessels, though South Bay affords also good protection. Water and wood may be obtained at this island, but as the natives have a very bad character even among the Feejeeans, it is necessary for visitors to be on their guard.

Totoia is 5 miles in length, east and west, by 3½ wide. Its North and South Bays form deep indentations, and are separated 3½ miles. The altitude of Notch Peak is 1148 feet.

MATUKU.

The Island of Matuku lies 22 miles southwest of Totoia. It is much broken. Volcanic craters are numerous, some of which are well-defined; the sides rise up in picturesque peaks, and between them are fertile valleys. The island is 4 miles long, north and south, and 3 miles wide at its southern end, but it does not exceed 1½ at its northern. It is surrounded by an extensive reef, which has three openings in it, two on the east side and one on the west; the former leads to Colvo Harbor and Rocky Cove, the latter into Carr's Harbor.

The reef extends to the distance of 1½ miles from the southeast point, and to the same distance from the northeast point.

The entrance to Colvo Harbor is 180 yards wide; the sea sets into it when the wind is strong. The anchorage is good, though the water is 20 fathoms deep. This harbor may be easily known by a craggy peak and the walled town situated on its projecting point. There is a passage inside the reef for boats, to the north; to the south, one exists for large vessels, so that a ship may pass round the south end of the island within the reef, and make her exit through the reef at Carr's Harbor, on the west.

The entrance to the north of Rocky Point is only suitable for small vessels, and is extremely intricate, from the patches of coral that are situated just within its entrance. Half way between this opening and Colvo Harbor there is a considerable sand-island, which rises from the reef.

Matuku affords every facility for wooding and watering, and the supplies that these islands afford may be had here.

The entrance into Carr's Harbor is 400 yards wide, but being on the lee side of the island, and the course in due east, a vessel has a head wind to enter; consequently it is very difficult for any but a small or quick-working vessel to succeed. The passage widens after entrance, and the water is deep close to the reef. Those having a desire to pass in, must take the precaution to examine the state of the current, in the boats, before making the attempt; if it should be setting out, it would be next to impossible to attain the anchorage. Fre-

quently the current will be found to set out; for when the wind blows strong the water washes most over the reef on the weather side of the island, and flows round to escape on the lee side through this passage, the only one for its exit. Within the reef to the north there is no passage for a vessel beyond Cocoanut Island, but several openings for canoes and boats. The passage to the south, as far as Cocoa Point, is suitable for vessels, but beyond this it was not particularly examined, for want of time. A safer course for vessels which seek Colvo Harbor, is to take advantage of the fair wind which leads round the south end of the island to Carr's Harbor, to pass out, instead of attempting to return through the narrow entrance. This route was not particularly examined, though it is believed to be feasible and safe.

MOALA.

Moala is a high volcanic island. Its surface is very much broken; there is a constant succession of hills and valleys. It is well wooded and extremely fertile. It has an extensive and deep bay on its east side. The shape of the island is somewhat of a triangle, its north side being 6 miles in length, that trending southeast 5 miles, and that trending north-northeast, 7 miles, with an average width of 2½ miles. On the north the sea-reef is entirely wanting; in place of it there are a great many coral patches near the shore. Off Rocky Point, at a distance of 2 miles, the north point of the sea-reef begins; it extends in a south-by-west direction, the whole length of the island, and a mile and a half beyond Valivuaka Point, when it turns west 4 miles, and thence to the western end conforming somewhat to the shore-line of the island. In all this distance (18 miles), there are but two passages through it: one on its eastern side, opposite Charley's Harbor, and another on its southwest side, opposite the harbor of Thacopa. Attached to the shore there is a coral reef of 200 yards in width; the coves have sandy beaches, but elsewhere rocks of lava rise perpendicularly.

This island offers, from the easy access to its harbors, great facilities for vessels.

Charley's Harbor is the large bay on the east side, 3 miles in length by one mile in width. It has three large towns situated within it, viz.: Ketira, Nathuvinemaishi, and Vonuga. The soundings in it are from 9 to 30 fathoms in depth. Supplies of all kinds

may be had here, but in consequence of the disposition and character of the natives, it is deemed advisable to be prepared against their evil machinations, if communication is had with them. The eastern passage is quite safe, and is the best to enter by, even if desirous to anchor under the lee of the island in the harbor of Thacopa, which is situated on the southwest side, and has a fine opening through the sea-reef abreast of it. There are two anchorages on the west side: one to the south of Ridge Point, the other to the north of it, near Green Island. This latter is the best, being more protected, and offering every means to get to sea without difficulty. The town of Thacopa is situated at the head of a bay. On the north side there is Female Bay, which is quite small; at the head of it, the town of Malago is situated. Some provisions may be had there, but I would advise vessels to resort to the regular anchorage for supplies.

ANGAU.

Angau resembles the rest of the detached islands of this group in having lofty peaks, of volcanic formation. It is 10 miles long, northwest-by-north and southeast-by-south, by 4½ miles wide. Of its high peaks, that of Dilathoa is the most lofty; it is 1560 feet in altitude. Its hills range with the length of the island, and there are many fertile valleys, surrounding the numerous bays, that are formed by projecting points.

The coral reef extends quite around the island; on the west side it is 2 and 3 miles removed from the shore, while on the east it becomes a shore-reef, and is from 100 to 200 yards wide.

On the east side there are two openings, 150 yards wide, near Uthivione Point, which is the north point of the island: this is a ship channel, and leads to the town of Thopanauti. The other is near the town of Lamilu and Pig Islet, but the harbor is small, and but little protected from the prevailing winds. About half way between these, there is an entrance for boats, leading to the town of Maluai. Off the south end, the shore-reef extends some distance, and at low tide the water is too shoal for a boat. On this reef, off South Point, is the small low island of Lathiba, one mile distant. The southwest side of the island, extending from Point Lobo to that of Via Via, is detached from 2 to 3 miles from the shore, forming two bays; that of Levuka, which is the largest and most southern, and

Waicama: these are separated by Tongue Point. In both these bays there is good anchorage, and around them several towns are situated, being well protected from all but the southwest winds, which seldom blow; immediately west of Levuka Point there is a fine ship-passage through the reef. Vessels resorting to these bays would do well to enter through the reef off Sauieke Bay; here there is a passage between the sea-reefs, nearly a mile wide. Sauieke Bay lies on the northwest side, immediately opposite the opening, but it is too much obstructed by coral patches to afford safe anchorage to any but small vessels. A vessel after having passed through the reef, and wishing to proceed to Levuka Bay, should steer for Via Via Point a southwest course, and then continue to Pirate Point, when both the bays will open to view, and the anchor may be dropped abreast either of the towns, where supplies may be had of wood, water, and provisions. It is proper here to remark, that, as this island is subject to the king of Ambau, it is necessary to have permission to obtain supplies, as the natives have fears relative to supplying vessels, without some authority from the king.

On the north side of Angau the reef approaches the shore, and within, it is much broken up in small patches, having very shoal water between them.

Dilathoa Peak is the most conspicuous on Angau. This peak in clear weather is readily perceived from the large island of Viti Levu, from which it is distant 30 miles.

MUMBOLITHE REEF.

Eight miles south-by-west of Lobo Point, on Angau, lies the insulated reef of Mumbolithe. It is in shape nearly an equilateral triangle, whose sides are one mile in length: on it the sea usually breaks. It is a dangerous reef, and ought to be carefully avoided.

NAIRAI.

The Island of Nairai occupies a situation north 35° east of Angau, 7 miles distant. It is 6 miles in length, north-northwest and south-southeast, with an average width of 2 miles. It has the same volcanic formation, but its peaks do not rise as high as those of Angau: it has several fine bays and good anchorages, which are made by the peculiar

form of its reefs. On the west it has the Onoruga Reef; on the south, the Mothea Reef; on the east and projecting to the north, the Flying-Fish Reef, while on the northwest side it is entirely free. The Onoruga Reef extends more than 5 miles due west from the west side of the island; it forms an extensive bight, in which are several outlying patches of coral. As this reef approaches the island, its course, when within a mile of the shore, trends southerly, off Lanagi Point, where it terminates. Several coral patches lie between it and the Mothea Reef; the openings between these afford safe passages for vessels, by which they can pass to the various anchorages on the south and west sides of the island. An extensive basin is formed by the bight of Mothea Reef, which extends to the south 5 miles; it is 3 miles wide, and within it is the Cobu Rock, an insulated rock, a mile from Nalico Point. On the west side the harbor of Venemole is the best anchorage; it is well protected from all the prevailing winds: on the north by the two small islands of Sudine Levu and Sudine Lailai, which are joined by a wide coral reef, which extends to the island, stopping up the entrance into Venemole Bay, and rendering it inaccessible for any kind of vessel. This Bay is an extensive sheet of water, nearly circular in form, and has the appearance of having once been an extensive crater. The depth of water in Venemole Harbor is from 12 to 15 fathoms, with good holding-ground. It is easy of access, and supplies of water may be had at the town of Venemole, situated at its head. No special directions are deemed necessary to enter. The two small islands on the reef are readily discovered. When approaching the island from the northwest these may be steered for, and when within half a mile of Sudine Lailai haul round it, and anchor within half a mile of the reef or shore. The only danger is a small sandbank, which lies to the south: there is 3 fathoms on it at low water.

On the east side is the Bay of Corobamba, where there is good anchorage, being well protected by the reef, which here follows the trend of the island. This bay reaches from Muselana Point to that of Toburoro, a distance of 3 miles. Corobamba is situated within a mile of Musilana Point, and is the second largest town on the island of Nairai: the depth of water is 15 fathoms on a clear bottom of sand. Within a mile of Musilana Point and to the northward of it, there is a break in the reef; this divides the Flying-Fish Reef from that of Mothea. Vessels must at once haul up sufficiently to pass to windward of Musilana Point, and after it is passed, the town of Corabamba

will be open, off which is the anchorage. The Flying-Fish Reef extends 4 miles, trending to the north-northwest; at its north end it takes a turn for one and a half miles to the west. Near the north end there are some patches of coral, but they lie very near the reef. The extreme point of this reef is some feet under water, and as the sea does not at all times break on it, a vessel should not approach too close. When the central peak on Nairai, Corobata, bears south (true), it will cut the end of the reef. At 2 miles from the island there is an opening through this reef, which may be used in case it becomes necessary. The channel leading from Corobamba Bay round Tuburoro Point, between it and the sea-reef, is safe, and free from any obstructions; the only danger is a small coral patch, a quarter of a mile east-southeast of Nalico Point. After this is passed, either side of the Cobu Rock may be taken, and thence due west of Cobu Rock to a safe passage through the sea-reef.

Besides the towns mentioned, there is another on the north side, called Tauloa, which is at the head of the bay of the same name. It affords little protection for vessels, but supplies may be had there.

On the southwest side of the island is Lanagi, another large town, at which supplies may be procured. At this island the natives are very friendly, and although under the authority of Ambau, yet they are at times independent of it. The natives are reputed to be well skilled in making mats, &c. &c., in which articles they generally supply many of the other islands, and in consequence have a good deal of trade and intercourse with them. The population of Nairai is reported to amount to 7000.

Navigators should not go to the west of Nairai during the night. The Sea of Goro, which lies to the east of this island, is quite free from dangers, excepting the Tova Reef; having passed it, there is no necessity for a vessel running further; there is plenty of sea room to lie to or keep under way on short boards. By standing on to the westward, after nightfall, little or nothing is gained, and many perplexities, by the near approach to dangers, will be encountered.

AMBATIKI.

Ambatiki is a small volcanic island, situated northwest from Angau and west of Nairai, from both of which it is 11 miles distant. It is nearly equilateral in form, the sides of which are 2 miles in

length: it rises in a dome-shaped hill to the altitude of 750 feet. The reef is continuous around, and offers no protection for vessels, and only a few passages for boats; it does not extend from the island more than a third of a mile. There are several small villages. The inhabitants of all are subject to Ambau, and are afraid to do anything without the authority of its chief; therefore it is fruitless to attempt to get supplies from them, unless having permission from the proper authority. The number of inhabitants amounts to 500.

GORO.

The Island of Goro lies north of Nairai, 25 miles: it is half way between the latter and Vanua Levu, and is southwest of Vuna, 30 miles. Goro is a high island, not so much broken as those I have already described; has no sharp peaks, but is capable of being cultivated to its very top; a large part is table land. Like the rest, it is of volcanic formation. It is 9½ miles in length, by 4 in width. The usual sea-reef is here wanting, and the shore-reef is not continuous. The form of the island is a trapezium, its length lying nearly north and south. On the east side the shore-reef is irregular, having many projecting points and deep indentations, in shape of large segments. This reef projects at the northeast point one and a half miles to the north. There are likewise patches of the shore-reef off the southwest and northwest points of the island, but the west side and part of the north end are free from coral. There are two small anchorages under this island: on the west side, one at the northwest, and the other at the southwest point. That in Kalau Harbor, under the north point, is the best. On the north side there is no anchorage. Useless Bay is too much filled with patches, and Coa Coa Bay offers no inducements. Under Ruku Point, close to the shore, there is anchorage, but it cannot be recommended. The east side, from the trend of the reef and its being the weather side of the island, offers scarcely a place for even a small vessel to seek shelter in. Temporary anchorage may be had near the southeast point. The northeast point must be avoided, on account of the distance to which the shore-reef runs off. On this reef there is a small sand-spit, beyond which the reef extends three-quarters of a mile.

Goro has 2000 inhabitants, and there are many towns, which are very flourishing. It produces more cocoanut oil and tortoise-shell

than any other of these islands. Provisions may be procured here, but wood and water it is far preferable to seek elsewhere, where they can be procured with less difficulty.

HORSESHOE REEF.

The Horseshoe Reef lies between Goro, Nairai, and Ambatiki. From the south point of Goro, it bears south-half-west, 13½ miles, from the north point of Nairai, northwest 10½ miles, and from Ambatiki, northeast 11 miles. It derives its name from its form. It is one mile in diameter. It has an entrance on the north side. In boisterous weather the sea breaks on it, and then it may be seen from the heights of the surrounding islands, but in fine weather there is seldom any break on it beyond the ripple at certain times of the tide. It is a dangerous reef, and ought to be shunned.

KANTAVU ISLAND.

The Island of Kantavu, which bounds the Kantavu Passage on the south, is very high, of volcanic formation, and has many conspicuous peaks rising from its central ridge. Near the middle of the island it is very narrow and low, having the appearance of two islands at a distance. The whole length is 26 miles. The eastern portion is 7 miles wide; whilst that of the western is but 4 miles. Its southern coast is indented by a deep bay,—Gressin Bay. On this side it has one or two good harbors, but they were not examined by the Expedition. The north side is well provided with coral reefs, to form harbors, so much so as to have some of its bays quite obstructed by the patches, which extend nearly across them, and debar their being entered, except through tortuous passages. Among the best, are those of Mallatta and Tabuka Bays, but I cannot recommend either of them for more than temporary anchorages. A vessel intending to anchor in either of them must have good lookouts aloft, and thread her way. There is no difficulty in reaching an anchorage in 17 to 20 fathoms water; but if a vessel is desirous of approaching nearer the shore, to anchor in shoaler water, she should warp into a proper and suitable berth.

There is a large population on this island, and the natives are well-disposed. The island is very fruitful, and supplies may be had here, by previous arrangements being made with the chiefs; it is well,

however, for vessels communicating with this island to be upon their guard; for although the natives are disposed to be friendly, yet, if opportunity offers, they will detain an officer for a ransom. Large spars may be had here, the island being well covered with lofty timber on its high lands. The most remarkable peak on the island is situated at its western end. This is known as the Peak of Kantavu; it is of a cone shape, and its top has the appearance of being a crater. The altitude was found to be 2879 feet.

The coast of Kantavu, to the east of Mallatta Bay, is destitute of coral reefs, excepting at one point, where a small patch occurs, until the approach to the island of Ono, situated off its eastern end, and divided from it by a channel 3 miles wide, in which there are many coral patches. The Island of Ono may be reached without difficulty by a vessel, and good anchorage found under it on its west side.

Ono is 12 miles in circumference, and rises about 80 feet above the sea, in the form of a regular dome; from it the great Astrolabe Reef extends to the north 12 miles, and has a mean breadth of 3 miles. Within this reef there are eleven small islands, which I have called the Passed-Midshipmen's Group, after the officers of that rank attached to the Expedition. On the west side, the reef is much broken, and a large vessel may pass through it, and find temporary anchorage under the largest islands. No directions are deemed necessary to enter, as the breaks in the reef clearly show themselves. The anchorages, however, cannot be recommended for any but small vessels to make use of. The northern end of the Astrolabe Reef is rounded, and has an opening of 250 yards wide. In the centre of this northern bight stands an insulated black rock, which is very conspicuous.

The eastern side of the Astrolabe Reef is unbroken, and forms a slight curve to the eastward. As it trends to the south, it joins the Island of Kantavu at its extreme eastern point,—Point Bligh. This reef obtains its name from the narrow escape from wreck which the French discovery vessel, the Astrolabe, Captain D'Urville, had when in the group. From the north end of the Astrolabe Reef the high land of the islands of Viti Levu, 'Mbenga, and Kantavu can be seen. The Black Rock lies in latitude 18° 43′ south, and longitude 178° 27′ east.

The Island of Kantavu is the Mywoolla of Captain Bligh, who was the first that touched at it. The north side of the island is generally the resort of the English whalers for supplies, which they readily ob-

tain, consisting of yams, taro, &c., the products of these islands. Wood and water can be had there in abundance.

VATULELE AND FLYING-FISH REEF.

The Island of Vatulele lies 16 miles south of Viti Levu, and 30 miles west-by-south of 'Mbenga; it is 8 miles in length, by 2 in width, trending northwest and southeast; from its southern to its northern end it gradually rises to the height of 70 feet above the sea-level, and is composed of a reddish clay and sandstone, lying in horizontal strata. Its southwest side has but a narrow shore-reef, throughout its whole extent; this on the northeast side becomes a sea-reef, and extends to the distance of a mile and a half to two miles from the island. The sea-reef, after trending three miles to the southeast, again trends towards the centre of the island, embracing an extensive lagoon, and encloses four small islands, which I named the Midshipmen's Group, after the officers of that rank in the Expedition; they are nearly as high as the north end of the island. There is a narrow passage between the reef and the island, for boats or canoes, as far as the south end, and a few entrances into the lagoon. Vatulele offers very little to claim the attention of the navigator or trader; it has a few inhabitants. The north bluff of the island exhibits the same red earthy formation as that part of the coast of Viti Levu called the Red Bluff.

To the east-by-north of the south point of Vatulele, 7½ miles distant, is the Flying-Fish Shoal or reef; it is 300 yards north and south, by 150 east and west, and is awash; on it the sea always breaks. Both Vatulele and 'Mbenga may be seen distinctly from it in clear weather. From the southwest bight of the reef of 'Mbenga, it bears southwest, distant 14 miles. This is the only detached reef in the Kantavu Passage.

KANTAVU PASSAGE.

The channel lying between the Island of Kantavu on the south, and 'Mbenga, Viti Levu, and Vatulele, with their reefs, on the north, I have called the Kantavu Passage. At the eastern end, in a northwest direction from the north point of the Astrolabe Reef to that of 'Mbenga, it is 24 miles wide, and at its western end, between the west point of Kantavu and Vatulele, it is 30 miles; it is 40 miles in length.

The direct course through, is east-northeast and west-southwest; it affords ample room for a vessel to work in. It must be borne in mind, when navigating through it, that the tides are strong, and that the flood sets to the northward and westward, while the ebb runs with some velocity to the southward and eastward: during the night there is generally little or no wind, and a vessel may consequently be subjected to the full action of the tides. In order to enable whaling ships to obtain their longitude correctly in passing this group, I carried meridian distances from the Observatory at Ovolau, to the peaks; their true positions, therefore, have been ascertained with much accuracy through azimuthal bearings and distances determined by triangulation.

The latitude of the Peak of Kantavu is 19° 05′ south, and its longitude 177° 58′ east. 'Mbenga Peak is in latitude 18° 22′ 30″ south, and longitude 178° 07′ 30″ east. The southeast point of Vatulele is in latitude 18° 37′ 30″ south, and longitude 177° 39′ 30″ east. Navula Point (west point of Viti Levu) is in latitude 18° south, longitude 177° 12′ 30″ east.

OVOLAU.

The Island of Ovolau is very nearly the geographical centre of the Viti Group, and taking into consideration its position, fine harbors, fruitful soil, and the ease with which supplies can be obtained, both of wood, water, and provisions, ranks first among the islands. It is of an ellipse form, its longest diameter being 8 miles, north and south, while that of its shortest is 5 miles, east and west. Its surface is very much diversified into hill and valley, and some of its peaks rise abruptly to the altitude of 2500 feet; between the highest there are deep chasms and many rivulets, which join and form large brooks before they reach the sea; these afford a sufficient supply of water to irrigate its surface, by which a constant verdure is maintained, and it may be obtained in any quantity. The island is composed of volcanic conglomerates. Some of its lesser peaks rise up in basaltic needles.

On Ovolau there are many towns and villages; the principal of these are Levuka, Voona, Vi Tonga, and Livune. These are in different districts, and under different chiefs, who are frequently at war with each other. The interior of the island is held by the mountaineers,

who are an independent tribe; this circumscribes visitors to the limits of the friendly district of Tui Levuka, who has fully experienced the advantage accruing to himself and people by communication with the whites, and he offers every facility for them to obtain the supplies they need.

The harbors of Ovolau are all formed by coral reefs. These reefs extend along the eastern side, and from the Lada Reef off the northern extremity of the island to the Moturiki Passage, on the south, and include the islands of Moturiki and the two Anuthas. In places the reefs are broken, affording good entrances through them to the anchorages.

The harbor of Levuka extends from the Fore-finger on the south, to Underwood's Tower on the north, a distance of 5½ miles. It is a fine harbor; the anchorage is good throughout, in from 11 to 17 fathoms water, remarkably easy of ingress and egress, and the directions for entering it are simple. After passing Ambatiki, steer for the Peak of Dille-Ovolau, the highest peak of Ovolau;—this lies northwest of the town of Levuka,—and when within two miles, a black coral rock will be observed, on the reef, some distance to the southward of the entrance; when up with the entrance, and the passage through the reef is open, the Observatory knoll will bear west-by-north, for which you then steer. If the flood tide is running, keep the south reef aboard, but if the ebb, the north. This passage is not over 800 feet wide. Should the wind prove light, I would recommend the boats to be got out, and ready for towing, as it may fail at the most critical moment in the entrance, and leave the vessel somewhat in danger of being cast on the reef. When the reef is passed, sail should be taken in as soon as possible. The width of the harbor at this place is less than half a mile. In coming to anchor be careful to avoid a small coral patch a little to the south of Observatory Point. The best anchorage is in 11 fathoms water, off the town of Levuka. Fail not to make a present to the chief; it ought to be one of the first duties, by which means he will be propitiated, the intercourse satisfactory, and the supplies ample. Should a contrary course be recommended by the resident whites, avoid the advice, and refuse to espouse their quarrels. The northern openings are the best to depart from. Either side of the *sandspit* which lies between the coral reefs, may be taken.

The Ovolau Reef continues to the south, and forms the northern

boundary of the Moturiki Passage. There are several narrow passages through the reef, leading to good anchorages under the island.

On the west side of Ovolau the coral reef is wanting, except in a few places. Two miles from the island, there is a large area covered with coral patches, called the Mana Shoals, which must be carefully avoided; there is no difficulty in doing this, as there is sufficient room, either with a fair or head wind. All the direction deemed necessary is to keep the island side of the channel, with a careful lookout from aloft. The channel between the Mana Shoal and the reef off the north end of Moturiki Island is a mile wide and clear.

On the north of Ovolau, the Lada Reef extends 4½ miles; its form is irregular; it encloses an area of about 3 square miles. Patches of coral compose its western side, and project from it to the west, 2 miles. Boats may pass among them, but it would be dangerous for even a small vessel to venture.

MOTURIKI.

The Island of Moturiki lies within the same reef, and on the southwest side of Ovolau: it might be considered as one and the same island; for they are almost connected by the two small islands of Anutha-levu and Anutha-lailai with their reefs. Moturiki is 5 miles long, by 1 wide; it trends north-northwest and south-southeast, 5 miles. To the west, abreast the middle of the island, it has some small outlying patches of coral; its shore-reef extends the whole length, and round on the east side, till within a short distance of Laudolib Islet, on the southeast point of the Ovolau shore-reef. On the north of Moturiki, and between it and Ovolau, there is good temporary anchorage.

Moturiki has two towns on its southwest side, Sabuna and Corabo, and one on its east, Aubuti.

MOTURIKI PASSAGE.

The Moturiki Passage is 4 miles in length, by three-fourths of a mile wide in its narrowest part, between the Island of Thangala on the north, and those of Leluvia, Angasau, and Tombu, with their reefs, on the south. This last is situated at its entrance, near the point of the great reef of Viti Levu, that trends towards Kamba Point. These small islands and reefs form the portals to the Bay of Ambau; they

are each about a mile in circumference, and covered with foliage: which gives them a pretty appearance. In the passage there are no soundings, but under the western side of the Island of Leluvia a vessel may anchor in 10 fathoms water, sandy bottom. The mark for sailing through the Moturiki Passage is Rich's Peak, on Viti Levu, which bring to bear due west. Before reaching Leluvia, on the south side, there are some small coral patches; it is best to avoid these by keeping on the north side. The tides run strong through this passage; the flood flows in, and the ebb out; the latter continues 8 or 9 hours out of the 12. Anchorage may be had under Thangala or Moturiki, by passing through the entrances in the north reef.

VITI LEVU.

The Island of Viti Levu is the largest of the Viti Group; its shape is somewhat of an ellipse, being 100 miles long, by 60 miles wide. The general appearance of the island is broken, and of volcanic formation, rising in many high and needle-shaped peaks, often to the altitude of several thousand feet. The highest range lies north-northeast and south-southwest, dividing the island by passing obliquely through it. This range is called the Ulunikoro Mountains. Some of the measurements of its peaks gave an altitude of 5750 feet. From this range there are many spurs, which set off in different directions, in sharp ridges, towards detached peaks, which rise in regular cones; to these the names of some of the gentlemen comprising the corps of naturalists of the Expedition were given. These, with the extent of broken surface, give the impression that the greater part of the island is entirely unadapted to cultivation, or even for the abode of any number of inhabitants. Like all the islands of any extent situated in the trade-winds, the leeward side is subject to long and excessive drought, and has a very different appearance from that of the windward part. Viti Levu on its leeward side enjoys the advantage of several harbors, where a plentiful supply of water may be had from the streams which flow from the mountains,—sufficient even for irrigation in places. Its weather side is abundantly supplied with streams, and the Wailevu River enters into the sea at Rewa, after a winding course of some 45 miles from the mountains. Along the banks of this river the most fertile portion of the island is found, and it is

the most densely populated, and destined to be the seat of improvement when the Feejeeans become more civilized and enlightened.

As this island embraces a large number of smaller islands situated on its reef, and connected with its harbors, I shall include them in the description as they occur, in which both 'Mbenga, and Namuka, and three reefs will be embraced, beginning at the Moturiki Passage, which leads into the Bay of Ambau on the east, and thence around its southern, western, and northern sides.

From Leluvia the inner reef trends due south, 11 miles: this forms the eastern boundary of the Bay of Ambau; at its southern end lies the small island of Tombarua. There are several extensive patches of coral connected with this reef, lying three-fourths of a mile to the west. The Bay of Ambau lies between this and the east end of the Island of Viti Levu; the shores are low, and along them lie several small islands, on which the principal towns, Ambau, Viwa, and Verata, are situated, where the political power has long been concentrated, and where it now exists. The bay is 12 miles in length, by 4 in width: it is a fine sheet of water, and has anchorage throughout. Kamba Point forms its southern termination, while that of Verata bounds it on the north. The water towards its western shore is shallow, and there is no harbor except the open bay; small vessels may anchor under the Island of Viwa. Although the anchorage in the bay is good, it is exposed and unsafe for a vessel: in gales of wind many vessels have been either wrecked or lost their anchors.

One and a half miles off Verata Point there is an extensive coral patch, 2 miles in length, north-by-west and south-by-east, and a mile wide. Between it and the land there is a passage, and another to the eastward, where there are many patches of coral, some of which are bare at low water. There are several other coral patches, which have not been located on the chart, as I was not satisfied that we have their places correctly ascertained. Vessels sailing in the Bay of Ambau are recommended to keep a good lookout from aloft, and not to attempt passing through it without daylight. As to supplies, the Bay of Ambau offers no inducements to visit it, nor is it advisable to incur the risk while the Feejees remain in their present savage state, and while supplies may be had elsewhere in security.

There is a communication by water with Rewa, by a small stream that flows into the Bay of Ambau, a branch of the river of Rewa, the length of which is ten miles. All the productions of this group

are very abundant here; the population is greater, and the consumption of supplies larger than in other parts of the group. Every trick is resorted to by the chiefs, great and small, to exact presents from strangers, by throwing impediments in the way of obtaining supplies; it is, therefore, better, unless a vessel has especial business with the authorities of Ambau, to seek them in another part of the group.

To the east, around Kamba Point, there is a passage for small vessels or boats through the reefs, but it is very confined and much obstructed by patches of coral; the outer sea-reef coming from the north forms the northern side of this passage; in its bight of the outer reef lies the small island of Mambualau, and 3 miles to the west, on the inner reef, that of Tombarua; both have groves of cocoanut palms on them, which is also the case with the small island of Nezimbazimba, directly off Kamba Point. The land about Kamba Point is all low, alluvial, exceedingly fertile, and densely covered with vegetation. On the outer reef the sea breaks at all times. The sea-reef joins Kamba Point; it then trends 3 miles to the east, and follows the coast-line to the south.

Four miles south of Kamba is Kuva Point, which is also low, and covered with trees. The width of the reef from Kamba Point is 3½ miles. Nasilai Point is southwest of Kuva, 3 miles, and between the two the coast makes a considerable indentation, and the shore is free of coral. The reef terminates at Kuva Point and reappears at Nasilai Point, forming a large and extensive bay, but in consequence of its being open to the sea, and exposed to the prevailing winds, it forms no harbors of safety for vessels. From Nasilai Point the coast trends to the westward to Kania Point, the eastern termination of the Roads of Rewa, the line of the reef running with the coast, but without openings. The land is low, and covered with cocoanut palms. Just beyond Kania the reef turns towards the northwest, joins the land, and ends three-fourths of a mile to the west of that point. The interruption is believed to be caused by the fresh water discharged from the Wailevu. To the southwest of Kania Point, 3 miles, are the islands of Nukulau and Mukulau, which with their reefs form the protection to Rewa Roads. There are three passages into the Roads, on the east, southeast, and south: the first, between the reef off Kania Point and that of Nukulau Island, a mile wide, called the Kania Entrance; the second, between the islands of Nukulau and Mukulau, called the Middle Entrance; and the third,

on the west side of both islands, the Southern Entrance: the last two are not wide, but the safest. The Island of Nukulau is one-third of a mile long, but there is a long sandspit, which extends to the eastward half a mile, covered at high water: the width of the island is one-fourth of a mile. The coral reef connected with this island is 2 miles in length, by half a mile wide; it is only bare in places at low water, and unless there is a heavy swell the sea does not break on all parts of it: its sides trend east-by-north and west-by-south.

The Island of Mukulau is smaller, not more than half a mile in circumference; it lies south of Nukulau, and has a reef extending from it to the eastward. The Northern, or Kania Entrance, is somewhat obstructed by coral patches, off the east side of Nukulau sandspit, and ought not to be used without a good lookout being kept from aloft, and if used it should be in the morning hours, or before the sun gets to the west: three coral patches lie in it, on which there is but 6 and 8 feet water, but around them it is deep. Vessels ought not to anchor in the Kania Entrance, unless in case of absolute necessity: the bottom is uneven, and the liability to lose an anchor great. The course for sailing into the Roads when off Kania Point, is to steer for 'Ndraketi Point, until clear of the Nukulau Island Reef, then stand on to the west until that island bears southeast. Anchor on a line about half-way between the island and 'Ndraketi Point.

The Middle Entrance is between the extensive reefs which surround these small islands. The islands are situated on the western side of the reef, and the dangers lie to the eastward of them. This entrance is a mile and a half in length. At its eastern termination are also some outlying coral patches, which are not visible until close upon them. To pass through, the course is west: it is better to keep in the middle; the reef will be visible on both sides. It is one-fourth of a mile wide, and joins the South Entrance, which leads north to the anchorage.

The best entrance to Rewa Roads is that from the south: it may be used at all times. It is bounded by the islands of Mukulau and Nukulau on the east, and the broad sea-reef on the west. The channel is a mile in length, and at its narrowest part 400 yards in width. When off it, 'Ndraketi Point can be seen clear of the islands, and nearly on a line with them: it bears north-by-west; this is the course to steer; it will lead directly through it, and towards the anchorage. 'Ndraketi Point is low, and forms the western point of the Wailevu or Peale's River; although low land, the trees on it make it quite con-

spicuous. When inside the Island of Nukulau, a vessel may anchor in any berth, in from 7 to 15 fathoms water, muddy bottom, and good holding-ground; but the best anchorage is that already given. Three miles west of the south entrance into Rewa Roads, there is another break through the sea-reef. This is 300 yards wide; a small grass or sand islet on the reef points it out; it is, therefore, a good sailing mark; but this entrance is only to be used to depart from, as the wind would be ahead, and a vessel have a long beat among the coral patches within the reef to reach the anchorage after passing through, which could be made quicker and with more safety outside. Besides these there are several boat-passages, and at high water a boat may pass over the reef without difficulty, if there is no swell.

The mouth of the Wailevu River is visible from the anchorage. The deposit of sand is very great, and shifts frequently: a large quantity of water flows out of it. The town of Rewa is situated 6 miles up the river, from the anchorage; it is a narrow stream, has a very tortuous course, and is difficult even for a boat to navigate, on account of the many sandbanks and bars that are in it; vessels drawing more than 10 feet cannot enter. The water of the river is fresh, and may be obtained in abundance: that which is found in a pool on the Island of Nukulau, is bad and unwholesome. Supplies can be procured at Rewa, but the same difficulties are liable to occur here as at Ambau,—the kings and chiefs desire to make the most of the visit, by compelling presents to be made to them. Rewa is a large town, containing over 500 houses; it is built on the right bank of the river. Its lanes, or streets, are very narrow; on both sides they are fenced in with tall bamboo reeds. The low situation of the town causes it to be a perfect mud-hole, and it seems scarcely possible to believe that human beings could long survive living in such filth.

Rewa is the rival to Ambau; the king holds the second rank in political power. The people of Rewa are much more liberal and kind to strangers than those of Ambau.

Rewa is the residence also of the Wesleyan missionaries; they do all in their power to assist visitors. As yet they have made but few converts, though they are much esteemed by the natives. The population of this part of the island, together with the independent tribes on the river, amounts to 5000. The River Wailevu was ascended by the boats of the Expedition up to Budd's Point, which place is the limit of navigation.

To the west of Rewa Roads, 4 miles distant, lies Suva Point: it is low, and projects beyond the general line of the coast. On the west side is Suva Bay; at the head of the bay there is a small stream, which falls into it, and where water may be procured with facility.

At Suva Point the reef follows round the bay, and forms a convenient harbor for vessels; the anchorage is good, one of the best the island affords; the low shores are skirted with mangroves. The town of Suva lies on its east side, and Malloni on the west. Supplies can be obtained here in abundance and cheap. The natives are friendly, and some of them are termed Christians.

From Suva Bay to the town of Indimbi to the west, the coast is low, and bounded, for the distance of 13 miles, by a reef, trending nearly on a line with it. Indimbi is near the mouth of a considerable stream, supposed to be a branch of the Wailevu, or a river taking its rise near its source in the mountains. There is no good harbor at Indimbi. From thence to Nangara Point, the distance is 12 miles, the coast trending west-southwest; it is of the same low character, but the flat or low land is not so wide, the hills approaching the coast. Nangara Point, although formed by a high hill, has its extreme termination low. The coral reef continues to follow the shore as far as the point, and has no break. The channel between the reef of 'Mbenga and Viti Levu, from Indimbi to Storm Islet, situated on the former, is 7 miles in width, but gradually contracts up to Nangara Point, off which there are many detached patches of coral, which nearly unite the two reefs: the passage through from this cause is rendered somewhat intricate and unsafe.

The sea-reef of 'Mbenga is 17 miles in length, east and west, by 12 miles at its greatest breadth; it is irregular in its outline, particularly on its south side, where the reef is continuous. The north side of the reef, or that towards Vitu Levu, is very much broken. This reef encloses the Islands of 'Mbenga, Nemuka, Stuart's, and Bird. Storm Islet is situated on the northeast side of the reef.

'Mbenga Island is 5 miles in length, east and west, by 3 miles wide; it lies in the eastern bight of 'Mbenga Reef. It is high, rising up in two cone-shaped peaks to the altitude of 1289 feet, and is of volcanic formation. It contains two harbors, Sawau and Elliott: though not large, they are safe: the former has its entrance at the north and east end of the island, the latter at the west end. The land round Sawau rises in most places from 1 to 200 feet. The town is situated on a

high craggy peak at the head of the harbor, 500 feet higher than the land by which it is surrounded.

To enter it, pass through the reef near Storm Islet, which is a good guide for the passage: due south of this is the entrance to Sawau. The distance asunder of Point Leavett and Dobbs, is not over one-fourth of a mile. This harbor enlarges after passing these points, and extends to half a mile in width, and a mile in length; the soundings decrease from 12 to 4 fathoms. At the head of the bay there is a wide shore-reef, with three small islets situated on it; through a break there is a passage for boats to the shore. The coral reef elsewhere is narrow. Around the harbor water and wood may be obtained in plenty, and the usual supplies that are to be found in this group. Anchorage is in 4½ to 11 fathoms.

Elliott's Harbor lies on the west side of 'Mbenga; it is three-fourths of a mile wide at its entrance, and enlarges till it becomes nearly a circle, one mile in diameter. Immediately off the harbor there is a coral patch, which is directly in the way of vessels seeking the harbor: either side of it may be taken; to the west, one and a half miles distant, there are also several small ones, which must be avoided. The anchorage is in deeper water than Sawau,—from 13 to 20 fathoms. On the left of the harbor stands the village of Y'some, with a white sandy beach in front of it, off which there is a large coral patch, and between it and the beach a small vessel may anchor. Supplies may also be had here.

Stuart's Island lies off the southwest point of 'Mbenga, a mile distant; it is one and a half miles in circumference, and high; has a reef around it, and two small patches on its northwest side. The channel between it and 'Mbenga is clear.

Namuka lies to the westward of 'Mbenga, 7 miles, and is at the western bight of the reef: it is 1¾ miles long, north and south, by one wide. Anchorage may be found near Namuka, but there is no harbor; it has a very narrow coral shore-reef. Namuka is of considerable height, and of volcanic formation; it contains about 100 inhabitants, who are very friendly, and disposed to trade their provisions, &c. Bird Island is a small, low island, two miles north of Namuka: it has a reef around it; the island and reef being 1¾ miles in circumference: it is covered with foliage.

The Madono Reef is the largest outlying reef: it is situated 2 miles to the westward of the west side of the 'Mbenga Reef, and is 3 miles in length, by half a mile wide, trending northwest and southeast. Dye's

Sand Island and Shoals lie directly in the fair way, and with the Whippy Harbor and Madono Reefs, form serious obstructions to the navigation of the channel between the 'Mbenga and Vitu Levu Reefs.

The western side of the 'Mbenga Reef has two passages through it. Near the southern one is a large black rock, which is quite conspicuous at low water; this sea-reef is well-defined, and may be closely approached.

Three miles west of Nangara Point, the reef from the Vitu Levu shore takes a sharp turn to the south, and extends 5 miles; thence it makes again for the shore in a bend towards the west: it encloses a large area free from coral, and forms Whippy Harbor: this area is 1½ miles, on an average, in width. Its southern end terminates in a point, towards the east. There are several boat-passages through it, on its eastern side, but no ship-passage. The Whippy Harbor Reef is one of the most remarkable conformations of coral in these islands, extremely fantastic in its shape and trending; in many places there is good anchorage within it, in from 5 to 20 fathoms water. On the western side, two and a half miles from the shore, there is a ship-passage 200 yards wide, and through this a vessel may pass with safety, and seek the inner harbor. This is a small bay, completely sheltered from the sea and wind. Twin Island, situated off its western point, forms a good landmark: after passing through the entrance in the reef steer for it on the north course, 2½ miles. This inner harbor is doubly protected by the outer and inner reefs, and has good holding-ground, muddy bottom, with a depth of water from 5 to 7 fathoms. Wood and water may be obtained in plenty. Boats can cross the bar of the river at high tide. The town lies a mile up the river or creek.

The next harbor to Whippy is that of Granby; it is 4½ miles to the west, but not so well protected as that of Whippy; it lies open to the southern swell; is a mile deep, and 1½ mile wide. It can only be used as a temporary anchorage: the passage in, is one-third of a mile wide, due north. The best berth is with Beacon Islet bearing east-northeast one-third of a mile distant, and Point Dunlop south-southeast three-fourths of a mile, in 9 fathoms, black sand and mud. The shore-reef of Granby Harbor joins that of Whippy.

Eight miles west of Granby Harbor is Red Bluff. The land here rises to the height of 2500 feet, and continues of nearly the same altitude until reaching the harbor of 'Ndronga. 'Ndronga is 28 miles

west of Granby Harbor, and the shore-reef continues unbroken, and offers no kind of protection in all this distance. A shore-reef surrounds the bay; it is narrow; on it the surf beats violently. 'Ndronga affords temporary anchorage; it is not a safe port; the swell rolls in heavily, and a vessel is very much exposed. The anchorage is in 8½ fathoms, sandy bottom. To the northwest of 'Ndronga is Peck's Peak, which is the landmark for the harbor.

After leaving 'Ndronga the land changes its character, becoming sandy, and much less in altitude. Six miles west of 'Ndronga is Leku Island; here there is a fine harbor for small vessels; the entrance is narrow; a northeast course leads in. The only wind to which it is exposed is that from the southwest, which seldom blows. Leku Island is easily recognized from the groves of cocoanut palms; huts were seen on it, but it is believed to be only a temporary abode of the natives: wood and water may be procured there. From Leku, the coast of Viti Levu trends to the northward and westward, the low land gradually extending in width as the hills retreat from the shore-line; the hills are destitute of wood, but the lowland is covered by extensive groves of cocoanut palms. The distance to Navula Point, the extreme western point of Viti Levu, is seven miles; the shore-reef extends to the distance of a mile to a mile and a half from the shore. There is no opening in the reef until the Navula Passage, which lies 4½ miles to the westward of Navula Point. This passage is a good one for small vessels to enter, though the course through takes a sharp elbow turn. As the wind which generally prevails under the lee of Viti Levu is from the westward, a vessel in coming out is obliged to make several tacks. After passing the reef and entering Navula Bay, a vessel may anchor in any part of it, in from 12 to 15 fathoms water, muddy bottom. The direction of the Navula Passage is northeast-by-east; it is half a mile wide, and a mile in length, the soundings in it 13 fathoms. The flood sets into the passage, and the ebb out, both strong, the latter 2½ to 3 knots; the low tide generally leaves the reefs bare, when the outline of the passage is visible. This passage may be used by a ship to pass in, but I would rather prefer recommending that of Malolo, 3 miles to the west, both to enter and depart from.

After clearing the reefs on the west side of Viti Levu, and being desirous of proceeding to the northward, the best course to pursue is to hug the Viti Levu shore. The winds in this part of the group

are generally light and variable, sometimes from the southwest, until reaching Vunda Point, where they prevail from the northeast. Navula Bay is three miles across from Navula Point on the south, to Vavula Point on the north, and is two miles in width; the coral reef extends around it, and the shore is lined with mangrove bushes, and extensive groves of cocoanut palms. There are two villages within this bay, and supplies may be obtained. The next bay to Navula is that of Vitiraurau, which is 10 miles in extent, from Vavula Point to Talatala Point; its greatest depth does not exceed 4 miles. In the centre of the bight lies Mangrove Island, within the shore-reef. The smaller bights within it are mostly filled with coral reef. The land immediately around is quite low, and the shore which surrounds it is entirely covered by extensive mangrove bushes. There is sufficient room for vessels of any size to beat about. Good anchorage is found in any part of the bay, in from 12 to 20 fathoms water, with muddy bottom. The western side of this bay is bounded by the Island of Malolo, and its reefs, and those of Underwood's Group; the latter are all low, sandy islands, from a mile to a mile and a half in circumference, covered with vegetation, and surrounded by coral reefs. North of Talatala Point lies Watmough Island; it forms the southwest point of Matau Bay. Kanusi Point bounds it on the northeast. The distance between these points is 6 miles. An extensive coral reef, 3 miles in length, lies across this bay, which affords good protection to the anchorage between it and the shore, a mile and a half wide. The channel between the reef and Kanusi Point is wide, and free from dangers; that between Watmough Island and the reef is partly blocked up by a sand islet, but the passage between them, though narrow, is safe. The Underwood Group lies off to the west, 6 miles, and protects the bay on the outside from any heavy seas. The reefs that encompass these islands trend towards Vunda Point, and make the passage between it and Vandeford's Island very narrow. By Vunda Point is the only safe ship-passage when proceeding northward and eastward along this coast. The sea between the island of Viti Levu and Vomo, a distance of 12 miles, is filled up by a succession of reefs and patches of coral (called the Kasoa Reefs), that makes it next to impossible to navigate it with any degree of safety even for the smallest class of vessels. Many of these patches are visible, extending in long lines, while others are scattered about at different depths below the surface. After passing Vunda Point, the route is

direct for Votia Island, which lies off Vitonga Point, the next conspicuous headland to the northeast, a distance of 10 miles; this is entirely protected by the line of the Kasoa Reefs. Three miles from Vunda Point is Sand Island, and Sam Island lies three miles beyond it. The western side of these islands is to be preferred, anchoring wherever it is deemed necessary. The bottom is good holding-ground, and the water not deep, and will at all times be found smooth. If wishing to enter into Vitonga Bay, either side of Votia Island may be taken, as may appear desirable. On reaching Vitonga Point, a vessel may pass into the Sea of Viti, and be well to windward of the Kasoa Reefs, which lie to the westward, but it is more advisable for a ship to keep within the reefs and near the land, until arriving at one of the passages more to windward. Off Vitonga Point, the shore-reef extends to some distance, but leaves a clear passage between it and Votia Island, though a very narrow one, into Vitonga Bay, the least water being 5 fathoms. Vitonga Bay lies between Vitonga Point and Tabooa Point; it is 9 miles in length. This bay is protected on the north by an extensive coral reef, which lies parallel with the shore for 4 miles, and is about half a mile wide; it is exposed to the sea by the opening between the reef and Votia Island Reef, which is 2½ miles wide; the anchorage, however, is good under the reefs. Vitonga Point and Tabooa Point are both formed by sharp spurs from the mountains, but the land between is low and cultivated; mangrove bushes growing along on the shore-reef.

Off Tabooa Point 2 miles, lies Tabooa Island, situated on the southern end of an extensive reef, which projects to the northeast, and with others forms a line of sea-reefs, enclosing what I have named Ba and Egleston's Bays, which extend to the northeast 15 miles, to the Leonidas Passage, near the Dongaloa Islets.

After passing Tabooa Point the hills take a sweep inland, making a bend as far as Batia Point, a distance of 22 miles. This portion of the island is densely wooded, its shores being also overgrown by mangrove bushes. The trend of the coast continues northeast to Ba Point, after which the shore inclines more to the eastward. The distance between the sea-reef and the shore, beyond Tabooa Point, increases to the width of from 2 to 3 miles, until arriving at Dongaloa Islets, which is within 4 miles of Batia Point, where the channel again becomes contracted to less than half a mile. The Ba Passage is a

break in the reef about the middle of Ba Bay; it is 2 miles long, and one wide, and leads into the Sea of Viti.

Numerous streams of fresh water enter into these bays, and anchorage is to be found in almost any part, in from 5 to 15 fathoms water, muddy bottom. There are a few coral shoals in the former, but they are easily avoided. It is confidently believed that no other dangers exist. It is well, however, for vessels to be on the lookout. The Leonidas Passage lies abreast of the Dongaloa Islets, and at the eastern terminus of Egleston's Bay; it is a mile wide, and is the best pass through the reefs into the Sea of Viti. To proceed further to windward or to the eastward, within the reefs, is exceedingly laborious, and causes much delay,—the wind being for the most part of the time dead ahead, and some of the passages between the reefs are too narrow for a ship to beat through. Many of the sea-reefs are covered with sand, and show at low water as extensive sandbanks. On the northern shore of Viti Levu, the fishery of the biche de mer is extensively carried on. The sea-reefs are of great extent and well supplied with this animal. Wood and water may be procured along this coast in many places, particularly in Ba and Egleston Bays.

There are many towns along the coast of Ba. From the water they are concealed from view by the thick growth of mangroves which stud the shore. Thick forests cover the extensive plain between the two points. Ba Point separates Ba from Egleston Bay.

From Dongaloa Islets to Batia Point, is a distance of 4½ miles. Batia Point is a sharp point, projecting to the northeast, and forming one of the boundaries of Batia Bay, which lies directly to the eastward of it. The point is high and rocky, with Batia Islet adjoining, forming a part of it. The sea-reef approaches within half a mile of Batia Islet. The passage is narrow, but is free from obstructions.

Directly north of Batia, there is a small sand islet on the sea-reef, which is visible at low water; it points out the channel leading into Batia Bay from the sea. At the head of Batia Bay is the large town of Batia, and near it is Tokotusi Peak. The country around is extremely fruitful, and supplies may be had in quantities. The chiefs require permission from Ambau to furnish them.

Batia Bay is 3 miles in depth, by 2 miles across its mouth. On the east it has a projecting reef, 2½ miles to the northward, towards the Sakau Passage, and approaches to within one-third of a mile of the sea-reef dividing Batia from Sakau Bay. Sakau Bay is 8 miles

in length, and the distance between the shore and sea-reef is 3 miles. On its eastern side it is much blocked up with shoals and patches, particularly off the town of Taboua.

Raki-raki Island and shoals, which are situated to the east of Anufe Point, nearly close the passage between that point and the Loa Reef, which lies off the coast; it is difficult to get through unless with a favorable tide, as a vessel will meet a contrary wind, which prevails all the way up to the Annan Islands and through Malaki Bay. Opposite Anufe Point is the Raki-raki Passage, leading north-northwest between the coral reefs; it is about two miles in length, and one mile wide. A vessel may pass through without difficulty, either way, with the prevailing wind. It is a good passage to enter the Sea of Viti, and sufficiently to windward for a vessel to sail directly for Vanua Levu, and to reach 'Mbua Bay by daylight.

Anufe Point is low and well wooded. There is no shore-reef on the east side of the point, but it extends some distance from it, and includes Ika Isle. To the west there are large patches of coral, which make the passage intricate, especially when beating up. Easterly winds will be found to prevail here almost constantly when the weather is fine.

Four and a half miles distant from Raki-raki Island is Tuki Islet, which is a mile in diameter; it lies half way between the sea-shore and reef. The reef which surrounds it nearly joins the shore-reef on the south. A mile beyond is Tub Islet; the Malaki Passage through the sea-reefs bears northeast from it. This passage is three and a half miles long, and from three-quarters to half a mile wide; its narrowest point being at its outer entrance. When Tub Islet is brought to bear southwest, the passage will be open, and by steering for it, the course will lead through clear of the reefs on either side. It is a good passage, but too narrow to beat out of, and ought not to be attempted when the wind is scant.

The Island of Malaki is high; it is situated in the bay of the same name, which extends from Tub Islet to Monersah Point. It is of triangular form; its sides are two miles in length. It was formerly well inhabited, but has been entirely laid waste by the Ambau people, who killed the men, while the women were taken into captivity. It still bears the appearance of having undergone devastation. This bay affords good anchorage; it is well protected from the swell by the sea-reef, which is 1½ miles in width. On the north, near to

Malaki Island, is the Malaki Passage. When bound for the island of Vanua Levu, the Sea of Viti can be entered through it. With the ordinary winds a vessel can sail direct for 'Mbua or Sandalwood Bay, a distance of only 30 miles; with daylight, many of its dangers may be seen and avoided. I cannot too strongly urge the necessity of navigators visiting this group, to avoid passing the night under way in any of the seas and channels, if it can by any possibility be prevented, as it will greatly endanger the safety of a vessel. Although I have great confidence in our charts, yet I feel the necessity of recommending every precaution in case the navigator, on his entrance into the group, might be disposed to trust too much to them. When he has been a short time within the influence of the reefs and channels, these precautions will be unnecessary, as he will have found himself in situations that must arouse his attention and insure watchfulness afterwards.

Monersah Point lies 2 miles to the east of Malaki Island; it is the most northern point of Viti Levu, and is the eastern point of Malaki Bay. The point is high; the land rises immediately behind it into lofty spurs, which come from the central range of the island. Three miles to the eastward of Monersah Point are the Annan Islands, three in number: these are of volcanic formation, and project some three miles beyond the mainland to the northward; the sea-reef again projects beyond them. The larger Annan is 610 feet in height. They trend north-northwest and south-southeast, are 4 miles in length, and three-fourths of a mile in width; they are connected by coral reefs, and communication can be kept up without difficulty between them. To the east of the Annan Islands are several patches and sunken shoals; they require care to pass among them.

Between the southern end of the Annan Islands and Viti Levu is the Kume Channel; it is only one-third of a mile wide, and may be used by a large vessel. It leads into Novelou Bay, distant 2½ miles, where there is good anchorage. This bay is small and somewhat circumscribed; to reach it from the west many shoals have to be passed. With a head wind it ought not to be attempted. From the east there is no difficulty. By steering for the south point of the Annan Islands it will lead clear of these shoals, which lie nearly parallel to the coast. The town of Novelou lies at the head of the bay, where supplies may be obtained. From Novelou Point the shore of Viti Levu trends south-southeast, 4 miles, and from thence south-southwest, forming the

western side of the Bay of Viti Levu, which is 4 miles deep, by 2 wide. At the head of this bay a large stream empties, after the long circuitous course of 40 miles from the interior, taking its rise in a lake, as reported by the natives. The coast between Novelou Point, across the mouth of Viti Levu Bay as far as the Island of Navumbalavu, a distance of 30 miles, is destitute of a sea-reef; in place of it there are a number of scattering coral patches along the shore-line, and many broken reefs lying due east of Viti Levu Bay, and between the small island of Vitimira and the shore, called the Katakatana Shoals.

Vitimira is a rocky islet covered with some vegetation, and has an elevation of 560 feet above the sea. It lies west-southwest 6 miles from the west end of the great Mamoa Reef, which extends from Ovalu or Passage Island. The Katakatana Shoals are connected with this island by a reef 2 miles in length, stretching off to the south-southwest; they are broken up in places into small, sunken patches, but generally lie in the line with the reefs; their whole length is 10 miles, in an east-southeast and west-northwest direction.

Between Vitimira and the Mamoa Reef the passage is clear; it is the best channel leading into the Sea of Viti through the Straits of Ovolau. To the north of Vitimira there are two small reefs, lying in a line with each other; their whole length is 2 miles.

Illalu Point lies 2 miles to the southeast of Ceva Point, the southeast point of Viti Levu Bay. The coast beyond Illalu Point trends to the southeast as far as Batatho Point, off which lie the Navumbalavu Islets. Three miles to the southward of Illalu Point is Nukatimba Bay; it makes but a small indentation in the coast, but it affords protection if a vessel is anchored well towards the head of it. The Katakatana Shoals also serve, in part, to protect the anchorage from the sea, but it cannot be called safe in the stormy season. The next bay is Vela, 3 miles further to the southeast; it is divided from Nukatimba by Round Island. To the southward and eastward, the coast forming it trends due south 2 miles, thence east to Linea Point, but this bay is contracted and exposed, and affords only a temporary anchorage. Linea Point is also the northwestern boundary of Inarmara Bay. It is somewhat larger than the former, and more protected by coral reefs, particularly off Toki Point on the southeast. The sea-reef approaches very near to the shore-reef off this point, but there is a narrow passage between, which may be made use of in passing along the coast to the northwest. At the head of Inarmara Bay there is a fine stream of water, near to which is the town, surrounded by

groves of cocoanut palms. The shores of the bay are lined with narrow coral reefs. The anchorage is in 12 to 15 fathoms water, coral mud, and good holding-ground.

Five and a half miles to the southeast is Toba Point. Situated a short distance inland is Toba Peak, one of the most remarkable peaks in the group, and which was extensively made use of in our surveying operations. It is very conspicuous from all the peaks, islands, and reefs which lie between the two large islands of the group, and a conspicuous mark to procure bearings while navigating through the coral reefs of this group. Its latitude by the triangulation is 17° 33′ 30″ south, and longitude 178° 17′ east.

Off this part of the coast there are many coral patches which require some care to avoid; they generally lie parallel with the shore, are of little width, and from a quarter of a mile to a mile in length.

The next point to Toba is Tua, 4 miles distant; the coast has nearly the same trend to the southward and eastward. The flourishing towns of Doasan and Matagora are situated on either side of this point, where supplies may be readily obtained. Along this coast the ebb tide sets to the southeast, while the flood runs in the opposite direction as far as the Annan Islands.

Batatho Point is 3½ miles beyond Tua; off it lie the Navumbalavu Islets, which are surrounded by extensive coral reefs. These islets are situated to the east of the point, and with the reef afford protection both from the prevailing winds and sea; vessels can anchor in 7 fathoms water under them. The reef which surrounds the islets and that which makes out from Batatho Point approach near to each other, but leave a narrow passage along the coast. On the point is the town of Batatho.

From Batatho Point the trend of the coast changes to south-by-east as far as Verrata Point, and the coral reefs become irregular in outline and extend from the shore; they increase in width in some places to the distance of 3 miles; their indentations are deep, but they do not form any harbors.

The small island of Nukulevu lies 3 miles south-southeast of Navumbalavu. It is surrounded by a reef: there is a good passage between it and the shore-reef for vessels. The coast of Viti Levu makes a considerable bend between Batatho and Verrata Points, but the coral reef cuts it entirely off, and the shore is unapproachable. The two islets of Omene and Taunava are on this reef, on which there are

towns of the same name, the natives occupying them as places of safety. The land of Viti Levu is low for some distance from the shore, exceedingly fertile, and well cultivated: from it the inhabitants of these towns procure their subsistence.

NAINGANI.

The Island of Naingani is small but high, one mile in length and three-fourths of a mile wide, with an irregular coast-line; from the southeast side a coral reef projects to the southeast 2 miles, at which distance it comes to a well-rounded point. This coral reef skirts the shore on the east side; on it are two small islets. The north and west sides are destitute of coral. The height of the island is 420 feet; it rises in two regular peaks; is inhabited by a few natives, who are subject to the king of Ambau, and frequently interrupted in their occupations and despoiled of all by the rapacious chiefs under his orders. Naingani lies but 2 miles north of the Mana Shoals, before described; between its reef and the shoals there is a passage a mile wide, but I would advise vessels to pass around to the north of Naingani, where the sea is quite clear. Naingani is northwest of Ovolau 6 miles, and the same distance to the east-northeast of the Island of Navumbalavu or the northeastern point of Viti Levu. In leaving Ovolau by its north channel, the course would be, when the Island of Naingani opens, to steer for it, and after passing the Lada Reef Shoals, then to keep it open on the port bow, which will lead to the Island of Vitimira, and thus into the Sea of Viti. The tides flow on this course, and will afford assistance or retard the progress as they may claim the attention of the navigator.

WAKAIA.

Wakaia lies to the northwest of Ambatiki 11 miles, and 10 miles east of Ovolau, forming the eastern side of the Straits of Ovolau. Wakaia is high and volcanic, 4 miles long, by 1½ wide; it has several peaks, and precipices formed by escarpments of their sides; its whole outline is picturesque. Its north end is the widest; tapering to a point at the south; the sea-reef on the west side becomes a shore-reef the whole length of the island.

Although it is capable of being well cultivated, it has but few inhabitants, who are subject to the chief of Levuka on Ovolau. There is little to tempt a vessel to anchor at it; all its productions are brought to Ovolau for sale.

The Wakaia Reef extends in the direction of Ambatiki, 5 miles, leaving a clear passage of 6 miles between it and the latter island. The position of this reef is at all times visible as the sea breaks upon it; in places it is bare at low water. The reef which encompasses the Island of Wakaia, is 9 miles in length by 5 miles wide, and is continuous, except at its northwest end; on the northeast, it is much broken, lying in patches, through which there are many passages leading to the north end of the island, where there is good anchorage, in Flying-Fish Harbor, for small vessels.

Four miles north of Wakaia the two sides of the reef form a junction, and continue united for a short distance, when they again separate and form another extensive lagoon, in which is situated the Islands of Mokungai and Mokundranga.

MOKUNGAI AND MOKUNDRANGA.

Mokungai lies to the eastward of Mokundranga. It is much the largest of the two islands, and situated on the eastern side of the lagoon. This island is 3 miles long, north and south, by 1½ wide; it is volcanic and hilly, and very much broken at its northern end. On the northwest side lies Mokundranga, of slight elevation, 1¼ miles in length, by a quarter of a mile wide. Between the two is a harbor, protected by the reefs on the north as well as those on the northwest. This harbor is accessible from north, east, and west. On the south the Mokungai Reef is 6 miles in length from its junction with the Wakaia Reef to its extreme northern extremity. Its eastern side from the junction tends directly to the island, where it becomes broken, and in places assumes the character of a shore-reef, but there is a narrow passage between the shore and the reef. On the northwest side the reef is broken, but is still distinctly marked, and lies nearly at right angles with the western side of the reef; these patches extend 3 miles, and form the northern side of the lagoon, and the eastern side of the Mokungai Passage, leading from the Straits of Ovolau into the Sea of Goro. Just off the point of the reef and at the entrance of this passage there is a large coral patch, which may be

passed on either side, but it is better to keep to the westward of it with plenty of sea-room. The Mokungai Passage is 2½ miles wide; the west side is formed by the acute angle of the Ovalu or Passage Island Reef, with that of the great Nemena Reef. The former reef runs to the west-northwest, towards the Island of Ovalu, which is 7 miles distant, while that of the Nemena makes a bold sweep to the northward and westward and then to the eastward towards that island: these reefs are both visible for a long distance. The course through Mokungai Passage is northeast-by-north; the tides set through it north and south.

OVALU OR PASSAGE ISLAND AND REEFS.

Ovalu is a small rocky island, situated within the acute angle formed by the Passage Island and Nemena Reefs: it is half a mile long, and has but a few trees and bushes on it. Under its lee or western side there is anchorage for a small vessel; several breaks through the reef at or near the island afford passages for vessels, and if desirable a vessel may pass through them, and to leeward of the bend of the Nemena Reef, which divides the Sea of Viti from that of Goro, pursuing a direct course (north) for Buia Point. It requires care to avoid the sunken patches, that make off from the Vanua Levu shore to the distance of 9 or 10 miles. The clear space between these patches and the main reef is about 4 miles wide; the former are visible from the masthead, and with a good lookout may be easily avoided. The advantage of this route over that to windward or eastward of the Nemena Reef, when bound for the Island of Vanua Levu, is that a vessel is not dependent upon the tide to pass through the Mokungai and Buia Passages, which at times runs with great velocity. If a vessel should not have sufficient wind to command her movements, she would be very much at the mercy of the tide, and cause her some danger by carrying her very near the reefs. The Nemena Reef makes a circuit of 40 miles, and then encircles that island in the form of a loop, joining the main reef again, 6 miles from its eastern termination.

NEMENA ISLAND.

The Island of Nemena is 310 feet in height, and is well wooded. Its length is one mile, by one-third of a mile wide. It has anchorage

under its northwest or lee side in 13 fathoms water, sandy bottom. There are no inhabitants, but the natives resort to it in the turtle season,—April and May. There are some small springs where water may be obtained : a larger supply may be had by digging wells.

On the south side of the reef there are two narrow openings, through which a ship may pass with safety, one the Nighthawk Passage, 150 feet wide : this was entered by the Vincennes. To the west the reef is so much broken up that it is but a continuation of sunken patches. On the north side there are two openings bearing due north from the west end of the island. It is necessary for a vessel to have a commanding breeze when attempting any of these passages: at such times they are easily and quickly passed, but with the wind light there is much cause for uneasiness, and great anxiety and danger may be incurred. The eastern side or bight of the reef for 7 miles has no breaks in it; it is very well marked by the sea constantly breaking on it.

The Buia Passage has been most frequently used in passing through the Nemena Reef; it is 1½ miles wide. The directions for passing it are to bring the high point of Nemena Island to bear east per compass, and steer for Buia Point. The reef of Nemena at the surface is 50 to 100 yards wide, throughout its whole length.

VANUA LEVU ISLAND.

This island trends east-northeast and west-southwest, and its length between its extreme points is 100 miles, its mean width 25 miles. It has very many fine bays and harbors, formed by its coral-reefs, affording good protection for vessels: and supplies can be obtained at the island in abundance. It is of volcanic formation, and many of its peaks shoot up in needle-shape points to the height of 3200 feet. It is extremely fertile along the coast, well peopled, but they are savage in their dispositions, and require every precaution to be taken to insure safety to parties on shore.

Buia Point is a high bluff point readily recognized, and is the southern point of the large island of Vanua Levu. It is the termination of a spur from the main ridge which traverses the island; beyond it a large bay sweeps to the northward and westward as far as Lecumba Point. This is surrounded by low land, which continues beyond Lecumba Point and around Sandalwood or 'Mbua

Bay, a distance of 15 miles. Off Buia Point there are one or two sunken shoals, and the shore-reef extends to Cocoanut Point,—a low point 3 miles distant, covered with a fine grove of cocoanut palms, whence its name. Off it the channel is contracted and somewhat intricate, caused by sunken patches of coral, approaching almost near enough to form a junction with the island. There are two psssages; the one nearest the point is to be preferred, although it is much less in width than the outer one, but the reef admits of its being easily followed. From Cocoanut Point, a northwest-by-west course will lead directly to Lecumba Point, which is low. Corobatoo Peak should be kept open on the starboard bow. The distance to 'Mbua Bay is 10 miles: the channel in places is not over a mile wide, particularly as you approach the western terminus to pass into 'Mbua Bay. The soundings in it vary from 10 to 20 fathoms, muddy bottom; the patches of reef on the outer side of this passage are numerous, but they are not in the way, unless a course is shaped more to the south than that recommended; if deviated from, the sight of coral rocks under the bottom will soon be evident, if they do not bring the vessel up. After leaving Cocoanut Point, and having passed the first group of patches, care must be taken that the reef bounding the north side of the channel is not mistaken for the outer one; this may happen by inattention in passing the small island of Rabi-rabi. Should it occur, the first opening that is met with should be taken to get into the main channel again, leading to Lecumba Point. It may appear quite unnecessary to give this caution, but that it is likely to happen, I can speak from experience.

'Mbua Bay is 3½ miles deep, by 3 miles wide: it is bounded on the east by Lecumba Point, and on the west by that of Dimba-dimba. The east and north sides are low, and studded with mangrove bushes, which grow on an extensive shore-reef. There are three rivulets which enter into the bay; they are not of any length, are shallow, and will scarcely admit a boat, except at high water. The water is good when taken from a distance above the rise of the tide. On the west side of the bay the land rises into the Peak of Corobatoo, 850 feet in height. This peak may be seen from the southern islands distinctly in fine weather, and affords a good landmark for bearings, and by which to shape a course.

'Mbua Bay has several extensive coral patches in it, on the largest of which there is a small sand-bank. Notwithstanding these reefs

occupy a large space, still there is room for a fleet to anchor. The holding-ground is very good, and the depth does not exceed 12 fathoms. The best and most covenient anchorage is near Lecumba Point; there a vessel is better protected by the vicinity of the reefs, at the same time with the prevailing winds being under the lee of the land, and in no way exposed to the sea from any quarter. The sea-reef extends quite across the bay, leaving the channel leading to the eastward, of which I have spoken above, and that to the westward, round Dimba-dimba Point, clear between it and those formed in the bay. This sea-reef is of great extent, being 6 miles long, northwest-by-west, and 3 miles wide; at high water it is covered sufficiently to admit a boat to pass over it, but at extreme low water the irregularities of its surface are seen. Off its extreme western limits there are many detached patches, that obstruct the passage leading to the westward towards the Island of Y'Endua. Around 'Mbua Bay there are many towns. These are situated on high and inaccessible hills, for the safety of their inhabitants, in consequence of the continual wars which the different chiefs are waging one with another; this state of things renders it difficult to procure any supplies here. 'Mbua Bay was formerly principally resorted to for sandalwood, but this has been long since exhausted: and vessels have ceased to seek this harbor. The reefs, however, were well supplied with the biche de mer, but from the extent of this fishery of late years, these animals are becoming also scarce on the reefs. 'Mbua is a good and safe stopping-place for vessels, and if the chiefs would settle their domestic feuds, there is no part of the group where supplies could be obtained more easily and in greater abundance.

In passing out of 'Mbua Bay, on the eastern side, into the Sea of Viti, it is necessary to hug Lecumba Point and beat to windward of the great reef: to the west, it is much studded with patches, both above and below water, but the wind being fair they may be easily avoided, and are soon passed. On reaching Dimba-dimba Point, the coast trends north-by-west for 4½ miles to Point Suke, and off this point the coral reefs extend to the distance of 3 miles from the shore, leaving a comparatively free route, and sufficiently wide for a vessel to beat in. The shore is bold and rocky, with but a narrow coral reef bounding it. To enter Ruke-ruke Bay, on arriving off Point Suke, and opening out Sleepy Point, you must steer for the latter, and pass within the coral reef, which runs directly across the mouth of Ruke-

ruke Bay. This is the route, whether intending to anchor in the bay, or to proceed further to the eastward.

Ruke-ruke Bay is a deep indentation in the coast, two miles wide. It is partly surrounded by high land, and has from 9 to 12 fathoms water, muddy bottom. The only direction necessary is to bring Wailea Rock (seen over the land) to bear east-by-north, true, when the anchor may be dropped in any part deemed convenient as to depth.

On the south side of Ruke-ruke Bay lies Nucumung Harbor. To pass within, you enter a narrow channel between the reefs off Point Southworth, bearing from Sleepy Point south-by-west; the points of this reef are half a mile from the shore, and the channel is 400 yards wide. In entering follow its lead, on a south course, and after having passed the bluffs the harbor will open. It is 1½ miles in length by half a mile wide. The shore is surrounded by a narrow coral reef, and a thick growth of mangrove bushes; the harbor is a very safe one, and surrounded by fruitful valleys. Corobatoo Peak lies to the south-southwest, on which is one of the fortified native towns. The anchorage is from 4 to 6 fathoms in depth, muddy bottom. This will be a very safe harbor for whalers to make repairs in, when the inhabitants can be trusted; the winds generally allow a vessel to sail in and out of the harbor without difficulty. The reef that stretches across Ruke-ruke Bay is 5 miles in length and half a mile wide; it reaches nearly abreast of 'Mbua Point, the entrance to the Monkey-Face Passage. Off 'Mbua Point there is an opportunity, if the outer side of the reef at Suke Point should have been taken, of gaining the inner passage. On coming up with 'Mbua Point the Island of Anganga opens. It is 3½ miles distant, is high and rocky, trending nearly east and west 5½ miles, and forms the northern side of the Monkey-Face Passage. A remarkable similarity of outline in the rocks of Ivaca Peak to that animal, has caused the name to be given to the passage between it and Anganga Island. From 'Mbua Point the coast trends east-by-north 3½ miles; it is high, and rising in places 470 feet perpendicular: the shore-reef extends off to a considerable distance. Near a small town, half-way through this passage, fresh water is to be had at a rivulet in abundance: groves of cocoanut palms are growing around. Ivaca Peak rises to the height of 1160 feet. In sailing through Monkey-Face Passage, it is advisable to be ready to shorten sail, for the wind not unfrequently comes down off the high

land in heavy squalls. The best direction is to keep the reef of the south shore close aboard, and as soon as the Island of Naloa bears east, if the wind will permit, steer directly for it; you will then pass in mid channel between the reefs, and avoid those that lay off the Anganga side, which extend nearly half-way across the passage. After passing Marquis Point, the coast again trends to the southeast 2 miles to Dillon's Rock, which forms the western point of Wailea Bay; its east point being formed by Leonidas Island. Between the Monkey-Face Passage and Wailea Bay the shore-reef, together with a small coral reef, extends to the east, 1½ miles, by one-third of a mile wide, and in order to reach Wailea Bay, it is necessary to make a circuit around them. There is a narrow passage on the west, but unless the wind is fair, it would not be advisable to attempt it with a vessel. Wailea Bay is of an oval shape; its shores are low and muddy, and thickly set with mangrove bushes; the water in the bay is not deeper than 6 fathoms, and a stream of fresh water empties at its head. Leonidas Island is three-fourths of a mile in circuit, and rocky. There are one or two towns around the bay, on Wailea and Dillon Bluffs: these appear to be well fortified, and are secure positions from native attack.

The coast from Leonidas Island to Veraki Point makes a considerable bend to the southward, forming Naloa Bay; the distance between them is 9½ miles. The shore is quite low for some distance back, and the mangroves prevail as elsewhere. A mud-flat extends to the distance of a mile in some places from the shore, and the usual shore-reef of coral is met with. In the Bay of Naloa there are five islands,—Naloa, Tavea, Vendrala, Anutunga, and Rock Islet. The first three are high and rocky, though covered with vegetation; the last two are low: all are surrounded with a coral reef, and are inhabited. Tavea has an extensive and populous town on it, and so has Naloa, but on the rest there are comparatively few natives. At Orana Point there is a small stream of fresh water, which empties into the bay. A boat may enter it at high water; it leads to the town of Votua, which lies about a mile from the shore, but the stream has a very serpentine course, making the distance nearly 4 miles. Supplies may be had here, and the natives are friendly. This part of the island has a very fruitful soil, but owing to the civil wars that are constantly carried on, little attention can be paid to cultivation or the raising of any kind of provisions. There is anchorage through-

out the bay, but the best berth is between the Islands of Vendrala, Naloa, and Tavea; the depth of water is from 8 to 10 fathoms, muddy bottom. There is a small coral patch between the three islands nearest to Vendrala; but it can be readily avoided in daylight.

To the north of the islands in Naloa Bay are several reefs, with islands on them, extending in a line to the eastward of Anganga, and forming the northern side of the channel, along the coast of Vanua Levu, viz.: Nakumbutha, Vatungili, Vatou, Loangi, Brackenridge, Nuvera, and Nambiti. Connected with these are reefs extending several miles from the islands to the northward, and from one to two miles in width. There are narrow passages between the reefs, but no anchorage, and little use can be made of them, as they lead only to the area which lies to the north, and bounded at the distance of 18 miles by the Great Sea-Reef. This space is very much obstructed with sunken coral patches, so as to make it extremely dangerous for any vessel to venture through it, unless favored by the weather, and keeping good lookouts aloft. In the Great Sea-Reef opposite to Anganga, there are two openings, which are shown on the chart. Nakumbutha and Vatungili, are both rocky and small; while Vatou, Nuvera, Nambiti, Loangi, and Brackenridge Islands are low, and covered with mangrove bushes. The first three are in length from 1½ to 4 miles, and not over half a mile wide; the two latter are quite small, not over one mile in length. Between Vatou and Vatungili, and Naloa and Vendrala, the space is 2 miles wide, but there are four coral reefs, which almost fill it up; near to Vatou there is a good anchorage in 11 to 15 fathoms water. The bottom is very tenacious, composed of mud and sand. A vessel desirous of taking this route may thread her way through the reefs, but it is not advisable to do so. Veraki Point is the eastern point of Naloa Bay, and its distance from Vatou is 2 miles.

The coast trends to the northeast-by-east, 5 miles to Nuthila Point, which is rocky and projects beyond the line of coast; here the low land terminates. The extensive mud-flat still continues to make out from the shore to the channel. There are many small streams which empty into the sea along the coast; basaltic columns are visible in the distance, and the land rises towards the centre of the island in several lofty peaks. Among the most remarkable of these are the Mitre and Two Sisters, which attain the elevation of 2300

feet. Off the west end of Nuvera and in a line with Nuthila Point there is a coral patch, which should deter vessels from passing too close to the north side of the channel. It lies three-fourths of a mile from Nuvera Island. On either side of it there is a passage, but the south side should be preferred.

Oandrou Islet lies in midchannel; it is half a mile in circumference, and has a coral reef surrounding it. It is a good mark for sailing up and down the channel, and by steering for it a vessel will keep in the deepest water. The soundings vary from 6 to 9 fathoms. In beating in this part of the channel, a vessel should not go nearer to the main shore than 4 fathoms.

From Nuthila Point to Winn's Point the distance is 4 miles northeast, between which the coast forms Murderer's Bay. It is useless for vessels, the mud-flat extending half way into the main channel. The town of Navendarra is situated at the bottom of this bay. Winn's Point is rocky and elevated. 2 miles northwest from it lies Cocoanut Islet, covered with cocoanut palms. This islet is 6 miles from Oandrou, and bears from it northeast. From Winn's Point to Ravu-ravu Island is 4 miles in a direct line northeast, but it is necessary to deviate from it to pass the shoal off Nuvera, before spoken of. The coast here again rises in hills from the shore: and instead of the mud-bank, a coral reef bounds the shore, which begins about a mile east of Winn's Point, and 3 miles from Vana Point. Off Vana Point coral patches again appear in the channel and confine it to narrow limits; these approach within half a mile of Ravu-ravu Point. The Yande Reef lies directly off Ravu-ravu Point: its outline has many indentations, and it is particularly irregular on the land side. The principal indentation is opposite Ravu-ravu Island. This makes it necessary to pass close to that island. When up with Ravu-ravu Island, that of Muthuata will be visible, bearing east-by-north, distant 7 miles, and also the small island of Nucumbati, due east 4½ miles.

Ravu-ravu Island is situated off the tongue of land of the same name; it is 1½ miles long and three-fourths wide. It rises into two conspicuous peaks, and forms the western side of Navutu Harbor. This harbor is quite small, much of its space being taken up by the coral reef. The water is shallow, from 3 to 6 fathoms. The anchorage is safe, and at the head of the harbor there is a small stream of fresh water. The town of Navutu lies on the east side, where the land is somewhat lower. The coast from Navutu trends

due east 3½ miles, to Nucumbati Bay, where it makes an indentation around the Island of Nucumbati. In the bay the water is from 4 to 5 fathoms deep. The distance from point to point is 2 miles, and the indentation three-fourths of a mile deep. On either side of Nucumbati the channel is good, though narrow. Two coral patches lie between the island and the head of the bay. Nucumbati Island is one-third of a mile long, north and south, by 400 yards wide; the north end of it forms a high knoll, while the south is low and covered with cocoanut palms. The town was formerly populous, but it was deserted when we visited the island. The Bouri is one of the largest in the group, which generally betokens the consequence or rank the place has held.

In sailing to the east from Ravu-ravu Point, steer directly for the western point of Nucumbati Bay; when within a mile of it, haul up for the point of the island, and after passing it, then direct for Muthuata Island; by keeping Muthuata open a little on the port bow, you will pass to the southward of all the coral patches, in from 9 to 10 fathoms water. The distance from Nucumbati to Muthuata Island is 2½ miles, and forms Muthuata Harbor. Anywhere within this space is good anchorage, but the most convenient berth is off the town of Muthuata, both for obtaining supplies and being more protected from the north winds by the Island of Muthuata. The Island of Muthuata is 1⅛ miles long, by half a mile wide, rising in two peaks to the altitude of 1005 feet. It has some fine timber growing on it, but very few inhabitants. It is one of the principal burying-places of the natives, and consequently is tabooed to them. Muthuata is one of the principal towns of Vanua Levu, and the residence of the king, Tui Muthuata. With him and his chiefs all arrangements are made for supplies, fishing for the biche de mer, and trading for tortoise-shell; and it is well to effect a good understanding with these chiefs by presents in the first instance, as it will prevent much trouble and difficulty afterwards. The channel between the island and the town is a mile wide; the depth of water varies from 6 to 9 fathoms. To the north are several extensive coral reefs, among them the Henrietta and Rotu Reefs. The first is 5½ miles long, by 1¼ wide; it trends nearly north and south.

The Rotu Reef forms a crescent, 4 miles in length; part of it lies 1½ miles north of the Island of Muthuata; between it and the Rotu Reef there is good anchorage, the depth of water ranging from 7

to 10 fathoms. Between Henrietta and Rotu Reefs is the North Channel, three-fourths of a mile in width and 3½ miles long, which leads towards the passage in the Great Sea-Reef, off Kie Island. The course through this channel is north; and the passage through the reef is distant 7 miles from the entrance into the North Channel. It is the best route to approach the harbor of Muthuata, as the openings through the sea-reef are safe, although narrow; either opening can be made use of, as may be thought most advantageous. Inside the sea-reef there are no difficulties, and the space is believed to be free from coral shoals or sunken patches, but nevertheless a good lookout ought to be kept.

To the east of the Rotu Reef and Muthuata Island is the Triton Channel, which may be used as well as the North Channel, and is equally safe. At the entrance of it is the Vincent Reef, triangular in shape; which may be passed on either side. Its northern point is 2½ miles from the sea-reef, and bearing from the passage southeast. It is best to take the east side of the Vincent Reef, when a south-by-west course will lead a vessel between it and Dimba Reef, then pass around the east end of Rotu, having Coru Reef on the port side of the main channel, near 'Mbiti Island. Three miles to the eastward of Muthuata Harbor is the entrance to this channel; it is as wide as the north one, and its length about the same. The wind is generally favorable in both channels. Wood, water, and supplies may be had at Muthuata. The west end of Muthuata Island lies in latitude 16° 26′ 30″ south, longitude 179° 02′ 30″ east. Four miles to the eastward of Muthuata Harbor are the Tiri Islets, seven in number; they are all low, and covered with mangrove bushes, viz.: Williams, Green, Mills, Piner's, Pully, Richmond, and Day's. The channel between them, leaves four on the north side, and three on the south side. They extend 3 miles. The depth of water is from 11 to 16 fathoms across the channel, which is half a mile wide. The three south ones, Pully, Richmond, and Day's, lie half a mile from the shore, which here becomes steep and rocky, and is destitute of coral. From Muthuata to Middle Point the trend of the coast is east-by-north. There are extensive groves of cocoanut palms along shore. Middle Point has a knoll on it.

To the northward, in a bend of the Great Sea-Reef, lies the Island of Kie; rising in a single peak to the elevation of 760 feet. Kie is but half a mile long, by one-fourth of a mile wide; it is of volcanic formation, the same as the coast. The bend of the sea-reef extends

3 miles further north, and the whole distance of the projection is 6 miles. Kie is situated in the middle of this bight, and is free from coral. There is a good passage through the reef, 2 miles west from Kie; and two others bearing southwest, half a mile from the first. These three are not as easily passed through as one 2 miles more to the south and west: with the prevailing wind a ship may lay her course through it, and not be subjected to make a tack, which it is desirable to avoid, as a misstays in these narrow passages might bring about disaster. Kie Island is 12 miles north of that of Muthuata; its latitude is 16° 14′ 20″ south, longitude 179° 04′ 30″ east. From the extreme northern bend of the Great Sea-Reef, off Kie, to the west point of the Mali Passage, is 11 miles south 60° east. The reef itself makes a sharp turn in this distance to the east; there is no opening in any part of it; the sea breaks constantly upon it, and with violence. The reef on the west side of the Mali Passage is 4½ miles in length, while that on the east is but 2½ miles. The passage gradually narrows from its outer to its inner end, where it is half a mile wide. The wind at all times does not permit a vessel to sail through it, and frequently it becomes necessary to make several tacks; this is sometimes attended with danger. When the tide is flood, it sets with some velocity on the lee reef, and care should be taken to avoid being subjected to it. The ebb tide is the most suitable to pass out, for then much assistance will be had in working ship on the weather side of the passage, and in gaining an offing. There is no anchorage; the course through the passage is north 30° west, or south 30° east. The weather reef should be hugged close. The direction for entering the passage is, to bring the west end of Mali Island open with the line of the reef on the east side, then haul up immediately for it; and after having passed through, a vessel may anchor in Mali Roads, in 13 fathoms, or pass on to the westward through Mali Bay, steering south 30° west for Sac Point, which is 5½ miles distant. Having run 3 miles on this course, and opened the south side of Mali Island, Middle Reef will be passed, when keep off to west-by-south for the centre of the Tiri Islet, a distance of 7 miles, which is free from any shoals, except that running off from Gibson's Island to the westward. This extends one mile, but it is not in the way of the direct course pointed out. The channel between Middle Point and Gibson's is one-third of a mile wide.

The depth close to Middle Point is 8 fathoms, so that a vessel may pass very near the shore without any apprehensions.

The coast from Sac Point eastward is again low, and lined with mangrove bushes, trending nearly east-by-north 5½ miles. It is then terminated by another rivulet, which is opposite to Mali Harbor, and suitable to procure water at. Between the Island of Mali and the main land is Sarah's Bosom; it extends the whole length of Mali Island, and forms a secure harbor. There is a good passage to the east between Mali and the large island, a mile wide, but the water is not over 6 to 7 fathoms deep. The main island at the eastern part of Sarah's Bosom is again low, and studded with mangroves; three small streams of water discharge into it.

Mali Island is 4 miles in length, by three-fourths wide. It has two remarkable sugar-loaf-shaped peaks, and low land between them; the western is the highest, its altitude being 350 feet. These are easily distinguishable when approaching the passage. The channel to the east runs on the north side of the island, the depth of water in it being from 8 to 14 fathoms; it is 1½ miles wide. At the east end of Mali is Malitu Bay, a good anchorage for vessels engaged in the biche de mer fishery, as it is near the reefs on which they are taken. The northern side of Mali has some patches of coral at its points, but they extend but a short distance. From the east end of Mali to Sau-sau Islet is 5 miles, course north 50° east. Sau-sau Islet is a small sandy islet, situated on a projection of the inner part of the sea-reef. The ship-channel passes between Sau-sau Islet and Point Lloyd, distant from it half a mile. It is quite free of dangers in a line without Point Roberts and Point Lloyd, and the water from 10 to 12 fathoms deep. The coast beyond Point Lloyd has many indentations or small bays as far as the 'Ndrundrua Islands. The headlands bear north 70° east from each other. These bays are small, and do not offer more protection than the open channel, the depth of water in which does not exceed 18 fathoms. Off Point Fenno there is a patch of coral, but this lies near the shore. The shore is well covered with wood, and water may be procured at several places. Point Graves has a small reef projecting from it, and within it an islet, which is connected by the reef with the point. The point is remarkable, rising up to a considerable elevation in a conical peak; it is the sailing-mark to enter the Sau-sau Passage. The course through the passage is south 32° east, or bring Hale's Peak, in the interior of the island, on with Point Graves. If coming from the eastward, it would be advisable, after making the eastern point

of the reef, to haul in at once for Point Graves, and when you have run 1½ miles, to keep off and steer for the bluff on Fenno's Point, in order to clear a sunken coral patch, that lies at the distance of 2 miles from Point Graves on the eastern side of the passage. The Sau-sau Passage at its entrance is three-fourths of a mile wide; it gradually opens out as it approaches the coast to 2 miles wide; there is therefore plenty of room to work ship in, and I am of the opinion it is one of the safest and best passages for vessels both to enter and depart from. The wind that generally prevails enables a vessel to sail free through it both ways; it has in this respect the advantage over the Mali Passage, and no lee reef to cause anxiety.

Blunt's Point is a projecting tongue of land, 2 miles long; there is a high bluff at its outer end, where it is a mile broad. Within a mile of it, bearing northwest, is Henderson's Islet, small and low, surrounded by a coral reef. Between Point Graves and Blunt's Point is a bay, 1½ miles deep, and the same in width; it has from 7 to 8 fathoms water in it. Both wood and water may be procured; but there are no villages. The coast from Blunt's Point to Point Bolin has two extensive bays, but they are useless, being filled with coral. The islands of 'Ndrundrua or Druau Island, Cabeva, and Hanbury, lie off these bays, and afford every security for anchorage that could be desired. The first is the largest, two miles in length, north and south, and a mile wide; it rises in a dome shape; on its northwest point it has a very remarkable peak. Cabeva is a mile long and one-third in width, and Hanbury is much smaller. Druau has a clear channel around it, which is the case with Hanbury, but Cabeva is situated on the sea-reef. These three islands enclose a triangular space, which forms an excellent harbor, and is easy of access. The depth of water is from 10 to 14 fathoms, with good holding-ground, and is secure from all winds. The harbor may indeed be said to extend as far as Blunt's Point.

On the sea-reef, a mile to the north of Druau Island, is the Monk Rock. It is a basaltic column, 80 feet in height, and very conspicuous in sailing down the coast: its latitude is 16° 10′ 53″ south, longitude 179° 35′ 50″ east. To the northwest of the island of Cabeva one mile, are the Sail Rocks. They are smaller than the Monk Rock, in appearance more conical, and can also be seen off the coast 8 or 10 miles distant.

Point Bolin lies one mile east of Druau Island. To the eastward, the coast trends nearly due east to Tibethe Point, 5 miles, but the

channel is very much obstructed by innumerable coral patches, and the sea-reef approaches within a few hundred yards of Tibethe Point. This is the end of the channel along the north shore of the great island of Vanua Levu for large vessels; smaller ones may pass through the break in the reef into Tibethe Harbor. The sea side of the Great Sea-Reef, between the Mali and Sau-sau Passages, trends north 53° east, 12 miles; from thence, a distance of 15 miles, it runs nearly due east to the Aramula Passage. In the latter space the reef is much more irregular in its outline, and not so broad, as it is between Mali and Sau-sau.

The Aramula Passage leads from sea into Tilingitha Roads and Tibethe Harbor. Its course is south half east, and its length 4 miles, and from one-half to a mile wide. At the head of Tilingitha Harbor is Bukalau Island, which is low, a mile in length, lying within the shore-reef; near its eastern end a fine rivulet, called Endregatta, empties. At the mouth of this rivulet is a considerable town of the same name. Tibethe Harbor extends from Tibethe Point to Tilingitha Islet, and joins Tilingitha Roads. It has many coral patches in it, but still sufficient room for small vessels; the depth of water is from 3 to 6 fathoms, and good holding-ground. Large vessels should not attempt to go farther in than Tilingitha Roads, where they may anchor in 7 to 9 fathoms off Tilingitha Islet.

Tilingitha Islet is small and low, in shape a triangle, with its base to the eastward. It is covered by a dense vegetation. The length of either of its three sides does not exceed half a mile. It lies within the reef, and is a mile from the shore; there is no passage to the eastward for a large vessel. Vanua Levu again becomes low, is bordered with mangrove bushes, but rises a short distance inland in high peaks, which are conspicuous a long distance at sea. Bush Peak bears south half east off the entrance of the Aramula Passage. Water, wood, and provisions may be had here; the natives are civil and ready to exchange their products. The coast from Endregatta trends to the northward of east for three miles to Bunabugea Point, the boundary of Vicuna Harbor on the west; the shore-reef here extends off and unites with the sea-reef, forming a wide flat, which is nearly dry at low water. East from Tilingitha Roads, there is an extensive bight, but no greater security for a ship to anchor in it, than that which is to be found in the road. A boat may use this bight to facilitate her route to the eastward, being

able to pass over the narrow part of the reef into the Vicuna Passage at high water.

The entrance to Vicuna Harbor through Vicuna Passage is very narrow, so much so as to make it dangerous for even a small vessel to attempt it, unless the water is very smooth. It lies between Tilingitha Reef and that of Vicuna, and runs due south. After having entered the passage, it widens, and a course steered for Tibethe Point will carry a vessel through. At the distance of 2 miles, the channel between Severacota Point and Vicuna Islet will be open; steer through it south-southeast, and anchor under Vicuna Islet in from 6 to 9 fathoms water.

Vicuna is low and marshy, situated on the southwest corner of the Vicuna Reef; it has a large town on it, the natives of which are quite friendly. The harbor extends into a deep bay to the west of Rititbicumbue Point; it has a shore coral reef around it, which extends to Issingalossa Point, off which there is another coral patch. The channel between Issingalossa Point and Vicuna Reef is a mile wide, and the water increases to the depth of 12 fathoms, where it joins Nucussa Harbor. Nucussa Point lies 2 miles to the eastward of Issingalossa Point. Haycock Islet lies off Nucussa Point, where the passage turns short to the north-by-west, and is a mile long, but not over one-third of a mile in its narrowest part. It is a convenient and safe entrance, and may be known by the remarkable peak resembling a nipple which lies inland; when this bears south 50° east, and within a mile of the reef, the entrance will be open, and Nucussa Point distinctly visible. To the east of this entrance there are two deep indentations in the reef, which may be termed false harbors: they must be carefully looked to, as they are both quite small; the true Nucussa Passage is sufficiently distinguished from these, as it is funnel-shaped, the reverse of these. The reef to the westward of the Nucussa Passage extends to seaward beyond the eastern side, and trends more to the westward; by this also it may be known. If Vicuna and Haycock Islets can be seen, there is no need of further directions. The water in Nucussa Harbor is deeper than it is in Vicuna. The best anchorage is between Haycock Islet and Issingalossa Point. If farther security be desired, a vessel may pass into Vicuna Harbor. These two harbors are easily entered, but they are extremely difficult to depart from. The Vicuna Passage is the most difficult to pass out of; it is only fit for very small vessels, boats, or

canoes. The disadvantage of the Harbor of Nucussa is that a vessel is obliged to beat through a narrow passage. I would therefore recommend, if a vessel should seek shelter here, that she should wait for the land-breeze, or a favorable slant of wind, before attempting to get to sea.

The sea-reef to the eastward of the Nucussa and Vicuna Passage trends north 70° east, 10 miles, as far as Unda Point, the most northern point of the island. The sea-reef becomes united to the shore-reef, and is about a mile wide; there are but two openings in it, but they are narrow and only afford a passage for a boat to the land. The coast is much more irregular in its outline, though the trending from point to point is the same. There are several towns on this part of the coast, and the whole has the appearance of being well inhabited. Unda Point is a long low point, with a knoll at its end; the reef extends 3 miles to the northeast of it. After turning around this reef off Unda Point the great Bay of Natava is open. The coast now trends south 70° west for 18 miles, and forming Natava Bay. This bay is 15 miles deep, by 7 miles wide; it has no harbors; the shore-reef is continuous around it. From the west side there are many projecting reefs, and the water is very deep in most parts of it; the land around is high, and there are many volcanic peaks perceived jutting up in the interior. There are many small villages on the west side; but the principal town lies at the foot of Natava Peak, on the east side; there is nothing to induce the visit of a vessel.

Unda Point is in latitude 16° 7′ 30″ south, and longitude 179° 55′ 29″ west.

RAMBE ISLAND.

Rambe Island lies off Vava Point, the eastern point of Natava Bay, from which it is separated 3 miles; the channel between is practicable, although the coral patches project from both shores; it is 4 miles in length. Rambe Island is of a triangular shape; its longest side trending northeast and southwest, and the other two north and south and east and west. It is of volcanic formation, and rises to a considerable height in peaks, the eastern ones having flat tops. It contains but few inhabitants. From its northeast point the coral reef projects to the northeast for 1¾ miles, and forms, as is often the case

with reefs, a considerable curve to the eastward. It is necessary when vessels are passing it to give it a good berth. Rambe has but little space susceptible of cultivation.

KEA ISLAND.

The shore of Vanua Levu from Vava Point trends south-by-west 10 miles, to Rocky Point. The Island of Kea lies in front of Mataponi Bay; it is 9 miles in circumference, has a high ridge, which runs through its centre northeast and southwest, and affords several good harbors,—a very safe one, Port Safety, at its northern end. The sea between it and Rambe is very much obstructed by coral patches; as these extend from the Rambe side, it is necessary to avoid approaching that island, and in passing through between Rambe and Vanua Levu a course should be steered for Kea Island, which will lead clear of the patches and foul ground; no attempt should be made to haul out into the Straits of Somu-somu until well up with Kea Island, when these dangerous shoals will be passed.

Kea Island forms the protection to Mataponi Bay; it lies directly before its mouth. This bay is 3 miles in depth by 2½ wide: its shape is that of a large segment. The west point of Kea terminates in a long and narrow tongue, which points directly into this bay; it is three-quarters of a mile distant from Mela-mela Point, the south point of Mataponi Bay. On the north and west side of the bay, the village of Mataponi is situated, just within Rocky Point, the north point of the bay. The passage between Kea Island and Vanua Levu is safe for vessels. There are two small reefs lying to the eastward of Mela-mela Point, 2 miles distant from it, which may be avoided by keeping near either shore; the best passage is on the Kea side. The anchorage in Mataponi Bay is in deep water, from 21 to 30 fathoms, blue mud bottom; that abreast of the village of Mataponi is to be preferred; but the bay affords little to induce a vessel to enter, as it is surrounded by high land, and has but the one village. The natives are few in number, and supplies in consequence scarce and difficult to be obtained.

Port Safety lies at the northeast end of Kea Island; it is a deep indentation, formed by a neck of land 2 miles in length by half a mile in width, which bounds it on its northern side, leaving a bay, 1½ miles in depth, and nearly three-quarters of a mile in width. The

southern part of it has the shape of a basin. The eastern point of this port was named Cook's Point, and the western Point Carter. Half a mile from Cook's Point to the west is a coral patch, 1500 feet long by 500 wide; on both sides of it, there is sufficient depth of water for a vessel of any class. The harbor is very commodious, and has good holding-ground in 10 to 12 fathoms. The course to be steered to enter when the bay is open is due south until Point Carter bears northwest and Cook's Point north-by-east, when you will be in the centre of the bay. The latitude is 16° 37′ 30″ south, longitude 179° 58′ 30″ east, variation 9° 30′ easterly. The shores of this bay are lined with coral, and at the head of it there is a small stream of water, where a supply may be obtained; from Point Carter the island trends off to the west. Port Safety may be recommended as a suitable harbor for vessels of any size, and may be sought in bad weather, if such should be encountered in passing through the Straits of Somu-somu. There is no village on this island, and very few inhabitants.

The coast between Mela-mela and Long Points (the latter is the eastern point of Vanua Levu), makes a small curve around Kuku Islet; the distance from point to point is 5 miles southeast.

VUNA.

The Island of Vuna is one of the most fertile of the group, and the seat of the second political power. It is 25 miles in length, trending southwest and northeast, and 8 miles in width. It rises to a central ridge, which runs through its whole length, and whose greatest altitude was found to be 2050 feet. The island is most of the time capped with clouds, particularly during a strong easterly wind. It is separated from the larger island of Vanua Levu, by the Strait of Somu-somu.

On the southeast side of Vuna there are no harbors. The shore is destitute of coral; but on the northeast side, bounding on Tasman's Strait, the coral reefs again appear, and form Tubou Harbor, a most excellent anchorage, on a sandy bottom, in 10 fathoms water, admirably adapted for a port of refuge in case of necessity, when passing through Tasman's Strait. It offers a safe harbor from the prevailing wind, and supplies may be had there. No particular directions are necessary for entering it, as the reef will point out clearly the passages and openings.

If a vessel wishes to anchor at Somu-somu, the principal town of the Island of Vuna, it is necessary, if favored by the tide, and coming from the northward, to close with the Vuna shore to the north of Corolib Island, which is free of coral. The best berth to anchor in is directly off the town of Somu-somu, with the Island of Corolib bearing west, 1½ miles distant: there the anchor may be dropped in 12 fathoms water.

If desirous of proceeding to the south from Somu-somu, an inside passage between Corolib and the land may be taken, passing the sand-banks to the south-southeast of that island (which are visible at low water) and the Vuna shore. Owing to the eddy winds under the lee of Vuna, this passage is sometimes very tedious, and therefore it is better to seek at once the middle of the strait, as less subject to calms and eddy winds.

If bound to the northward, the ebb tide will carry you clear of the island, where the regular easterly trade will be found, and enable a vessel to stand to windward of the Island of Rambe and Unda Point. It is advisable to keep, as near as possible, the mid-channel between Rambe and the Ringgold Isles, which is free from coral reefs or obstruction.

Somu-somu offers refreshments of every kind, which are purchased from the king, who is friendly to foreigners. Two missionaries reside there, who obligingly afford all information that may be necessary.

STRAIT OF SOMU-SOMU.

The Strait of Somu-somu separates the large island of Vanua Levu from the Island of Vuna and the Ringgold Isles. It is 10 miles in length, by 5 wide at the narrowest part. Opposite to the town of Somu-somu, the strait is much obstructed with shoals, surrounding Corolib or Goat Island, and the great reef which extends from the Vanua Levu shore a long distance into the strait. The tides are rapid; the flood runs to the southward, while the ebb sets strong to the northward. This strait is perfectly practicable for vessels, but requires precaution in navigating. When bound to the southward, the middle of the strait should be kept, until the Island of Corolib bears east-northeast; the shoals near it will then be passed. These shoals extend nearly a mile to the west of the Island of Corolib: in some places there is not more than 10 feet water on them. After

passing Corolib, keep a mid-channel course, until to the southward of Tokanova Point; this clears Tokanova Reef, which projects nearly due east from that point. When clear of it, the Vuna side ought not to be closed with, as a vessel may be becalmed for a long time under the lee of the island. The shore, however, is bold, and may be closely approached. At this part of the Island of Vuna there is only a shore coral reef, of little width.

KAMIA, LAUTHALA, AND MATANGI.

These three islands lie within the same reef, to the east of Vuna; they will therefore be described together. Kamia and Lauthala are very lofty, rising nearly to the height of Vuna; their surfaces are much more broken and less susceptible of cultivation. The length of Kamia lies east and west; it is much the largest, being 6 miles long, by 4 wide. Lauthala lies with its length across that of Kamia, and is but 3 miles long by 1½ wide; they are separated by a channel half a mile wide, which is free from dangers, with deep water. The Island of Matangi is but a mile and a half in circumference; it rises to a considerable elevation, though in consequence of its nearness to Kamia it appears low, and cannot be distinguished until well up with it. Matangi is surrounded by a shore-reef. A mile to the eastward of it, the Great Sea-Reef which surrounds these islands begins, trending first east and then south, around Lauthala, whence it turns west, parallel with the Island of Kamia, until it reaches its southwest point, where it ends in broken patches. The whole length is 18 miles; it has no breaks in it. The west end of Kamia forms the eastern side of Tasman's Strait. It has two bays, formed by indentations at its western end, but they are filled with coral; the southern one may be known by the Pig Islets. Neither are places for anchoring in, particularly when better and more suitable harbors are so near at hand. The principal harbor is under Matangi, between it and Kamia. In the approach towards Matangi there are several patches of coral, which are visible; they may be passed without danger, by keeping a good lookout; they extend in a curve round to the northwest from the island into Tasman's Strait.

TASMAN'S STRAIT.

Tasman's Strait is 4 miles in length, by 1 mile wide; it separates the Island of Kamia from that of Vuna, and is much choked up with coral shoals, several of which are just beneath the surface, on which the sea does not break. A range of these shoals lies across the northern entrance, stretching from the eastern point of Vuna around towards Matangi, which require attention on the part of navigators. The passages between them are readily perceived, and may be passed through without difficulty by daylight.

In the narrowest part of this strait the water is deep, and by keeping a good lookout it may be passed through without apprehension. The winds are frequently light under the lee of Kamia, the high land causing calms or light eddy winds. When a strong southeast wind prevails, the wind draws through the strait from that quarter. To the northward the water is smooth, the flood-tide sets through to the south, while the ebb flows strong to the north.

SOUTH COAST OF VANUA LEVU.

Mount Cocoanut is situated on the extreme east end of Vanua Levu; it rises to the height of 500 feet. To the westward it appears somewhat of a sugar-loaf in shape, and is very conspicuous in passing down the Somu-somu Straits; from the north it serves as a good mark to steer by, keeping it a little open on the starboard bow when in midchannel. The land slopes from Mount Cocoanut to the southeast, and terminates in Niebee Point, which lies 1½ miles to the eastward of the meridian of Mount Cocoanut; it is low, and beyond it the Tokanova Reef extends into the Straits of Somu-somu nearly 2 miles.

From Niebee Point to that of Tokanova the course is southwest 3 miles; between them there is a considerable bay, in which are situated three small islets near the shore. This bay is entirely useless, the reef running across it east and west, and has no break in it; consequently there is no access for vessels. Boats at high water may pass over the reef, and find a safe and good passage along the land, secure from the swell of the ocean. The centre one of the islets which lie on the western side of the bay, 1¾ miles from Tokanova Point, was named Tom's Islet. Tokanova Point is the southern point

of the south side of Vanua Levu. A mile to the westward of it, inside of the sea-reef, lies Baino Islet; it is small, but an excellent mark for vessels to recognize the situation of the point of the reef. Off Tokanova the sea-reef trends to the northward and westward for 4 miles, where there is a break leading into Baino Harbor. This channel is 700 feet wide and 1500 feet in length; beyond it opens out and forms a capacious harbor, one mile deep by 1½ miles wide. The course in, is north-by-east (true); steer directly for the bluff of Sharp Point, a small spur whose projection divides the two indentations of the land. At the head of the harbor is the best berth to anchor in, with Rock Point and Black Island in range bearing southeast, or if desirous of being nearer the shore, anchor in the eastern bight within Corodowdow Point. The harbor of Baino is sufficiently large to accommodate many vessels; there are a few coral shoals or patches in it, but they are visible and can be readily avoided. There is a good boat-passage withinside the reef, both to the eastward and westward. The depth of water in the entrance is from 15 to 22 fathoms, and within the harbor it is from 10 to 20 fathoms. The town of Baino is situated at the head of the western bight; it has a number of inhabitants, but they are savages. Water may be procured from a small streamlet near the town; wood also may be had. Baino Harbor lies in latitude 16° 44′ south, longitude 179° 51′ east, var. 9° 30′ east.

The coast between Baino and Fawn Harbors trends a little to the north of west 4 miles; the sea-reef has nearly the same direction. There is a small islet, called Lavou, situated half-way between Baino and Fawn Harbors, but there is no passage for vessels within the reef; boats may pass at high water over the reef, which is about a mile in width. Fawn Harbor has but little space within; it is much more difficult of egress than Baino, in consequence of the direction of its channel more towards the point from which the wind usually blows, the entrance being narrow and somewhat curved; the projecting points of its reef also nearly overlap. It is upwards of a mile deep, and may be known by the small islet lying on the western side of its reef, called Tukonreva, covered with cocoanut trees. The course through the entrance is north half east; between the outer point of the reefs, it is not more than 500 feet wide; as it increases in width, the water deepens to 28 fathoms, until the first quarter of a mile is passed, when it shoals to 10 and 12. To enter, steer for the Bourri-house or centre of the village of Tukonreva, which is situated at the head of the har-

bor. The best anchorage is with the Island of Tukonreva bearing west. The area is small, and but few vessels can be accommodated. At the village of Tukonreva, water may be procured from a creek, which empties into the harbor to the east of the village; its position may be known by a beautiful grove of cocoanuts. The villagers are not to be trusted. Fawn Harbor was so named from the loss of the brig Fawn; whilst attempting to beat out of the harbor, she missed stays, went on shore on the western reef, and was bilged. Although this harbor is an excellent one for small vessels, yet I would caution all navigators from entering it, unless their vessels work well, and would recommend Baino in preference. Fawn Harbor lies in latitude 16° 43′ 42″ south, longitude 179° 47′ 11″ east. Besides the Island of Tukonreva, the situation of this harbor may be known by a conspicuous conical hill, which lies directly in the rear of the village.

From Tukonreva Island to the entrance of Nabouni is 5 miles. The sea-reef and the island trend nearly due west, and the reef is 1½ miles wide; the whole extent of its surface is flat, with here and there a narrow and intricate channel for boats, but which only can be passed through at high water. Before reaching Nabouni Bay, about a mile to the eastward of its entrance, there are two conspicuous black rocks, by which it may be known; it is very narrow, and a mile in length, which makes it very difficult for even a small vessel to beat out of; the water is deep, and as the land is approached its width enlarges to a bay, on which lies the town of Nabouni. Nabouni is one of the largest towns on the south coast, and the two small islands of Ya and Nabouni lie directly in front of it: on these the inhabitants build their canoes. Both islands are low and well wooded, and distant half a mile from the town of Nabouni. On the west side of the bay is another large town, called Engada, and in front of it is the small island of Engada, very similar to that of Nabouni; to the west a short distance, there is another small sand-island. Benedict's Island and Point form the western termination of the Bay of Nabouni, which is 3 miles in extent. The land in this vicinity is low and fruitful, and well covered with groves of cocoanut. To the south of Benedict's Point, and within the reef lies the small rocky islet of Rativa, black and square, rising 12 feet above the surface of the reef. It is a very conspicuous object when sailing along the coast.

The boat-channel from Rativa Isle continues to the Rock Haven Passage, 2 miles to the westward. The greater part of the sea-reef is

bare at low water. This haven will only accommodate small vessels, the space within being very limited. The sea-reef, from the Rock Haven, turns towards the shore, and becomes a narrow shore-reef. To pass through the Rock Passage, steer for a small island situated near the town of Kopee, which bring to bear north half east (true). The depth of water in Rock Haven is from 5 to 10 fathoms.

Alelo is the next point to the westward; it is conspicuous when seen from the eastward, projecting farthest to the south of any land on the southeast side; it bears from Benedict's Point southwest-by-west, distant 4½ miles, the coast between the two making a considerable bight, in which is situated the village of Kopee. Between Kopee Village and Alelo Point is Black Point, and between the latter and Point Alelo there are four small islets situated on the reef, one near the point.

The next point to the west of Alelo, is Graham's, 1¼ miles distant; between them is a bay, at the head of which is situated the town of Alelo. The reef passes directly in a line from point to point, and has an opening through it 50 yards wide for boats, leading to the town; this opening is well marked by a rock on its west side in shape of a cone. If any difficulty should be found in recognizing Cone Rock, Alelo Point is well marked by black rocks situated off it on the edge of the reefs; it is half a mile to the eastward of the boat-entrance. Alelo is a large town, and occupies a pleasant situation. The natives have had but little communication with foreigners, and are not to be trusted. From Graham's Point the coast trends northwest 2½ miles to the town of Susu, which is situated at the head of a bay, and then it stretches southwest 2 miles to Hope Isle; the reef follows very closely the shore-line, and is about a quarter of a mile wide. Between Hope Isle and Graham Point there are five small islets; boats may pass over the reef between half tide and high water. The town of Susu is one of the most populous on this coast; but there are no conveniences for landing at it. It is surrounded by cocoanut groves, and the ground under cultivation is extensive.

From Hope Isle to that of Narangi, the trend of the coast is west-by-south 5½ miles; the land is more elevated than about Nabouni. The shore-reef within this distance again assumes its original dimensions, extending off abreast of Royes Island, 1½ miles; it afterwards gradually nears the shore, until it reaches Narangi, where it again becomes narrow. There are three breaks in this reef; the first is 1½ miles to the west of Hope Isle; it is narrow, for boats only; the second

enters into Rock Bay, a small indentation in the line of the coast 2 miles beyond the first; and the third break is within half a mile of Narangi Point and Isle. The shore from Narangi trends for one mile due north, and then west 3 miles to the town of Lotu; this town is situated on a bay formed by the small peninsula of Lamouka, which here projects a mile to the eastward, and is half a mile in width. Opposite the peninsula there is a small passage through the reef. Between Narangi and the point, the course of the reef is almost a straight line; on this reef near the peninsula are two small islets; between the most western and Lamouka Point is the passage into Lotu Bay. Lotu Bay will accommodate small vessels and boats, but from its narrow opening through the reef and its length, it is extremely difficult to get in or out, except with a fair wind. Passing round the Peninsula of Lamouka, the coast forms a bay to Green's Point, distant 2 miles; here is situated the town of Wanaba. The situation of it and Lotu may be known by a conspicuous peak, which lies just in the rear of them to the north. The reef in front of Wanaba trends in an east and west line, and off Green's Point is merely a shore-reef of a few hundred feet wide; it continues, following the trend of the coast for the next 2 miles, to Kea Point, and as far as Kotuku Point and Isle. Here it again turns with the line of the coast, stretching to the northward 2 miles, forming Nukobalab Bay, at the bottom of which, near a small islet, there is a boat-entrance to the shore. On the west side of the bay the coral reef is a mile wide, and follows the trend of the land, sweeping round almost parallel with it, to the entrance into the great Bay of Savu-savu. The town of Nukobalab is situated on the west side of the bay. Off Hupo Point (the eastern point of Savu-savu Bay), lie the two Malu Islets, situated upon the reef; it is bare at half tide around them; the reef is very extensive, projecting a mile to the westward, and affording much protection to the Bay of Savu-savu.

The Bay of Savu-savu is a fine sheet of deep water, ten miles in width from Hupo Point to that of Kombelau, and seven miles deep. The reef extends, with the exception of a mile, entirely across the mouth of the bay. From Hupo Point its shores have a trend north-east seven miles; the bay then makes a sweep round to the north and west until it joins Kombelau Point, which bears from Hupo south-west-by-west. The bay is surrounded by very high and broken land, rising in many places in lofty needle-shaped peaks. Hupo Point is

the lowest land in the neighborhood. The reef crosses the mouth of the bay, with a trend more westerly: the entrance is a mile wide, and three miles distant from Hupo Point: to the west there are several coral patches, and two or three openings through the reef near to Kombelau Point, but they cannot be recommended for vessels: if entered, many intricacies will be found within.

Three miles to the northeast from the entrance is the inlet of Wailea; a considerable stream of water flows through it into the bay. The hot springs of Waicama are situated about a mile from the bay up this inlet. The anchorage in the inlet is not a good one; the water is deep; and much exposed to the westerly winds. There are a few good berths for vessels, and by mooring head and stern far up it, protection may be had from all winds.

Around the Bay of Savu-savu are several towns, but there is little to be obtained from them. The character of the natives does not stand high, and it is necessary to be guarded in having communication with them. The town of Savu-savu is situated about a mile inland from the hot springs; the natives belonging to it constantly visit the springs for the purpose of cooking their food. Water and provisions may be obtained at Wailea in plenty; the natives furnish the usual products of the islands, for which cotton cloths and hardware are exchanged.

The land near Kombelau Point rises precipitately in hills from the sea-shore to a considerable elevation. The shores are generally fringed with narrow coral reefs; beyond these are large outlying reefs, some of which occupy a large area, and are partially bare at low water. The two that are most remarkable are the Sake and Tokelau Reefs; the one covers the Point of Kombelau on the east, while the other projects off from its point in a south-by-west direction. The former is 3 miles in length by 1½ in width, and the latter 5½ miles in length by 2 miles at its greatest breadth. Off Kombelau Point lie the islets of Moro and Rawaike on the west, and Makatu on the east, each surrounded by coral. There is a snug harbor for boats or small vessels within these islets; it is about a mile in length, and an eighth of a mile wide; the depth of the water is from 5 to 19 fathoms, decreasing from its mouth to the head, where is situated a Bourri house, and a large village or town, occupied by the Kombelau fishermen, who form a strong party in the group; they are much dreaded by all their neighbors, and hold the small towns

in other parts of this group in a state of terror, from the fear of incursions when they are unsuccessful in fishing. The course into this haven is due north.

Vessels usually take the inner, or ship channel; it lies between the Tokelau Reef and that which adjoins the Kombelau Islets. Though narrow, it is perfectly safe; the tide runs through it with velocity, and the depth of water is great. A vessel intending to pass through to the west should take the morning hours for it; then the sun forms no impediment to a full view of the reefs; but if the sun has gained the meridian and is declining in the west, it becomes difficult to make out the shoal patches with even a good lookout at the masthead. Before coming up with the Tokelau Reef there is no danger in the way, and a vessel has nothing to apprehend; it should be determined previously whether the outer or the ship channel is to be taken. They are both safe; the one may be chosen which may appear at the time to offer the most facilities.

The outer channel I deem best, if it is the intention to reach an anchorage to the west of Buia Point before dark; it is broad and there are but one or two patches of coral to pass: the depth on them varies from 9 to 12 and 15 fathoms. The bottom is very irregular, but no shoaler places could be found, and no soundings were obtained less than 9 fathoms. By keeping the outer passage the breeze is preserved, and a vessel has the full influence of the flood tide, setting to the west. In case of calm, an anchor might be dropped for the night on one of these patches. The south end of the Tokelau Reef is easily discernible, and also the outline of the great Nemena Island Reef, which bounds the channel on its south side, and trends east and west.

To the west of Kombelau Point, the coast trends west-by-north 5 miles, to the point of Nandi Bay; the land is high, much broken and gullied, and has but little coral along its shores, but there are several patches of coral lying from a mile to 2 miles from the shore. Vessels after passing through the ship channel may find a temporary anchorage under the lee or west side of the Kombelau Islets, where it would be advisable for them to anchor, if there is any prospect of being benighted in proceeding to the westward.

Nandi Bay is 2 miles wide by 1½ deep; at the head of it is situated the town of Nandi. The bay is fringed with coral; a very extensive shoal fills up a large part of it, which serves somewhat to protect the anchorage from the sea and wind. It is not a suitable place for a

vessel of any size. The coast from Nandi to Sualib Bay trends in a southwest direction 10 miles; it is bold and abrupt, and offers no harbors or places of protection for vessels. The shore is fringed with coral, and the whole is iron-bound. There are no villages or inhabitants throughout the whole distance.

Sualib Bay is within 2 miles of Buia Point, the most southern part of the Island of Vanua Levu. The bay is surrounded by high hills, forming a kind of amphitheatre; the sides and the flats at the bases are well cultivated, producing large crops of yams and taro. It is a mile in width by 1½ in depth, open to the southeast; the coral reef fills up half of its area, consequently the anchorage is very much contracted; the reef is dry at low water, is confined to the head and the western side. At the head of the bay there is a stream of water, on which the town of Tye is situated, surrounded by an extensive grove of cocoanuts. On the eastern side of the bay the town of Sualib is situated. These two towns are divided by a steep, projecting spur, but the extensive reef, when bare, at the head of the bay, enables direct communication to be effected between them at low water; the creek is easily crossed, so that the two at such times almost form but one town. They are under different chiefs; the Sualib chief is the most powerful, and rules.

With the wind at southeast this bay is a dangerous and exposed anchorage, not suitable for large vessels; small vessels and boats may find some protection within. The shore at this part of the island is steep and inaccessible. From Sualib Bay to Buia Point the coast trends a little to the southward of west; the shore is fringed with coral. At low water it is usually dry, not even admitting a boat to pass along; but this is in part owing to the fish-weirs, which the natives have constructed on the reef, with large stones. The fish are driven into these pens before half tide, where they are easily captured at low water.

The people of these two towns committed depredations upon one of our boats, for which it became necessary to punish them, and in so doing the town of Tye was burnt; the inhabitants ever since have shown every disposition to befriend the whites and their property.

Between Tokelau Reef and Buia Point there are three shoals, lying 6 miles from Buia Point; one was found to be 2 miles in length; the others are smaller, and lie to the eastward of the largest. Their length lies east and west, but they have very little breadth. Vessels

may pass on either side of them; the space is clear, being 3 or 4 miles wide. As these reefs lie to the east of the Buia Passage through the great Nemena Reef, they are not in the way of vessels making use of it.

Buia Point is a bold and steep headland, rising abruptly at first from the shore, and then gradually till it joins the main ridge of the island, of which it is properly a spur; it is easily distinguished by its reddish-black appearance. Between Buia Point and the spur to the eastward of it, there is a small contracted valley, which has a large Bourri house near the shore, surrounded by a luxuriant grove of cocoanut trees. The village had been destroyed, and its inhabitants forced to fly in a body, and to seek protection under some of the more powerful chiefs; those that were not able to do so were carried off to other parts of the group as slaves.

Off Buia Point the flood tides from the east and west meet, and flow off to the south, though not with great velocity. At the distance of 2 miles from the point, there is a small coral patch, which vessels should be mindful of; it is better to keep between the point and it. On rounding Buia Point, Cocoanut Point comes in sight; its distance is 3 miles northwest; a vessel proceeding to the westward must steer to pass close to it; the channel lies between it and the coral patches, which lie off the coast here; there is ample depth of water and sufficient room for a vessel of any size. Under Cocoanut Point the anchorage is good, in from 7 to 10 fathoms water. If night is approaching, I would recommend anchoring there. The distance to 'Mbua Bay is fully 10 miles; the channel has been before described, and although not intricate, is narrow, and requires care, as the tides run through it with some force.

Y'ENDUA.

The Island of Y'Endua lies off the west end of Vanua Levu, 10 miles distant; it is a high island and can be distinctly seen from 'Mbua Bay, one of its peaks, Loto, being 875 feet above tide; it is of volcanic formation, and has a very uneven surface; its shores are likewise indented with deep bays. Its greatest length is 4 miles in a northwest direction, while its greatest breadth is 2½. It has two good harbors, one on the south, Porpoise Harbor; and

another on the west, Strahan's Harbor. Besides these there are several places where a vessel may drop anchor.

The passage leading to it through the reefs from 'Mbua Bay I have called the Sifo Channel; a west-by-south course from Dimba-dimba Point will take a vessel through, though bordering the coral patches on its northern side, which are numerous and dangerous, and should be avoided if possible; therefore in passing through the Sifo Channel, if the tide should be setting ebb, it would be well to keep a more southern course until within 2½ miles of Y'Endua, when the Lela Reef will be passed. A vessel intending to anchor in Porpoise Harbor should haul up for Green Point (the south point of the island), and pass to the northward and westward of the outlying reefs, which protect the harbor from the sea on the south; these reefs are visible, and may be closely approached. If the wind should not enable a vessel to pass to the northward of them, the west end may be turned, and so through between the reefs until the entrance into the harbor is gained, which is near to Green Point; within the reefs, the water is deep and always smooth; the entrance is nearly a mile wide. After the entrance is passed, there are three rocks, two of which lie off Aliki Point, both visible: a vessel can pass between them; the third lies south-by-east a quarter of a mile from the others: it is awash. Porpoise Harbor is a mile in depth by a mile in width; it is formed by the small Island of Y'Endua Tomba on the west side, and that of Y'Endua on the north and east; these are connected by the coral reef, over which the tide flows at high water; the anchorage is in 10 and 11 fathoms water, muddy bottom. The reef that lies across the bay and encloses the harbor, projects from the south point of Y'Endua Tomba to Green Point, and is 1½ miles in length. The shores of the islands are in all parts fringed with coral, in width from 200 to 500 feet.

Strahan's Harbor lies on the west side of Y'Endua. It is not as extensive or so convenient as Porpoise Harbor, and is only separated from it by a tongue of low land, fringed on each side by coral. In it there are many coral patches, which occupy a large part of the area, curtailing the anchorage to a very limited space: these patches are discernible, and by ordinary care may be avoided; the chart of the harbor will be the best guide to point out these obstructions. Under Modonovi Point (the north point of the island), there is likewise a temporary anchorage. The east side of the island offers no

shelter for vessels, and is, as before stated, fringed with coral; near the centre of the island lies the small islet of Latu; it is connected to the island by the shore-reef, over which boats may pass when it is high water. The Island of Y'Endua has a fruitful soil, and but a few years before our visit (1840) contained a large population, who were abundantly able to supply the wants of vessels; but it had been almost depopulated since by one of the powerful chiefs of Vanua Levu, who massacred its inhabitants. It will be some years before it will be again in a state to afford supplies of any kind. Wood and water may be obtained here, the latter from many springs just above high water mark.

Vessels intending to go to sea from 'Mbua Bay, ought to take the Sifo Channel, passing between the Lela Reef and those off Y'Endua, steering a southwest-by-south course, until they bring Y'Endua to bear north, when they may keep away directly for the highlands of Ya-Asaua: this will carry them clear of the Fafo Reef; when Awakalo or Round Island is seen from the deck, they may steer for it: this course will avoid the Sakau Reef, extending 20 miles from Y'Endua to the west, most of it being sunken rocks, with various depths of water. On passing Awakalo, a course from west-northwest to northwest will lead to sea and an offing.

AWAKALO OR ROUND ISLAND.

Awakalo or Round Island lies north 75° west 32 miles from Y'Endua. The Great Sea or Western Reef of the Viti Group reaches to within 6 miles of this island; it loses itself here in a sunken reef, the point of which bears north from Awakalo. The Island of Awakalo is nearly circular in shape, and has but one part, on the west side, where a landing can be effected. The eastern side is a perpendicular escarpment, and the whole island has the appearance of having been torn and ruptured by volcanic fires. To the east and southeast, there are patches of sunken reefs, extending some 7 miles, no doubt a continuation of the Sakau Reef; although separated from it by a broad space.

This island is 515 feet high, half a mile in circumference, and can be seen at a considerable distance. Standing as it does alone, it has the appearance of a large mound: it may be quite closely approached. A vessel may anchor on its east side upon some

sunken patches, but it would not be advisable to do so, as it would be better to seek one of the fine harbors in the Asaua Group, where any supplies may be had if required.

The space included within the Great Western Reef, which begins at Kie Island, off Muthuata, and extends to Awakalo, although it was not all minutely examined by us, yet was found to have so many dangers within it as to preclude my recommending vessels to pass within it; there are many openings for boats and small vessels, through which they might pass to escape a rough sea outside, but it would be necessary for them to use great caution; yet many portions are comparatively free, through which a vessel may pass to get to an anchorage in one of the many harbors along the north shore of the Island of Vanua Levu. So dangerous do I think the navigation, that I deem it proper to discourage the attempt being made by a vessel of any size to seek a port through it, if it can be avoided. Towards the western termination of this great reef, which is 80 miles in length, the openings become more frequent and practicable. There is only one rock above the surface of the sea, and that is a basaltic column, called the Sail Rock, 7 miles north of Y'Endua, from which it is distinctly visible; and in clear weather may also be seen from the western side of Vanua Levu.

Round Island Passage is between the north end of the Asaua Group and Awakalo; it is 13 miles wide and without any dangers.

It is not supposed that navigators will approach this group for the purpose of entering it from the west through the Round Island Passage. This course cannot be recommended, as it would subject them to much difficult navigation in beating about among the reefs, where the tides are strong, and their direction and velocity frequently changed by the reefs. To depart from this group, the Round Island Passage is one of the safest, and all things taken into consideration, probably the best; much time and distance is saved, particularly when vessels are bound to the westward.

ASAUA OR WESTERN ISLANDS.

The Asaua or Western Islands of the Viti Group is composed of forty islands, including large and small ones; the islands range in a northeast and southwest direction, extending 55 miles from Round

Island Passage to the south. They are for the most part fringed with coral, and have extensive outlying reefs, running parallel with their length, and in many cases uniting neighboring islands; the reefs are connected with the west end of Viti Levu, and enclose the Sea of Viti on the west. The area between the southern part of the Asauas and the Island of Viti Levu is obstructed by reefs and sand-banks, which impede navigation; there are also a number of sand-islands, called Underwood's Group, within this space. The northern islands of the Asaua Group are Timboor, Kuisick, Asaua, Ya Asaua, Ovawa, Yasau-i-lau, Androna, Otovawa, Nanuia, Nangati, Matathoni Levu, Yangati, Naviti, Eld, Fox, Agate, Sinclair, Waia, Waialailai, Waialailai Thake, and Biva. The southern ones are Knox, Ombi, Davis, Totten, Baldwin, Lewis, Vomo, Carr, Walker, Johnson, Case, Emmons, Alden, Craven, Perry, Malolo, Malololailai, Soni, Palmer's, Waldron, and Speiden. They will be described in the order in which they come from north to south.

TIMBOOR AND KUISICK.

Timboor and Kuisick are two small twin islands, the most northern of this chain; they are quite low, covered with trees, and about a quarter of a mile in circumference, and lie within the same reef; this reef is 3½ miles in length, by one-third of a mile wide. They form the southern boundary of the Round Island Passage.

ASAUA, YA ASAUA, AND OVAWA.

Asaua and Ya Asaua are distant a mile and a half from Timboor. The former island is quite small, and is joined by the reef to the latter on its east end. The channel between Timboor and Asaua is free from danger, and has a depth of water varying from 10 to 15 fathoms. The course through is southwest-by-south. The reefs on both sides may be approached without fear; the side of Timboor should be preferred, as it is freer from any projecting rocks. I am not aware that there are any other dangers on either side.

Asaua is but half a mile in length by a quarter in width. It rises to the height of 50 feet, forming a knoll. It is surrounded by a coral reef, which projects nearly a mile to the southward and westward;

this reef is bare at low water. The island is covered with a scanty growth of trees, and is connected by its reef on the east with Ya Asaua. Half a mile to the west lies Levu Islet, with a small reef around it; between them the channel is clear and deep. The Island of Ya Asaua, as before remarked, is connected at its western termination by the reef with Asaua. It is 8 miles in length, and 2 at its greatest breadth; it has a central ridge running the whole length of the island. Both its northern and southern end curve to the west, forming bays. That to the north I have called Emmons Bay, and that to the south Raritona Harbor. The former is one mile wide by 2½ long, protected by a sunken reef, extending 2 miles to the southwest from its western point. It is tolerably protected on the west, but is entirely so on the east and north by the island from which the winds prevail. The depth of water does not exceed 15 fathoms; but the bottom, unless well up in the bay, is very much broken, and an anchor is liable to be fouled. It is necessary that all anchors should be provided by good buoy-ropes if let go here, as it may be impossible to regain them by any other means.

The Harbor of Raritona lies at the southern extremity, and is protected on the west by the Island of Ovawa and One Tree Islet; it is not a very capacious anchorage, from having a great part of its south and west side occupied by a coral flat. At the head of the harbor there is an extensive and fertile plain, from which the hill of Tauthake rises, to an elevation above the sea of 784 feet. The Island of Ovawa is 1½ miles in circumference, and rises 40 feet above tide. The shore-reefs are for the most part dry at low water. The channel from Emmons Bay to Raritona Harbor lies near the island, but the head of the harbor cannot be approached with the smallest sized vessel, on account of the above-mentioned flat. This island during our visit was almost destitute of any provisions, the inhabitants that were left being obliged to live upon the yaka, a wild root, in consequence of the incursions of the natives from Vanua Levu. The island was formerly under extensive cultivation, and will be again in a few years; when vessels will be able to procure all the productions that the islands are capable of raising.

YASAU-I-LAU.

The small Island of Yasau-i-lau is situated at the southern and

eastern extremity of Ya Asaua, and is connected by the same coral reef that fringes the shore. It is high and rocky, the sides being in places perpendicular, and shooting up into turret-shaped pinnacles. This island is but half a mile long, of irregular shape, and has an altitude of 437 feet. With the southwest end of Ya Asaua and Androna it forms a very commodious and safe harbor, which I have called Pulotu, one mile in extent north and south, and half a mile east and west. It has two entrances, one on the west, the other on the east. These openings are sufficiently wide and deep to admit vessels of large size. The western one is the best. The eastern entrance has two reefs, with rocky islets on them lying across its mouth, which occupy a considerable part of the channel, but they can be passed on either side without difficulty; either side is safe, and may be chosen according as the wind and tide are favorable. The wind generally prevails from the east, and is fair for passing through the eastern entrance. The situation of this harbor is easily known by Tauthake Hill, which is a prominent object from all the surrounding sea.

The western passage into Pulotu Harbor is close at the base of Tauthake, which forms its northern boundary, while the north part of Androna forms the south. Inside, on the left, near the entrance, there is a small patch of coral, and several others well over towards the eastern and northern shores; but they are all visible, easily avoided, and not in the way of vessels. The soundings vary from 10 to 15 fathoms, mud and sand. Water may be had on Ya Asaua, but not in any great quantities; the remarks relative to supplies is equally applicable to this harbor as the last.

ANDRONA.

The Island of Androna lies immediately south of Ya Asaua. It is a high rugged island, rising to the height of 900 feet. It has a central ridge; is 3 miles long by 1½ wide; its form is nearly a parallelogram. It is fringed with coral, which is bare at low water, and from 200 to 400 feet in width; its shores are steep, and there are few spots of low ground to be seen. It has several small villages visible from the sea; these are mostly situated in high and secure positions. No anchorages were found on its western side; but there are two harbors on its eastern side, which form very convenient havens for small vessels to

trade at. The natives are a wild and savage set; and have had little communication with whites: they are not to be trusted.

The most northern harbor on the eastern side of Androna is Faliki; it is a mile wide by 1¼ in length; it is formed by coral reefs, which are bare at low water. The entrance is 1000 feet in width, and the passage is one-third of a mile in length; the depth of water is from 7 to 10 fathoms. A north and south course will carry a vessel directly through the reefs and to the best anchorage. The small islet of Paka lies on the west side of the harbor within the reef; and Ita Islet is off its eastern point. The reefs extend for a mile from the shore, and are bare at low water. Water and such provisions as the islands afford may be obtained here; the natives are engaged in fishing, and some tortoise-shell may be procured. In entering the harbor, the western reef projects a quarter of a mile to the south of the eastern; the latter comes to a sharp point; if a vessel is to enter, care must be taken to haul up immediately on passing the point to the course directed. Paka Island is easily distinguished, and is a good mark for the harbor.

The harbor of Korai lies one mile southwest of that of Faliki, and is rather more conspicuous. At the head of it there are three small coves; in the centre one a considerable village is situated. There is a coral reef around the shore, but a sufficient depth of water to admit boats to land. This harbor also owes its existence to the coral reef; it is 1¾ miles in length and half a mile wide. Its length lies in a direction northeast and southwest, which is the course to enter; or, when the entrance is opened, steer for the centre bight, which will take a vessel safely through the break in the reef; its width is 1000 feet. The two points of the reef nearly overlap. After passing these, the harbor opens, and there is plenty of room to manœuvre a vessel. Half a mile from the entrance, on the east side, there are two small islets, which are called Pepe and Kiole. Between these and the head of the bay is the best anchorage, in from 5 to 6 fathoms water, muddy bottom; this depth predominates throughout the harbor.

Water may be procured and also wood. The land rises abruptly into hills and is rugged. This harbor is about 2 miles from the south end of Androna. It is the best ship harbor on the eastern side of the island, but will be found at times difficult of egress on account of the trade winds blowing here from the southward and eastward.

To the south of Androna there are two islands, Otovawa and Nanuia; these are separated from Androna by the Taofi Channel, three-fourths of a mile wide. This space is very much filled with coral patches; the reefs from the islands also extend to a considerable distance. On some of these patches on the Androna side of the channel, there are black rocks, which point out its direction. The water is sufficiently deep for large ships, and the course through in passing from the northward is nearly due south, until the channel between Otovawa and the northern Nanuia with the north point of Matathoni Levu is well opened, then haul up southeast. Although this is a ship channel, it requires great caution to sail through it even with a small vessel; and unless there is a necessity for using it, I would not advise the attempt to be made. Anchorage may be had in almost any part of it, in from 10 to 30 fathoms. The channel between Otovawa and Nanuia is also practicable for ships, as well as that between Nanuia and Matathoni Levu, and Otovawa and Matathoni Levu, in both of which there is anchorage.

OTOVAWA.

The Island of Otovawa is three-fourths of a mile in length, by half a mile wide. It lies nearly due north and south, and is surrounded by a coral reef; some of the patches of coral extend on the eastern side, and are part of those spoken of above as lying in the Taofi Channel. Otovawa lies west of the southern end of Androna one mile; it is high and rugged as the others of this group, and is of the same geological character.

NANUIA AND NANGATI.

Nanuia and Nangati are connected by a coral reef, but the tide flows through between them, leaving a good boat-passage. They are both nearly of the same size, though differing somewhat in figure; the northern one is a mile in length, by half a mile wide. Nanuia is the most southern, and is three-fourths of a mile in diameter. Nangati trends west and east. Both are high and have the rugged character already described as belonging to this group. They are both inhabited. There are no harbors, except that on the west of the islands,

and between them and Matathoni Levu. They are both bordered with a fringe of coral, of from 200 to 500 feet wide. The reef to the south extends beyond this distance, and on the southern point of it there are two small islets. East of these islands there are several outlying patches, one called Mafuna Reef: they can all be readily seen and avoided.

MATATHONI LEVU.

This island is 2 miles in length and lies north and south; its width, including the reefs, is a little over half a mile. It is high and has a central ridge, and is divided from the Island of Yangati, which lies to the south of it, by a narrow strait. The coral reefs of the two islands connect. Between the islands lies the small islet of Ato. Nifo Islet is also included within the same reef: it lies to the east. These islets are connected on the east and west with Matathoni Levu and Yangati; there is no passage between them, except for boats at high water.

YANGATI.

Yangati is the middle island of the northern section of the Western Group. It is upwards of 3 miles long, and lies, as most of the rest of this range, northeast and southwest; its width is 1½ miles; its features are rugged. It has no harbors for shipping, and there are but three towns on it, one on its north end and two at the southern end. Maca Point is its extreme southern point, and forms the north side of the Naviti Passage, lying between Yangati and Naviti Islands.

NAVITI PASSAGE.

The Naviti Passage is 2 miles wide, and has but one danger in it, a small coral-reef, lying near its centre, which is visible. Maca Point on the north, as well as Tapau Point on the south, are both highland. The course through this passage is east-southeast. The south side, towards Naviti, is somewhat obstructed by coral reefs, but they are visible and not far from the shore.

NAVITI.

The Island of Naviti is one of the most important of the Asaua

Group. It is 8 miles in length and upwards of 2 miles in breadth. Its peaks are distinctly seen from a great distance, and are next in height to those of Waia. On its west side towards the northern end there are many coral patches; its east side is much indented with bays, which, however, offer no shelter for vessels; at its northeast end it has a reef of outlying rocks off Kupa Point. There are several towns on this island; the most important is Kumia, on its west side, but it offers no inducement to visit it, and the inhabitants are not trustworthy. Within Vaka Bay lies the town of Vaka: this is the best anchorage which this island affords, and the bay is of easy entrance; the anchorage is tolerably safe, being partly protected by the coral reef which lies off its mouth, and with a proper lookout for the treachery of the natives, wood and water may be obtained.

ELD, FOX, AGATE, AND SINCLAIR.

To the south of Naviti lie four smaller islands, which I have named, after officers of the Expedition, Eld, Fox, Agate, and Sinclair. These are high, rugged, and rocky. Off Eld Island there is a temporary anchorage. They are not inhabited, but are occasionally the temporary abode of the natives from the larger islands. Eld Island is only separated by a boat-passage from Naviti; it is of a triangular shape, about one mile in length. Fox Island lies east and west, in shape a crescent; its length is over two miles. Between it and Eld Island there is a good passage. At its eastern entrance lies a small islet surrounded by a reef, and a mile farther to the east is the Moya Rock, which is visible and has around it a reef. Agate and Sinclair Islands are nearly of the same shape, but their lengths lie nearly at right-angles; they are connected by a coral reef, which is bare at low water. To the east of these there is an outlying coral patch.

WAIA PASSAGE.

The Waia Passage is bounded on the north by Sinclair Island, on the south by Waia Island; it is 3 miles wide between Vatu Islet and 'Mbua Point. There are no dangers lying within it, and the depth of water is adequate for a vessel of any size.

WAIA ISLAND.

Waia Island is the highest of the Asaua Group; its inhabitants are deemed the most warlike and treacherous. Its form is nearly circular, 3 miles in diameter, and it has but one indentation, that of the Bay of Poto on its southeast side. Its highest peak rises to the height of 1640 feet; there are several that attain nearly this altitude; indeed, the whole surface of the island seems to be but a collection of peaks and fastnesses. It is well populated, and the natives enjoy the reputation, even among the Feejee Islands, of being a set of pirates and bad fellows, making frequent incursions on the towns of the other islands; its population is estimated at 3000. Poto Bay offers a tolerable anchorage; there is a village lying on its western side. In approaching this bay there are three coral patches lying off Bombote Point, to the south and southwest, from half a mile to 2 miles distant. Waia is surrounded by a shore-reef, which extends on the north, and includes the small Island of Vatu, and also joins with that of Waialailai Island at the south. Wood and water and some provisions may be procured here, but I would not advise, unless in cases of necessity, a vessel seeking the island for that purpose. The inhabitants are mostly engaged in fishing for turtle on the neighboring islands and reefs during the season.

WAIALAILAI AND WAIALAILAI-THAKE.

Waialailai, as well as Waialailai-thake, lies directly south of Waia. They resemble it in its topography, but are of minor consequence. The former is 2 miles in length, by 1½ at its greatest breadth; the latter is a mile in length, by half a mile in breadth. On the latter is a remarkable peak, which now bears the name of Observatory Hill; its altitude is 555 feet. Temporary anchorage may be found under these islands on the eastern side.

BIVA ISLAND.

Biva Island is the most western of the Feejee Group; it lies 10 miles to the west of the Asaua range. It is low, of coral formation, has a lagoon on the south, which is formed by the extension of the

reef; its diameter is a mile; and although the reef is partly sunken and awash, yet its direction and outline are distinctly seen. The island is densely covered by cocoanut groves; it is inhabited, and ships may obtain fruit here. The natives are friendly and have had frequent intercourse with ships cruising in the neighborhood for whales. The sea between it and the Asaua range is clear, though it is better for ships lying off and on to keep to the west. It may be seen 10 miles. Its position is well determined, and was ascertained to be in latitude 17° 08′ 30″ south, and longitude 176° 53′ 30″ east. There is a narrow entrance on the west side into the lagoon, and anchorage may be found within.

PORPOISE SHOAL.

To the north-northeast of Biva Island, 5 miles, lies Porpoise Shoal, which is one mile in length, by half a mile wide; it is composed of coral. The sea seldom breaks on it, but the discoloration of the water may be seen some distance, and can be avoided.

WHITE ROCK AND MOKA REEF.

Five miles to the east of Waia Island, lies the White Rock. It is readily distinguished, and forms a good sailing-mark; 3 miles farther to the east is the extensive Moka Reef, trending from Vomo Island north-northeast towards the north end of Androna, unbroken as far as abreast of the Naviti Passage, a distance of 20 miles; thence northward are several patches, but the passages between them are wide. On the Moka Reef the sea generally breaks, which causes it to be seen a long distance in fine weather; its limits and trending were accurately determined, and are represented on the chart; its south end reaches to within 2 miles of Vomo.

VOMO, OMBI, KNOX, BALDWIN, DAVIS, LEWIS, AND TOTTEN.

Vomo Island lies southeast from Waialailai, 10 miles. It is a mile and a half in length; its southern and eastern half rises 250 feet, and has a flat top, while the western is low and sandy, connected by a coral reef with Vomolailai, a small rocky islet, rising abruptly to the

height of 60 feet, of volcanic formation. Within the bight of Vomo on the west there is anchorage for small vessels. Between Waialailai and Vomo there are three patches of coral; one lies just to the north of the latter island. To the west from Vomo extends the Fua Reef, which reaches to within a mile of Ombi Island, one of six small, rocky isles, which lie south-southwest, 8 miles from Waia Island; these were named Knox, Baldwin, Davis, Lewis, and Totten. They are all surrounded by narrow shore-reefs. There are two outlying patches of coral in their neighborhood, one to the north, 3 miles distant, and the other off the southeast end of Totten Island.

HUDSON ISLES.

The fourteen islands 8 miles south of Totten Island I have called the Hudson Isles, viz., Carr, Walker, Johnson, Case, Emmons, Alden, Craven, Perry, Malolo, Malololailai, Soni, Palmer's, Waldron, and Speiden. These are the extreme southwestern part of the Feejee Group; they are all surrounded by shore-reefs of little width, except at the points, where the reef extends from a quarter to half a mile. There are a few coral patches between Case and Craven Islands. The sea-reef from near the latter island stretches over 3 miles to the south. There is no sea-reef to the westward of the most northern of the Hudson Isles, as has been generally supposed, consequently they are exposed to the full swell of the ocean from the west, but being to leeward of the group, the sea is for the most part of the year quite smooth. The first eight are not inhabited, consequently supplies cannot be obtained. There is anchorage within them, yet they cannot be said to afford any safe port for vessels. Further remarks are deemed unnecessary, as the chart points out their relative situations, and renders a particular description of them useless.

MALOLO, MALOLOLAILAI, WALDRON, AND SPEIDEN.

Malolo and its accompanying four islets, Malololailai, Soni, Palmer's, and Kuku, are the southeastern islands. On the south and west they are surrounded by extensive coral reefs, which protect them from the force of the sea. Malolo is triangular in shape, its sides being 2 miles in length. This island is 400 feet in height; the ridge rises to a

peak near its centre; it has a diversified and picturesque appearance. For its size Malolo is one of the most fruitful islands of the group. It is well cultivated.

The reef around Malolo is much broken, and the passage intricate for small vessels. The sea-reef extends to Waldron and Speiden Islets; it is 2 miles in width; at these small islets there is an opening in the reef, which I named the Malolo Passage. These islets are situated on separate coral patches, lying inside the sea-reef, and covered with green bushes; they form an excellent mark for the passage. The coral reef on which they are situated extends several hundred feet in a northerly direction from the islets, but, notwithstanding, the passage is clear and safe. The islets lie northwest and southeast from each other, three-fourths of a mile distant, and about the same distance within the entrance. The course through and between the islets is northeast half north: the tide generally runs in the same direction. It is advisable to keep nearest to Waldron Islet, both passing in or out, as its reef is narrower; this will avoid the point of the reef extending to the north, off Speiden Islet. A mile to the north of the Malolo Passage there is another break in the sea-reef, which may be entered, steering to pass to the northward of Waldron Islet, but I should prefer to make use of the Malolo Passage. In the afternoon the wind generally is favorable to enter, at which time the reefs are visible, the sun being in the west. At low water the reefs are dry.

The anchorage under Malolo on the east side is confined and much obstructed by coral knolls; it is difficult to get a clear berth for any but a small vessel; for a vessel of large size, it is better to anchor outside the reefs, between Malolo and Viti Levu.

Malololailai is connected by the coral reef with Malolo; it is about one-third the size of the larger island. Palmer's and Soni Islands lie on the northwest side of Malolo three-fourths of a mile, and close to the reef. Kuku Islet is on the southwest side.

The inhabitants of Malolo were, until our visit, deemed, with those of Waia, the most savage of the Feejees. The necessity I was under of administering punishment for the massacre of my officers, has had the effect to change their character, and vessels may now visit the island with safety, and receive all the hospitality and assistance they may desire, with supplies in small quantities.

UNDERWOOD GROUP.

To the northeast of Malolo lie the Underwood Group, consisting of six islets, viz.: Linthicum, Smith, Henry, Ogle, Bateman, and Reynolds. These were named after the officers and men who died in the Expedition; it forms, with its reefs, a parallelogram, the centre of which is distant from Malololailai 6 miles. The sea is usually quite smooth, and the water of the deepest blue, and few scenes seem to make a deeper impression on the mind, or could afford a more lasting monument to the memory of the dead. Their position on the chart will show their relative situation, and renders any further description unnecessary.

SOUTH ENTRANCE AND ROUND ISLAND PASSAGE.

I have already described the entrances into the Viti Group, by the several passages through the eastern islands; it now remains to mention that from the south, which may be preferred by many intending to anchor at Ovolau, or pass through the reefs to some of the ports and anchorages in the larger islands, within the Sea of Viti.

In the approach from the south, the best island to sight is Matuku; it lies to the southward of all, is high, and may be seen a long distance in clear weather; a north-northwest course, after coming up with it, will take a vessel to Ovolau, 100 miles distant. There are no dangers, excepting the reef of Mumbolithe, on this route; it lies to windward of the course, but care should be taken to avoid it. The high island of Angau, off which this reef lies, will be sighted on the starboard bow, and when the centre of it bears to the eastward of north, this reef will be passed. On coming up with Ovolau, with a fresh trade-wind and favorable tide, it is necessary to shorten sail, otherwise the narrow south entrance to the harbor of Levuka may be passed, and oblige a vessel to seek the north entrance, and beat up to the anchorage off the village. In the forenoon the wind is generally light and variable.

In taking a departure from the Viti Group two routes present themselves which may be followed,—by the Southern Entrance, and the Round Island Passage—according as it may be the desire of the navigator to proceed to the southward or westward. If the former, the best course is to pass into the Straits of Ovolau, and beat to windward

until the reefs off Kamba Point can be cleared, then either to pass to the eastward of the Island of Kantavu, or through the Kantavu Passage to the westward; by this route a vessel will gain an offing much sooner than by any other. The departure by the Round Island Passage requires daylight; it is distant from Ovolau 100 miles; the course lies about northwest-by-west. In resolving to take this route there should be a commanding breeze, the weather fine, and an early departure made, in order to secure daylight. The first course after clearing the harbor is to steer for the Island of Vitimera, which lies some 30 miles west from Ovolau, thence direct for Awakalo or Round Island. There are no shoals in this route but what are visible, and by proper precaution in stationing lookouts, these can be seen and avoided. In the morning, when the sun is to the east, is the best time to pass out; by noon these reefs will all be passed, and if care is taken to avoid being set by the tide to the northward, there is no danger to be apprehended. After passing Round Island, all dangers are at an end, and an offing to the westward is soon reached.

CHICOBEA.

Chicobea is a small island lying off Unda Point, the northeast point of Vanua Levu. It is 20 miles distant, and in fair weather may be seen from the large island; it rises in two knolls to a considerable height. It is 3 miles in length, northwest and southeast, and 2 in width, and has a coral reef around its shores. There is no safe anchorage for vessels, or anything to induce a visit to it, and but few inhabitants. It is the most northern island of the Feejee Group. The latitude of its highest and most northern knoll was ascertained to be in 15° 47′ 40″ south, and longitude 179° 51′ west.

CHAPTER XI.

SOUTH PACIFIC ISLANDS.

STAVERS OR WOSTOCK ISLAND.

Wostock was discovered by Captain Bellinghausen in 1820. This island was seen by Captain Stavers in a whale ship. Its position has been well determined by the Expedition. It is a low, sandy islet, with a lagoon of oval shape and half a mile in diameter; it is well wooded, affords no landing, and is surrounded by heavy breakers.

FLINT'S ISLAND.

Flint's Island is reported to have been discovered as early as 1801. The position assigned it was found to be erroneous by the Expedition. It is a small coral island, 1½ miles in length, north-northwest and south-southeast, is thickly wooded; has high breakers extending off its points, and landing is extremely difficult, if not impossible.

PENRHYN'S ISLAND.

Penrhyn's Island was discovered in 1788. It is a low coral island, with a lagoon, in shape nearly oval, its longest axis trending north-northwest and south-southeast, 12 miles in length, by 6 in width. There is a boat-entrance into its lagoon. The sea washes over its reef on the northwest side. It is densely covered with cocoanut palms. There are many villages; the inhabitants are numerous and savage; great caution is required on the part of those who are desirous of communicating with them. There are several large patches of coral

in the lagoon. Under the lee of the island a landing can be easily effected, but it would not be advisable, unless the party was large and well armed, to protect themselves.

JARVIS ISLAND.

It is not known to whom the discovery of this island is due; some have thought that it is identical with Brock's Island, but I believe they are different. Jarvis Island was visited and surveyed by the Peacock and Flying-Fish. It is of triangular form, the sides being from 1 to 1½ miles long. It is a coral sand-bar, quite barren, excepting a few bushes and tufts of grass, and affords nothing; the surf is usually so high as to prevent landing. Jarvis Island in ordinary weather would be seen from the deck of a vessel about 6 miles. The Peacock searched to the westward some 50 miles in the same latitude for another reported island, but saw no appearance of land.

BELLINGHAUSEN ISLAND.

Bellinghausen Island was discovered by Captain Kotzebue in 1824. The island is of triangular shape, with its sides 2½ to 3 miles in length. It has a shallow lagoon in its centre without any entrance. Its northwest side is a bare reef, over which the tides flow at high water. The southeast and south parts are well covered with wood. There is no water on the island, nor any cocoanut palms. This island was visited by the Vincennes in 1839. There is no landing, except passing over the coral reef.

M'KEAN'S ISLAND.

M'Kean's Island was discovered by the Vincennes in 1840. It is but three-quarters of a mile long, by half a mile wide; it rises 25 feet above the sea, and is composed of coral blocks and sand, having no vegetation on it but a scanty growth of coarse grass. The surf was found to be too heavy to effect a landing. It is very dangerous, and vessels should be cautious how they run for it in the night, unless they are very sure of the correctness of their latitude and longitude. I am inclined to think that Arthur's Island may be considered identical with this, although 2° to the westward of it.

GARDNER'S OR KEMIN'S ISLAND.

Gardner's Island was visited by the Vincennes. It is a low coral island, with a shallow lagoon, which occupies the northwest end; there is no opening into the lagoon, and the tide flows over the reef into it. The island is $1\frac{3}{4}$ miles square. The trees on it are of large growth, 40 to 50 feet high, of the same kind as are usually found on the islands, but it is remarkable that there is no undergrowth similar to other islands. There are no inhabitants, and the birds in consequence congregate in numbers, and are quite tame and fearless.

SWAIN'S ISLAND.

Swain's Island was first seen by Captain Swain, of the whale ship Swain, and visited by the Peacock in 1841. It is of coral formation, has no lagoon, and may be classed with the high coral islands. It forms a large segment of a circle, and is $4\frac{3}{10}$ miles in circumference. Its height above the sea is from 15 to 25 feet. It is well wooded with cocoanut palms, pandanus, and other tropical trees and shrubs, is not inhabited, and there are no signs of its ever having been so, except the trees that produce fruit. The sea breaks violently on all sides, and landing must be at all times difficult. There are no soundings within a mile of the island with 250 fathoms of line. I am inclined to believe this island may be the Solitaire of Mendana, discovered in 1595.

SIMINOFF AND MIRIKOFF.

Twenty miles to the south of the Island of Ono, lie the two small islands of Siminoff and Mirikoff, both of which are inhabited. They were discovered by Bellinghausen the same year as Ono. They are separated from each other 6 miles in a west-by-south and east-by-north direction, are of nearly the same size, and have a coral reef surrounding them, which extends one mile. The most northern and eastern one is Mirikoff; it trends northwest-by-west and southeast-by-east; it is $1\frac{1}{2}$ miles long, by half a mile wide. The southern Siminoff, has its length northeast-by-east and southwest-by-west.

PYLSTART ISLAND.

Pylstart Island was discovered by Tasman, in 1643. It is a high island, and lies southwest-by-south 75 miles from Tongataboo, and offers nothing to invite the navigator.

This island was sighted by the squadron, and the appearance of the land does not warrant the belief that it is inhabited, or that supplies may be had there; its true position is given in the tables.

UEA OR WALLIS ISLAND.

This island was discovered by Mandeville, in 1781. The position he assigned it was erroneous. Wallis also believed he had discovered it. They both differ in their descriptions of it. There is little doubt in my mind that the two navigators have reference to the same island; both were in error as to its position. Uea lies nearly due west of the Samoan Group 180 miles. Instead of one island it is a collection of islands within the same reef, nine in number, which lie nearly north and south of each other. The coral reef extends some distance to the east of the island; in form it is a triangle, with its apex to the north and its shortest side to the southwest; the area between the reef and the islands is extensive. The largest islands are high and well wooded, and produce all the tropical fruits. The Catholic missionaries have an establishment here, and have been successful in promoting the good of the people, though with much risk and exertion. Fruits and vegetables are plenty. Although the natives are represented as savage, the chiefs are well disposed. Wood, water, fruits, and vegetables may be procured here, but it is advisable for vessels trading or seeking supplies to be on their guard. The southern side of the reef trends west-southwest and east-northeast; its length is one mile; there is a passage through it leading into the lagoon. This opening is the only one; it is near to the small Island of Eta, is 150 yards wide and half a mile in length; like all entrances through reefs, it requires care to pass in and out; the current generally is rapid. The direction of the entrance is north-northeast and south-southwest. It is deep enough for a large ship. After having entered, a vessel may stand to the north for the largest island, Little Oware, on which is the residence of the king; this is 6 miles from

the entrance. It is high water, full and change, at 5 o'clock; rise of tide 5 feet. All the islands are near the western side of the surrounding reef.

HOORN ISLAND.

Hoorn Island was discovered by Lemaire and Van Shouten, in 1616. It was passed by the Expedition in 1839. At a distance, it has the appearance of two high islands lying in a northwest and southeast direction; the height of the western mountain was found to be 2500 feet; they are joined by a low peninsula. The western one is very abrupt and rocky, and has many outlying black rocks; there is no regular shore reef; patches of coral are attached to the projecting points of the island. On several low points there are extensive groves of cocoanut palms. The island is well inhabited, but the natives are not friendly. Attempts have been made to establish missionaries among them, but without success.

I hold the opinion that Hoorn Island may be identical with the Enfant Perdu of Bougainville. The difference of longitude that he makes at the Navigators' or Samoan Group, is nearly the same as his assigned longitude to Enfant Perdu and the true position of Hoorn Island, viz., 2° too far to the east. I have in consequence erased Enfant Perdu from the chart, as having no existence whatever, and believing it identical with Hoorn Island.

Van Shouten and Lemaire passed some time in one of its bays, to which they gave the name of Eng Vaght, where they received a plentiful supply of fruits and vegetables.

KERMADEC ISLES.

These islands are composed of Raoul, Esperance, Macauley, Curtis, and the Rosarette Rock.

This small group lies nearly in a north-northeast and south-southwest direction. Raoul is the most northern, and Esperance the most southern. Raoul is the largest; it is triangular in form, about 14 miles in circumference, high and rugged, with steep and rocky sides. The landing on it is dangerous, and at all times difficult. It is said to be inhabited by a few sailors or runaway convicts, who have at times come off to whale ships, when cruising in this neighborhood, with a few vegetables. This island is identical with Sunday Island.

The next south of Raoul is Macauley. It is distant from it 50 miles. The formation of the island is similar to that of Raoul, but in size it is much smaller.

Curtis Island lies south half west of Macauley, and 20 miles from it. It is divided into two small, rocky, naked islets, separated a quarter of a mile from each other.

Esperance Rock is of small size, but high; it lies 45 miles to the south of Curtis Island.

To this small group I add the Rosarette Rock: it lies 35 miles to the west of Curtis Island; it was discovered in 1810. I think there is no doubt of the existence of this Rock; but the Rosarette Reef, laid down on the charts, in the same latitude and in 173° 40′ east longitude, there is; but in the absence of reliable information relative to it, I have deemed it proper to retain it on the chart.

MINERVA REEF.

The Minerva Reef was discovered by Captain Nicholson, in 1818. The discoverer encountered what he thought was two reefs; but it is now known to form but one. On this the Ship Minerva was lost, in 1831, near the southwest end. The reef trends northeast and southwest; is 45 miles in length; at either end the sea breaks. It is dangerous, and correctly laid down. The Peacock passed near this reef.

MACQUARIE ISLAND.

Macquarie Island was discovered in 1811. It is much broken in surface, of volcanic formation, and rises to the height of 1500 feet above the sea. It has no port or anchorage, and landing on it is at all times difficult. Off its north end lie two small islets, called the Judge and Clerk, while two others, of a similar appearance, are situated off its south end, which have been named the Bishop and Clerk: both have the appearance of basaltic rocks. The first two are distant from the island 5 miles; the latter, 25 miles.

The south end of Macquarie Island lies in 54° 44′ south latitude, and 159° 49′ east longitude. The island has no trees or shrubs, but is covered with a tall rank grass. The currents near the island are

strong, setting to the eastward; the winds generally prevail from the westward, and the weather is usually stormy.

ROYAL COMPANY'S ISLE.

The parallel of 49° 40′ south, on which the Royal Company's Isle is said to be situated, was examined by the Expedition, through eight degrees of longitude, passing directly over the position assigned it. There were no signs of it, or any indications of land, within the search.

MATHEW'S ROCK.

Mathew's Rock lies in the route of vessels bound from the Northern Pacific to New South Wales. It is a very conspicuous object, rising 1186 feet above the sea, of conical shape, and a mile in circumference. The position we place it in is 22° 27′ south latitude, and 172° 10′ 33″ east longitude.

AUCKLAND ISLANDS.

The Harbor of Sarah's Bosom, in the Auckland Islands, was visited by the Porpoise. Though a convenient harbor for whale ships, yet it is not so good and safe to effect repairs in as that of Lawrie's, which is secure from all winds. Sarah's Bosom lies in latitude 50° 38′ south, and longitude 166° 28′ east. Some few vegetables may now be obtained there. Wood and water can be procured in abundance, and many kinds of fish. The best anchorage is in 10 or 12 fathoms water. The Auckland Islands are of volcanic formation. The rocks have much magnetic attraction. The highest point of the islands does not exceed 1500 feet. The season for whaling in the neighborhood is in April and May.

CHAPTER XII.

ELLICE'S GROUP.

Ellice's Group embraces the following eight islands, viz., Funafuti, Nukufetau, Oaitupu, Nederlanditch, Speiden, Hudson's, Gran Cocal, and San Augustin. These trend in a northwest and southeast direction, and are comprised between the latitudes of 5° and 9° south, and the longitudes of 175° and 180° east.

Much discrepancy has existed relative to the position and the number of islands within the area embraced in this group, but they are now all known and correctly located, although during the visit of the Expedition there was not time for minute surveys of all the islands; the great detention it would have caused, prevented this desirable object from being effected.

This group I think is identical with what has been called Mitchell's, although there is nearly a degree difference in the longitude. The Peacock and Flying-Fish of the Exploring Squadron passed near its reported locality, but did not see anything of it.

Around these islands there is but little current; at the season of the year it was visited by the vessels of the Expedition there was none. The prevailing winds are from the northeast and east. These are intermitted by the monsoons, which prevail from the months of November till March, occasionally blowing strongly from the north to west, with thick and squally weather, accompanied with much rain and lightning.

There are reasons for believing that another island exists about 50 miles to the east of Oaitupu, but I have not sufficient confidence in its position to warrant me in giving it a place among the group. I have, however, marked it as doubtful, believing that it may be another position for Oaitupu or Tracy's Island.

For vessels passing from the North to the South Pacific it is advantageous to steer between Ellice's and the Samoan Groups; the sea is quite clear and the islands are well situated for the purpose of verifying chronometers, moreover many of them are high and can be seen at a great distance; the currents also are favorable for proceeding to the southward, and there is no route by which a vessel can make so short and direct a run to New South Wales.

This group lies within the variables or calms of the South Pacific, consequently the winds are somewhat irregular; they do not prevail from any quarter. The currents which exist are variable.

FUNAFUTI OR ELLICE'S ISLAND.

Funafuti Island was discovered in 1819, by Depeyster. It has usually been termed a group, but it has little pretensions to be so called. It consists of but two lagoon islands; the larger is nearly of the form of a parallelogram, whose longest sides trend north-northwest and south-southeast 13 miles, and the shortest is about 7; the eastern side is for 5 miles covered with groves; at the south end there are four islets on the same reef; the north and west sides are bare reefs, in some places with but a patch of sand visible at low water. The reef at the northwest corner is broken. There are two clear passages, by which a ship may enter and find anchorage on the east side under the land; the lagoon is clear of coral-reefs. At the south there is another small island, 5 miles in length by 1½ at its greatest breadth; its trend is north and south; its eastern side is also covered with vegetation similar to the large island. Between the two a passage exists, one mile, wide but whether there is sufficient water for a ship, there was not time to determine. The north and west sides are also bare of vegetation, and the reef is awash.

These islands have about 250 inhabitants, who are quite friendly, having had repeated intercourse with whites. They have nothing to supply. Wood and water are very scarce. They gave the name of the island as Funafuti.

These two islands I have included with those of Depeyster's and Tracy, and united them in one group, under the name of their discoverer, Ellice, Funafuti being the most southern and eastern of the group.

NUKUFETAU OR DEPEYSTER'S ISLAND.

This island lies to the northwest of Funafuti 45 miles; it is a low coral lagoon island, nearly square in shape, with the angles bearing from each other north and south, and east and west; the length of the diagonal is 8 miles. The south, east, and west points are covered with vegetation, consisting of groves of cocoanut trees; the southwest, northwest, and northeast sides being almost a bare reef, except here and there a few sand islets. There are six towns on this island; one on the southwest, and the others on the east and southeast sides, which contain a population of 1000. There is a passage into the lagoon on the northwest side for vessels, half a mile wide; the least depth of water is 4¾ fathoms. The current usually sets out strong, owing to the water being forced over the reef to windward. Good anchorage is found under a small islet, which is readily seen, from being higher than the others, and to which a vessel may carry from 17 to 20 fathoms, over a sandy bottom. The anchorage, though exposed to the wind, is protected from the sea, except that which arises in the lagoon. To the northward of the ship-passage are two boat-passages; with light boats and care the reef may be passed in many places at high water. About a mile off the west hummock, there is a reef or ledge, trending south-southwest for a mile or more to seaward, over which the tide sweeps, but there is not much swell; this reef lies very much in the way of vessels wishing to communicate with the principal town on the west point, and should be cautiously approached. Nukufetau does not offer much to induce a visit. Firewood may be obtained, and a small supply of water; taro is scarce. The natives are well-behaved, docile, and less addicted to thieving than those of many of the other islands.

OAITUPU OR TRACY'S ISLAND.

Oaitupu lies to the north-northeast of Nukufetau 30 miles. Its form is not known, or the extent it covers, or whether it has a lagoon or not. It is well covered with trees, and the vegetation on its western hummock can be seen at a distance of 15 miles. It is inhabited, and the natives resemble those of Funafuti and Nukufetau. The position

of its western part is well determined; it affords no more supplies than the other two islands.

NEDERLANDITCH ISLAND.

This island was discovered by Captain Kotzebue, in 1825. It is in shape a crescent, trending north and south 4½ miles; its width is less than a mile, with an elevation of 80 feet. It is not known to be inhabited, nor whether anything can be procured there.

SPEIDEN ISLAND.

This island I am doubtful to whom to assign the discovery. It was seen by the Peacock, and its true position ascertained. I gave it the name of Speiden, after the Purser of the Peacock. The Peacock did not succeed in getting sufficiently near it to make a detailed survey, nor to ascertain what it produces, or whether it was inhabited.

HUDSON ISLAND.

This island was discovered by the Peacock, Captain Hudson, in March, 1841. It was not found on any chart or among any of the list of islands we had. It is one mile and four-tenths long, trending north and south, and nine-tenths of a mile wide at the widest part. It has no lagoon; it is of coral formation, and is well covered with cocoanut groves; is inhabited, several natives and huts being seen on the beach. Reefs extend from its north and south points nearly half a mile, on which the sea breaks violently, which enables them to be easily avoided. This island may be seen 6 or 7 miles from a ship's deck. It differs from Sherson's or Torwell's Isle, in both latitude and longitude, and were it not from the late determination, by several good observers, of Gran Cocal, it might be probable that it has been often mistaken for it.

GRAN COCAL.

This island was discovered by Maurelle, in 1781; the position assigned it is identical with Sherson's Island, viz., in 6° south and 176° 36′ east longitude. Captain Duperrey places Gran Cocal in 6° 5′ south latitude, while this was found by the Expedition to be in 6° 19′ 30″, too great a difference to allow for error in observation; an equal amount of difference was found in the longitude, Duperrey placing Gran Cocal in 176° 6′, a difference of 30′. From a careful examination of the position of Gran Cocal, assigned by Duperrey, I am led to believe it does not exist there. San Augustin was found to coincide in latitude and longitude, by both observers, showing that their instruments and observations were good. The Peacock ran directly over the site of Duperrey's Gran Cocal. The distance between it and San Augustin, which was seen by Captain Hudson, is corroborative proof that neither Hudson nor Speiden Islands can be identical with it. Moreover, it is described as a low island, surrounded by reefs and covered with rocks, which does not seem to be reconcilable with either of them.

SAN AUGUSTIN ISLE.

San Augustin was discovered by Maurelle, in 1781. It is a low coral lagoon island, 10 miles in length, trending northeast and southwest; it is well wooded. A particular survey has not as yet been made of it, and therefore I am unable to say if there are any entrances into its lagoon, or whether supplies can be obtained. It is inhabited; and may be seen from 12 to 15 miles from the deck of a vessel.

CHAPTER XIII.

TARAWAN, OR KINGSMILL GROUP.

The Tarawan or Kingsmill Group consists of eleven coral islands, trending north-northwest and south-southeast, from the latitude of 1° 34′ south to 3° 20′ north, and between the longitude of 172° 30′ and 175° 20′ east, viz.: Taputeouea, or Drummond's Island; Nanouti, or Sydenham; Nanouki, or Henderville; Kuria, or Woodle; Apamama, or Hopper; Maiana, or Hall's; Tarawa, or Knox; Apia, or Charlotte; Maraki, or Mathew's; Taritari, and Makin; the two latter are known as Pitt's Island. All but two are lagoon islands, and, with the exception of the two last, are inhabited by savage and hostile people, who differ in character very much from those of Ellice's Group.

There are eight other islands, that lie to the eastward and westward of this group, which I include as a part of it. The five which lie to the east are Arurai, or Hurd Island, Onouta, or Rotche's Island, Nukunau, or Byron Island, Peru, or Francis Island, Tamana, or Phœbe Island. The three to the west are Meek's, Nameless, and Ocean Islands. It was found impossible to include those on the chart with the more important islands of the group, without reducing the scale. Being one of the principal grounds of the whale fishery, it became desirable to have it on as large a scale as practicable for the use intended.

The visit of the vessels of the squadron was made in the month of April, 1841, during which time they were engaged surveying the group, and had frequent communication with the natives.

The currents experienced were strong, setting constantly to the westward between the islands. The winds prevail from the northward and eastward, and resemble the regular northeast trades; at

times the winds blow strong and squally from south-southeast to north-northeast, with lightning and rain; the weather generally is pleasant. From the information derived from the whites, who had resided several years on these islands, it was ascertained that the westerly monsoon prevails from November to February, and heavy gales are experienced during that season, though they are not frequent.

If vessels should be drifted to leeward of this group by the currents, in order to regain their situation they ought to work to windward under one of the larger islands, by which means they will avoid the current and gain their point much sooner than by making long boards. It would seem, however, that westerly currents do not always prevail during the year, for Captain Duperrey, when he visited these islands, in the month of May, 1824, experienced a current setting past the southern islands of this group, north-northwest; near the middle of the group, to the north, and at the northern end it was found to set to the north-northeast.

TAPUTEOUEA ISLAND.

This island has heretofore borne the name of Drummond. Several might be designated as the discoverers. It seems to be due to Captain Bishop, but in what year I have not been able to ascertain. It was surveyed for the first time, by the Expedition, in 1841. It is of coral formation, 30 miles long in a northwest and southeast direction, and varies in width from half to three-quarters of a mile, which includes only the area above tide, a few feet above the level of the ocean. The reef extends off its western side, or to leeward, to the distance of 6 miles, and forms a large lagoon; but to the north it joins the island, forming sand-banks and detached reefs, seldom at a greater distance than a mile from the shore.

The island is but sparsely covered with cocoanut and pandanus trees, and is totally destitute of undergrowth and grass. The shore, for its whole extent, is almost one continuous village.

Off the town of Uteroa there is a good anchorage on an extensive bank, in 15 fathoms water, with a sandy bottom. The small sand-island off the town of Uteroa lies in latitude 1° 14′ 00″ south, and longitude 174° 53′ 00″ east. The Peacock's anchorage was with the north

point bearing north half west, and the town of Uteroa east-by-north, the small sand-island being distant 1½ miles east-southeast.

Vessels communicating with Taputeouea should be very much on their guard, as the natives are both numerous and treacherous, and are disposed to take any advantage that may offer to make an attack. This island offers a few supplies: fowls, fish, cocoanuts, and some taro; except for its anchorage it has nothing to recommend it. The current experienced here was found to be setting north 67° west.

In landing, care must be taken to choose the time of high water, for there is a long flat reef over which a boat will not float but at that time, and care ought to be taken in case of landing not to wait long enough to allow a boat to ground on this flat, as it might induce the natives to make an attack, and they would easily overpower an ordinary boat's crew by their numbers.

There are 14 towns on the Island of Taputeouea, all of which are under independent chiefs; and the entire island is supposed to contain 12 to 14,000 inhabitants.

NANOUTI ISLAND.

Nanouti Island lies 27 miles northwest of Taputeouea; this has been called Sydenham Island. It is a coral lagoon island, 19 miles in length, northwest and southeast, and 8½ miles in width. From its north end two-thirds is of the parallelogram form; the other part, forming its southeast termination, gradually draws to a point. The northeast side is almost a continuous string of islets, connected by the usual coral reef; while on the north, west, and southwest sides is a washed reef. The land is partially covered with cocoanut, pandanus, and other trees. Off the southwest and west portions there is a coral bank beyond the reef, about 1 to 1½ miles distant, with 8 to 10 fathoms water on it. Soundings were had 4 miles from the northwest end, in 265 fathoms water. No communication was had with the natives of Nanouti; they are represented to be the same savage people as those of Taputeouea, with whom they are in constant intercourse.

There is no entrance into the lagoon. This island is populous, and has several villages. Sable Island, or the isle said to lie due north of Depeyster, does not exist. Nanouti was circumnavigated by the

vessels of the squadron, and no island beyond the reef was found, nor was any in sight. The mistake in reference to it seems to have occurred from taking a small islet, connected with the reef and rising into a hummock, for a separate island.

This island can be seen on its eastern side from 8 to 10 miles in ordinary weather. In approaching it from the westward great care should be taken, as the reef would be fallen in with before any indication of land was perceived. It should not be approached, in that direction, at night or in thick weather, without great caution. The weather or eastern side of the island is clear of dangers; but as the currents set strong to the westward, a vessel had better pass to leeward, unless she has a commanding breeze, and can preserve her position to windward.

NANOUKI ISLAND.

Nanouki is the native name of the island that has borne the name of Henderville on the charts. Its shape is a triangle, with its base to the east. The sides trend west-southwest and west-northwest, while its base is on a line north and south: the former are 6 miles long, and the latter 5; they embrace a lagoon, but there is no entrance into it for vessels. Boats may find a passage over the reef at high tide on its southwest side. Near the western hummock there is a boat-passage. The base or east side is a continuous strip of land, on which there is a thick growth of trees, and two conspicuous mounds rising above the general surface of coral islands, which enable it to be seen some 12 or 15 miles in ordinary weather. The western termination or point has also a hummock, covered with trees, but it is detached, and only joined to the eastern part by a washed reef. On this end there are two towns, while on the eastern side there are several. It contains a large population, who are but scantily supplied with food, and the island affords neither wood, water, nor refreshments. The natives resemble those of Taputeouea and Nanouti. The western towns are constantly at war with those of the eastern side.

From the north end of the island around the western point, there is an extensive reef of submerged rocks, extending off from the latter nearly 2 miles. Off this point the sea usually breaks, which enables it to be seen in time to be avoided; there are reefs also off the north and south points, but they do not extend beyond two cables' length.

The south point of the island lies in 00° 09′ 00″ north latitude, and 173° 40′ 15″ east longitude. Nanouki lies northwest (true) from Nanouti, 52 miles distant.

KURIA ISLAND.

This island has borne the designation of Woodle's Island. It is a low coral island, and can be seen from Nanouki, from which it bears west-by-north (true) 6 miles. Its greatest length is 5 miles, in a northwest and southeast direction; but this does not include the bank which projects from its northwest end, which is 3 miles in extent. The island in shape resembles an hour-glass, or two triangles joined at their apices; its ends are 2½ miles wide. The northwest portion has two small lagoons; both parts are encompassed by coral reefs. There is a narrow boat-passage, a quarter of a mile to the southward of the reef, on its southwest side. The two parts are joined by a low reef, on which the sea breaks continually to windward.

The island has four towns on it, which contain from 4 to 5000 inhabitants. It is but moderately wooded with cocoanut-palm, pandanus, and a few stunted bread-fruit trees and some undergrowth.

There is anchorage on the bank off the northwest end; but a vessel would be much exposed to the wind and sea. Neither wood, water, or refreshments for vessels are to be had. The natives have but few things to barter. They resemble those of the islands last spoken of, but are apparently less hostile to strangers.

The island should be approached on its west side, as it is the safest. The current sets to the westward.

APAMAMA ISLAND.

This island has been known under several names,—Simpson, Harbottle, and Hopper; it was believed to form a small group, but the survey has reduced it to one low coral lagoon island, nearly in the form of a parallelogram, lying northwest-by-west and southeast-by-east, in length 10½ miles and in width 5 miles. On the north and east sides the land is continuous, except two small gaps on the latter, over which the sea breaks and flows into the lagoon. At the western angle there is a hummock, and another small one on the

southern side. On the northwest end there is an opening into the lagoon, nearly a mile wide; the soundings across it vary from 2 to 5 fathoms, over a coral and sandy bottom, after which the water gradually shoals, and renders this opening useless and unfit for vessels, the lagoon for a long distance within being much infested with coral lumps. There is a good entrance, half a mile wide, near a hummock on the south side. The situation of this passage or entrance may be readily known by this hummock, for which it would be proper to steer; it lies to the northward and westward of it. The course through is northeast and southwest (per compass), and after getting into the lagoon, a vessel may anchor in 8 to 10 fathoms, well protected by the reefs from the sea.

The Island of Apamama was discovered by Captain Bishop, who gave it the name of Simpson. It lies nearly northeast from Nanouki, distant 15 miles; the latter may be seen from the western side of the former. It affords but little if any water, and this would require to be obtained from wells dug in the sandy beach. There are some 12 towns on the island, which are all populous. The natives resemble those of Nanouki and Kuria, and have constant communication with them.

MAIANA ISLAND.

Maiana is the island that has been called Hall's Island; it was discovered by the Brig Elizabeth, in 1809. It is a low coral lagoon island, 9 miles in length, northeast-by-southwest, and 6 miles wide; in shape a parallelogram. The northeast and southeast sides are continuous land, but the northwest and southwest sides are, with a few exceptions, a washed reef. Off the southern end there is a sandspit, on which a vessel might anchor, in 10 to 12 fathoms water. The western sides of the island are dangerous to approach, in consequence of the sea seldom breaking on the reef, and its outline can only be seen by the discoloration of the water; therefore vessels sailing towards it during the night should be careful not to approach it too closely.

The eastern sides are well covered with trees, consisting of cocoanut, pandanus, &c.; they render the island visible 10 to 12 miles. There are many towns on the island; it is quite populous. The inhabitants have a close resemblance to those of the other islands

to the southward. There is no entrance into the lagoon. There are no dangers around or near this island which a good lookout and careful management may not avoid. This island bears north-northwest (true) from Kuria 40 miles. There are no refreshments to be obtained here of any kind.

TARAWA ISLAND.

Tarawa has borne the name of Knox Island, Gilbert, Marshall's, and Cook's, on the charts, but the whole constitute but one island, and must be hereafter merged in it. This is one of the most important islands of this group. It is a low coral lagoon island, in shape somewhat of a right-angled triangle. Its base trends east and west, 13 miles, the hypothenuse northwest and southeast, 20 miles, and the perpendicular north and south 18 miles. It lies due north from Maiana 19 miles.

On the southern and eastern sides of the island the land is continuous, with the exception of five places, which are separated by the usual washed reef, from which circumstance it is probable that they have been deemed separate islands, for at a distance they appear like distinct islands, with hummocks. The reef on the western side, for a great part of its length, is sunken, giving the lagoon rather the appearance of an extensive bay. Soundings were found upon it as deep as 5 fathoms, of sand and coral, which gradually increased on passing to the east, or within its boundaries. Within the lagoon there are very many knolls of coral and sunken patches. Good anchorage may be found within; but it would be better to seek it near the north or south ends, where a vessel would be more protected by the reefs. From the north point the reef stretches out nearly half a mile to the north, and another to the south, 3 miles, which is visible; the reef then becomes submerged. About 2 miles south of this point the Peacock grounded on the reef for a short time, but sustained no injury. The water on the west or lee side of the island is usually quite smooth.

This island is but moderately wooded, consisting of cocoanut groves, the pandanus, and a stunted undergrowth. There are several towns on the island, one of which is at the north end, and is built on poles, partly over the water, some 7 or 8 feet high. It is thickly inhabited; but the natives do not appear to have had much intercourse

with vessels, and were extremely shy. They speak the same dialect, and appear to resemble the rest of the group. It is scarcely necessary to say that it affords no refreshments, and neither wood nor water.

APIA ISLAND.

Apia is the native name of Charlotte Island. It was discovered in 1788. This is also a low coral lagoon island; it lies but 6 miles north of Tarawa, with a safe channel between. Apia is 15 miles in length, and of an average width of 6 miles. It trends north-northwest and south-southeast. It is somewhat in shape of a parallelogram, with its southeast corner cut off, the eastern side forming a curve, and its southern end terminates in a blunt point, while its northern end is square and trends perpendicular to its other sides. The whole length of the eastern side is one continuous belt of land. That to the north is a bare reef, and the western has on it nine hummocks. Half a mile to the northward of the centre hummock is a ship-passage into the lagoon. The southern part of the western reef is for the most part from 9 to 10 feet under water, while that to the north is raised 5 or 6 feet above. There is no island in this lagoon. The ship-entrance into the lagoon is a quarter of a mile wide, and has a depth of water varying from 3 to 4 fathoms, and the anchorage in the lagoon is in from 6 to 10 fathoms.

The island is thickly inhabited. There are a great many towns on it. The population consumes all that the soil produces, and the natives are at times subject to scanty fare; consequently they have nothing to dispose of. Water in small quantities may be obtained at the central hummock from a native well, but it was flat and brackish. The natives of this island are similar in character to the others, and are not to be trusted, as there is little doubt but that they will attack boats and small vessels the moment they conceive they have any prospect of overpowering them. Near the fourth hummock on the west side there is a town, with a wall built of coral on its sea front.

Off Apia Island the Peacock experienced a strong current, setting to the south, which during a night carried her 15 miles to the leeward of her position.

MARAKI ISLAND.

This island has been known on the charts as Mathew's Island. It lies nearly due east from the north point of Apia Island, distant 20 miles. It is also of coral formation, with a lagoon, in shape of an isosceles triangle, the base lying east and west, forming its southern side, 2½ miles in length, and its two sides trend north-northeast and north-northwest, each 5 miles and three-fourths in length; the whole is a continuous strip of land, excepting a small gap on the eastern side, where the reef is bare. It is but moderately wooded with cocoa-nut, pandanus, and a sparse shrubbery. The trees are less elevated than those of some other islands, which prevents it from being seen at as great a distance as those whose foliage is more dense and higher.

The island is well populated, and from several of the natives with whom communication was had, they appeared to have had but little intercourse with ships; all they desired was to have iron hoops. There is no entrance into the lagoon, but a good lee may be had under it from the northeast winds. The shore-reef extends entirely around the island, and has a white coral sand beach, that looms up very bright. At the north and southeast points of the island the reef extends off to a short distance, on which the sea breaks with violence.

This island offers no refreshments for ships.

TARITARI AND MAKIN ISLANDS.

These have been designated as the Pitt Islands. Taritari is the largest; it is nearly in form of an equilateral triangle, with an extensive lagoon, the sides being 13 miles in length; that on the east trending northeast and southwest; the one on the north, west-by-north and east-by-south; and on the west, north-northwest and south-southeast. The southern side is the only one which has any soil on the reef; this is well wooded, with the exception of two gaps, about a mile wide, where the reef is bare. The northeast angle of the triangle is cut off, leaving a short side, trending north-north-

west about 3 miles, which is a bare reef, excepting at its northern end, where there are two small islets or hummocks, well clothed with cocoanut trees. From this to the northwest angle the reef is awash, where there are two more hummocks, which are inhabited; near them is a boat-passage through the reef. On the west side, the reef is also awash for the whole distance, excepting near the middle of it, where there are two small hummocks on it, and three openings into the lagoon; one of these is a good ship-passage; it is 4½ miles from the south end of the island. The ship-passage is a quarter of a mile wide, and has from 4 to 5 fathoms depth of water, with good anchorage in the lagoon, near a small islet, which separates two of the passages; the third lies farther to the north, near a sand-spit, about 2 miles from the north point. This entrance is half a mile wide, but the ground is foul within, and there is no channel to the town, nor would it be safe to anchor within. It is dangerous to approach Taritari in the night, on its northern and western sides, as a vessel would be almost on the reef before it was discovered. There are, however, no outlying shoals or banks. The eastern side being covered with wood, may be seen at a distance of 10 or 12 miles.

Makin, the smaller island, lies off the northern point of Taritari, 3 miles distant. It is 6 miles long, and trends nearly north and south, and is from a half to a mile wide. It has three hummocks, the largest of which rises at its northern extremity. This small island is of coral formation, and has a small lagoon on its north end. There is a reef extending the whole distance around Makin.

The inhabitants of Makin Island,—for by this name they are both called by the natives, from the fact of the smaller island having been the seat of government,—are totally different in character from those of the southern islands of the same group, being as gentle, docile, and kind, as the others are savage and hostile. The islands are both well wooded with cocoanut, breadfruit, and pandanus, and are fruitful in taro, to the cultivation of which the natives pay great attention. Supplies may be procured here more readily than at the other islands, though not in plenty. There has been but little intercourse with these islands, and the natives are well disposed to give everything they have in barter.

There are besides these, five small islands, of which we obtained information during our visit to this group.

Arurai, or Hurd Island, is represented as very small. It appears to

have been discovered by the Brig Elizabeth, in 1809. It is inhabited, but affords no refreshments.

Onoutu, or Rotche's Island, was discovered by Captain Clest, of the Ship Palmer. It is inhabited, but of small dimensions.

Nukunau, or Byron Island, is represented as having a reef 2 miles in length from its north end. It affords no supplies. Its position I do not consider as very accurately fixed.

Peru, or Francis Island, has been often seen, but I still have doubts if it is well located. It is probably identical with Maria Island. It is small, of coral formation, and inhabited.

Tamana, or Phœbe Island. This island is inhabited, and well known to the natives of the Kingsmill Group. There are several whites on it, who are said to have obtained complete ascendency over the natives. The island is small and of coral formation, and produces nothing more than what is required for the consumption of the inhabitants. The three which lie to the west are small and unimportant.

The climate of the Tarawan or Kingsmill Group, though of a high temperature, yet is equable, and less oppressive than most islands situated under the equator, being moderated by constant breezes and frequent rains. From May to September, inclusive, the winds are regular from the east, and the sky generally clear and weather pleasant: this is the summer. The winter is from October to April, when the rains are more frequent, and the winds variable, generally from the westward. During this season violent gales occur from the southwest, lasting three or four days, when they gradually veer to the north by the west. These are sometimes so violent as to overthrow houses and tear up trees. Notwithstanding the devastation these storms occasion, they are looked for with anticipation by the natives, in the hope they will receive an accession of large trees, that are usually thrown upon the islands by the winds and currents from the southwest quarter. The trees are sometimes found to be squared and hewed with an axe, but they most generally are uprooted trees, with stones and resin entangled in their roots. These stones the natives make use of for various purposes, as hones on which to sharpen their adzes of shell or pieces of old iron hoop. They are generally of the size of a man's head, and those seen proved to be fine-grained basalt; the resin is similar to that which was found

buried in the soil at New Zealand. The trees were much worm-eaten, leaving no doubt but that they had been a long time in the water.

These circumstances are given in order to incite navigators to the inquiry, relative to the drift of the masses, and thereby throw some light upon the set of the currents in this part of the Pacific Ocean.

During the winter season the nights are frequently so cool as to make the use of fire necessary for comfort.

CHAPTER XIV.

NORTH PACIFIC ISLANDS.

WALKER'S ISLAND.

WALKER'S ISLAND is laid down on our charts in latitude 4° north, and longitude 149° west. The authority for it was derived from a master of a whale-ship, whose name I regret not to be able to give, having omitted to note it down when it was reported to me. Krusenstern gives its position as latitude 3° 54′ north, and longitude 149° 25′ west. The Porpoise passed to the eastward of the situation assigned it, but did not see it. I was in hopes of being able to verify its position or disprove its existence. Although I feel some doubts of its existence, and am still under the impression, that notwithstanding it lies many degrees removed from Fanning's Isle, it may have been mistaken for it, I have retained it on the chart, from the authority above quoted. There is another island, laid down on some charts, between the above and Fanning's Island, called Sarah Anne, in longitude 155° west. This I have omitted on our charts, believing there is no reliance to be placed in its existence. It is desirable that Walker's Island should be sighted, to ascertain its position correctly. The accounts represent it as a lagoon island, with many small islets on its rim.

FANNING'S ISLAND.

Fanning's Island was discovered by Captain Fanning, in the year 1798. It consists of three islands joined by a coral reef, enclosing an extensive lagoon, which has an entrance on the west side. The island is 9 miles east and west, by 6 miles north and south. The entrance is sufficiently deep for a large-sized merchant vessel. There is a sandbank off the opening, on which a vessel may anchor in smooth water, and be protected from the prevailing winds. Supplies of tropical

fruits, fish, &c., may be had here, and an abundance of wood and water. The island is covered with a luxuriant vegetation.

The western side is in latitude 3° 53′ north, longitude 158° 23′ west. Captain de Tromelin has given a good determination of this island, which was found to be correct, and has been adopted in our tables.

CHRISTMAS ISLAND.

Christmas Island was discovered by Captain Cook, in 1777. It is a lagoon island, semicircular in form, and 80 miles in circumference. The land lying on the east and south side is in the form of a crescent. There is an entrance into the lagoon at the west end, off which lies a small island, on which Captain Cook observed an eclipse, placing it in longitude 157° 32′ west, and latitude 1° 59′ north. The productions are few; there are some cocoanut trees and small shrubs, but the vegetation is scanty. The island, being composed of coral sand, and exposed to the heat of a tropical sun, with no water, renders it barren. The northeast side forms a bay, with a strong current setting into it; it should be avoided, as a vessel may become embayed, and liable to accident. The Ship Briton was wrecked there. Notwithstanding this island has been so long known, and its position considered accurately determined, yet from the many wrecks which have taken place on it, I am inclined to believe that there is some unknown cause, or great carelessness in navigating this sea in its neighborhood. It lies in the usual route for vessels bound from the Hawaiian Group to the south. I feel disposed to doubt the accuracy of its position, notwithstanding the high authority from which it is derived, and regret it was not in my power to have it examined; the information is derived from the best authority. The anchorage on the west side is safe, on a sandy bottom, in from 10 to 30 fathoms. It is immediately opposite the entrance to the lagoon.

The island, excepting at the entrance into the lagoon, is surrounded by a coral reef, over which the surf breaks heavily, which renders landing hazardous at any other place.

WASHINGTON ISLAND.

Washington Island was discovered by Captain Fanning, in 1798.

The island is elevated about 10 feet above the level of the sea. It is 3¾ miles long, in a northwest-by-west direction, and 1¼ wide, and entirely covered with groves of cocoanut and other trees. Off its eastern end, a reef extends half a mile, and there is a ledge off its western end, which extends 2 miles, the water on which appears much discolored, but the sea was not seen to break. This island was placed by the Peacock in latitude 4° 41′ 35″ north, and longitude 160° 15′ 37″ west. The surf was too heavy to admit of landing, and there is no anchorage. The current off this island was found to set to the northeast. As there were many islands reported to exist in this neighborhood, the sea to the westward was searched thoroughly, but none were found. Captain Hudson expresses himself well satisfied that no island but Washington Island exists thereabouts.

COPPER ISLAND.

Copper Island rests upon doubtful authority. In our passage from California to the Sandwich Islands it was impossible to run over its supposed position, in latitude 20° 06′ north, and longitude 131° 54′ west. I have thought proper to retain it on the charts, until its position shall have been examined.

COOPER ISLAND.

From the similarity of the name of Copper and Cooper, I am induced to believe that this latter may have been one and the same with the foregoing, but its latitude differs some 5° farther to the north. The situation assigned Cooper Island is in latitude 25° 24′ north, and longitude 131° 26′ west. It is to be desired that the position of this island should likewise be searched for in east longitude, where I am inclined to believe, if it exists, it will be found, as there are many others lying in the same latitude, and agreeing nearly in longitude.

SPACE BETWEEN LATITUDE 16° AND 18° NORTH, AND LONGITUDE 130° AND 140° WEST.

Many navigators have believed that there are islands existing within the above designated space, and several expeditions have sought

for them, but hitherto without success. One of the vessels of the Exploring Expedition was directed to pass over this locality, on the latitude of 16° 30′ north. Captain Beechey, in the Blossom, and Captain Belcher, with the Sulphur and Starling, passed twice between the parallel of 16° and 17° 30′ north, without seeing any indications of land; and it would seem that this ought almost to set the subject at rest. But as this space of ocean, comprising nearly 100,000 square miles, has been much frequented by whaling ships, some of which have reported the existence of islands, the positions of many are marked on the accompanying map. I cannot, therefore, deem it yet to be fully examined, and it may be possible that there are low islands situated within it. Vessels in passing to the westward, from the coast of South America, run over this space; and I have thought proper to call attention to the examination of it by those who are navigating within its limits, that they may devote some care to it, and add to the exploration by pursuing other tracks than those which have been passed over. The space which has been explored is marked by a dark shade on the accompanying map.

BIRD ISLAND.

Bird Island lies north 51° west of Kauai, 100 miles. It is a league in circumference; a naked rock; was discovered by Captain Douglass, of the Iphigenia, in 1789. It does not appear to have been known to the Hawaiians previously. It affords nothing, but is generally surrounded by birds, which at different seasons seem to frequent opposite sides of it. In the spring, summer, and autumn, they will generally be found to the southwestward of the island, but in the winter to the northeast. This points out the prevalence of the current near this island at those seasons of the year,—the food of these sea-fowl being found in the greatest abundance under the lee of the island; and by these indications the situation of the island may be known to navigators, in the various seasons, when passing in its neighborhood.

PALMYRA ISLAND.

Palmyra is a lagoon island, discovered by Captain Sawle, of the American ship Palmyra, in November, 1802. It is 14 miles in length,

east and west, and 7 miles in width. The lagoon is 7 miles in length by 2 in width. This island is inhabited, and is situated in latitude 5° 50′ north, and longitude 162° 23′ west. An opening is reported on its west side, through which the tide flows. The Palmyra anchored on a bank near its northwest side, in 20 fathoms, on a sandy and coral bottom, three-quarters of a mile from the island.

The Porpoise sighted this island, and found the position assigned it correct. It is low, and cannot be seen over 10 or 12 miles in fine weather. Water and fruits may be obtained in small quantities.

It is to be regretted that all these detached islands should not be visited by our national vessels, and friendly intercourse kept up with them. The benefit and assistance that any shipwrecked mariners might derive from their rude inhabitants, would repay the time, trouble, and expense such visits would occasion.

NECKAR ISLAND.

Neckar Island was discovered by La Perouse, in 1786. It is half a mile in circumference, and rises perpendicularly from the sea to the height of 350 feet. Against it the sea beats with violence, so as to make landing impracticable. It may be seen in fine weather 15 miles. According to our observations, it lies in latitude 23° 34′ 40″ north, longitude 164° 42′ 40″ west. Variation was determined to be 11° easterly. Soundings extend 2 miles from it to the eastward, in from 13 to 34 fathoms.

FRENCH FRIGATE SHOAL.

This was also a discovery of La Perouse, in 1786. On its northwestern extremity there is an islet, composed of sand, from which rise jagged rocks 150 yards in diameter, to the height of 100 feet above the level of the sea. The north point of this shoal lies in latitude 23° 45′ north, the south point in latitude 23° 34′, and the east side in longitude 165° 59′ 15″ west. The bank extends in a west-northwest and east-southeast direction, 15 miles.

GARDNER'S ISLE, OR MAN-OF-WAR ROCK.

Man-of-war Rock was discovered by Captain Morell, in 1825. It lies in latitude 25° 03′ north, and longitude 167° 52′ 45″ west. The position of this island was correctly determined by Captain Stanihowitch, of the Russian Navy. It is a bare rock, having a reef extending from its southwest extremity.

TWO BROTHERS, OR REEF SHOAL.

The position of this shoal is given in latitude 24° 14′ north, longitude 168° 30′ west. On it the Two Brothers was lost. It requires a new determination. The Porpoise and Oregon, from stress of weather, were unable to examine the locality sufficiently to determine its exact position. They saw no signs of it in the search they made. No appearance of a shoal was visible in the position indicated, and I am somewhat inclined to believe it may be another erroneous position for Gardner's Island. I have, however, retained it on the chart.

MARO REEF.

The Maro Reef was discovered by Captain Allen, in 1820, who named it after his ship. It was visited and surveyed by two of the vessels of the Expedition. It lies in a direction northwest and southeast, is 10 miles in length, and 5 miles in width, which includes the lagoon. The reef itself is not wide, and nearly awash; heavy breakers extend on its northwest, north, and east sides. On the southwest side there are some sunken patches, which lie between its two southern points. According to our determinations the east side is in longitude 170° 31′ 30″ west: its western extremity being in 170° 37′ 36″ west longitude. The latitude of its southern point we place in 25° 21′ 00″ north. It is an extremely dangerous reef, and vessels should be careful to avoid it, when in its neighborhood at night. In the daytime it may be seen 6 or 8 miles. The current in its neighborhood was found to set north-by-west.

LAYSON ISLE.

Layson Isle is an American discovery. It is a small lagoon island, nearly round, above 6 miles in circumference. It was also seen by Captain Stanihowitch, of the Russian Navy, who gave it the name of Layson. His determination I have adopted. He places it in latitude 25° 46′ north, and longitude 171° 49′ west. It is inhabited, but does not afford any supplies. It may be seen 8 or 10 miles in good weather.

LISIANSKY ISLE.

This isle was discovered by Captain Lisiansky, in 1805. It is quite a small island, situated in latitude 26° north, and longitude 173° 45′ west. In 1827, Captain Stanihowitch discovered a dangerous reef which had not been seen by the discoverer. The east point of the reef lies 7½ miles south 41° east from the northwest point of the island, and its western point at the distance of 3½ miles.

PEARL AND HERMES REEF.

This is one of the most dangerous reefs in the Pacific Ocean, on which the two vessels whose names the reef bears were wrecked, in 1822. It lies in a northwest and southeast direction; is 90 miles in length. It has many sand-islets upon it, and near to the centre two which are larger than the rest; these are called Pearl and Hermes. Its northwest extremity lies in latitude 28° 22′ north, longitude 177° 32′ west; its southeast extremity in 27° 31′ north, and 176° 28′ west. It is somewhat in the form of a crescent, with its bow turned towards the northeast. The Russian navigators give the situation somewhat different, but I have retained the determination which I believe to be the most correct. There is an anchorage on the west side near the larger islets. The island affords little that can be worth seeking; care should rather be taken to avoid it, unless necessity or interest compel a visit. That part of the squadron detached for the survey of the Western Groups were unable to sight these dangers, in conse-

quence of the shortness of their provisions, so that we were unable to get a confirmation of the position which I have here given, and believe to be correct.

ISLE CURE.

The Isle Cure is an American discovery, but to whom we owe it is not known. It lies due west of the northern point of the Pearl and Hermes Reef, 50 miles. It is but 2 miles long, northeast and southwest. It has a reef lying 4 miles on the west side, which extends some 6 miles to the north. Captain Stanihowitch, of the Russian Navy, who visited it in 1827, gives its position in latitude 28° 27′ north, and longitude 178° 23′ 30″ west, which corresponds with other authorities, and which I have adopted.

BYER'S ISLAND.

Byer's Island was seen by Captain Morell, in 1823. He gives it as 4 miles in circumference, and describes it as having a good anchorage on its west-southwest side, and a reef extending for 2 miles off its southeast point. The position assigned by him is in latitude 28° 32′ north, and longitude 177° 04′ east.

Byer's Island was intended to be sighted for a new determination of its position, but from the reasons above given, it was impossible to do so. Some have questioned its existence, but I have no doubt of it. In order to draw attention to it, I have placed it upon the chart, adding the doubtful sign.

MALLOON'S ISLAND.

Malloon's Island was reported as being situated in latitude 19° 26′ north, and longitude 165° 15′ west. We examined this position carefully, passed from 110 miles to the eastward of its assigned place, on the above parallel, to 60 miles west of it, but no indication whatever of land was seen. Another island was searched for in 19° 17′ north, and 166° 48′ west, and also a shoal, in 18° 20′ north, and 170° 30′ west, in the same manner, but there was no signs of either.

JANE'S ISLAND.

Jane's Island was looked for in or near the position assigned it, 16° 34′ north, and 173° 20′ west. It cannot exist hereabouts, or we must have seen it; the weather was extremely clear, and enabled us to take in an extensive horizon. In this neighborhood we experienced a strong current setting to the northward, which continued for two days, causing a difference in our reckoning of 36 miles.

AVON ISLAND.

Avon Island has a position on many charts, yet the authority for it is unknown. I have been induced to adopt it from the representatiens of many who believe it does exist in latitude 13° 05′ north, and longitude 168° 30′ west; but I consider the position given it as very doubtful.

There are two shoals reported to the west of Avon Island, in 13° 36′ and 14° 40′ north latitude, in longitude 170° 30′ west, which rest on the same authority as the island. From falling to leeward of these positions we failed to examine them.

SMYTH'S ISLAND.

Smyth's Island was seen by one of the vessels of the Exploring Expedition. Its reef encloses a lagoon, 10 miles northeast and southwest, and 5 miles wide. The island is similar to those of coral formation in the North Pacific Ocean, with several small islets, joined by extensive reefs, and many outlying rocks. There are two low islets on the northwest side of the reef; the eastern one, a mere sand-bank, the western one slightly elevated, covered with verdure, but no trees. The position of the last is in latitude 16° 48′ north, longitude 169° 45′ 36″ west. The reef lies deep, and cannot easily be discerned until within two miles of it, even with a heavy sea upon it. Captain Johnston, of the frigate Cornwallis, who discovered the island in 1807, gives its position in latitude 16° 53′ north, and longitude 169° 32′ west. The

islets are low, but covered with wood, and can be seen some 10 miles in fine weather. Several other navigators have sighted these isles: they agree very nearly as to the position we assign it in longitude, though differing somewhat in latitude, and the trending of the reef. I am satisfied that the positions above given are correct, the result of good observations made close to the island. The islets not being inhabited do not offer any refreshments for vessels, nor is there any anchorage. In the season, from August till October, turtle may be found on it.

GASPAR RICO ISLAND.

Gaspar Rico Island was discovered by the early Spanish navigators, who placed its position in latitude 14° 30′ north, and longitude 168° 42′ east. As there have been many situations of this island reported, I determined to make search from 175° 30′ west to 174° east longitude, and between the parallels of 14° 30′ and 15° 10′ north, in order to prove if any island did exist resembling that cluster. But after careful and close examination by daylight, there was no indication of land seen. The search I consider sufficient to disprove the existence of any island within this space.

CORNWALLIS ISLAND.

The position of Cornwallis Island, in latitude 16° 50′ north and longitude 169° 30′ east, was passed over by the Expedition, but no traces of land seen. I am inclined to believe, with other authorities, that it is to be considered identical with that of Smyth's, in west longitude. That it does not exist in the above situation, or within 50 miles of it, on its supposed parallel, I am well assured, as we searched from the eastward to the westward more than that distance on it. Another locality of a doubtful island, in the neighborhood of the position of Cornwallis, viz., in latitude 16° north, and longitude 171° 40′ east, was also passed over, but nothing was perceived which indicated land.

MORELL ISLAND.

This island was discovered by Captain Morell, in 1823. It is described as a small island, not over 4½ miles in circumference, of coral formation. A reef projects on its west side to the distance of 15 miles, and from its southeast side, to the distance of 10 miles. Its latitude is 29° 57′ north, and longitude 174° 31′ east. The Flying-Fish, one of the squadron, passed just to the westward, but did not see it. There is no doubt of the existence of this island and its dangerous reefs.

NEW NANTUCKET ISLE.

New Nantucket is reported to be a low coral island, of small dimensions, with but a few trees on it. Several islands have been reported near its position in the same latitude to the west; it is probable they are one and the same. I have retained the name of New Nantucket. Its longitude is not well established, and requires another determination. Two positions reported were passed over at different times by vessels of the squadron; the one situated in 00° 11½′ north, and longitude 176° 20′ west. If navigators should be passing in its neighborhood, it would be well to keep a bright lookout for dangers, as the position of this island may be in error, from 1° to 2°, probably, to the west of that above given. It offers nothing to tempt a visit, except turtle, in their season. A rock is also reported to exist 200 miles to the west; this I have also retained on the chart, but I am not satisfied that it exists. A reef has also been reported 60 miles northwest from the rock, which would place it in latitude 1° north, and longitude 179° 34′ east.

SAN PABLO ISLAND.

San Pablo Island is reported to exist in latitude 16° 07′ north, and longitude 179° 00′ west. Here it certainly does not exist; the position was passed over, and the search continued from 40 to 50 miles to the eastward and westward of it, but no indications of land perceived.

MILLE GROUP.

The Mille Group, reported to be in latitude 6° 12′ north, and longitude 172° 22′ east. This position was passed over and no land seen.

ARROWSMITH'S ISLAND.

Arrowsmith's Island is one of three islands lying in the Rulick or Eastern chain of the Radick Isles. It is a coral lagoon island, and inhabited. Its length lies in a west-northwest and east-southeast direction; it is 18 miles in length, and 11 miles in width. The southeast end was found to be in latitude 7° 05′ north, and longitude 171° 23′ 54″ east. It forms the western side of the Fordyce Passage.

PEDDER AND DANIEL ISLANDS.

Pedder and Daniel Islands are both of coral formation; they lie on the east side of the Fordyce Passage. They are small islands, with lagoons, lying northeast and southwest from each other, distant 20 miles, and the same distance from Arrowsmith's Island. Both are inhabited; and when passing through the Fordyce Passage, which is free from danger, they may be seen, the latter from the masthead.

MULGRAVE ISLAND.

Mulgrave Island was sighted, and its position determined to be in latitude 5° 59′ north, and longitude 172° 02′ 33″ east. This differs some 13 miles from the determination of Duperrey in latitude. It is low, extends 2 miles north and south, and 1½ miles east and west. Several small islets are situated on the reef which surrounds the lagoon. The island is inhabited: the natives resemble those of the Caroline Group. A few supplies may be obtained.

BONHAM ISLAND.

Bonham Island was discovered in 1809; it is a lagoon island. It lies 150 miles west of Mulgrave. It has 4 large and 20 small islets on its rim of coral, surrounding the lagoon, which is 30 miles in length, northwest and southeast, by 20 in width. There are three entrances into it on the northwest and southeast sides. The latitude of its centre is 5° 53′ 45″ north, and the longitude 169° 36′ 16″ east. It is inhabited.

HUNTER ISLAND.

Hunter Island was discovered by Captain Bond, in 1809. It is a small coral island, 1½ miles north and south, and ⅔ of a mile east and west, including the reef. It has no lagoon, and is elevated towards the centre. The latitude of its centre is 5° 42′ north, and longitude 169° 05′ 46″ east. It lies west from the south end of Bonham.

BARING ISLAND.

Baring Island lies west-southwest of Hunter Island, 40 miles. It is a small low coral island, without a lagoon; was discovered by Captain Dennet; is inhabited, and situated in 5° 34′ 42″ north, and 168° 26′ 24″ east.

FAROILEP AND FEIS ISLANDS.

Faroilep and Feis Islands were searched for along the parallels on which they were supposed to exist, viz.: 8° 36′ and 9° 47′ north, but there were no signs of land seen near the longitude assigned them. The determination of these islands by Leutke must be correct, who gives their position in longitude as 144° 36′ and 140° 38′ east.

OULOUTHY OR M'KENZIE'S GROUP AND SHOAL.

The eastern extremity of Oulouthy or M'Kenzie's Group is placed by us in 10° 07′ 53″ north, longitude 139° 54′ 58″ east. The southern extremity in 9° 46′ north, and 139° 44′ east. It is composed of an eastern and western island; which are separated by a passage of 8 miles. The western island is upwards of 20 miles in length, north

and south, and consists of a large number of islets, which are joined by the coral reef. There are passages into the lagoon, some having 7 fathoms depth of water. The inhabitants are numerous and appeared friendly. They have had frequent intercourse with the whites. Supplies may be obtained.

WAKE'S ISLAND.

Wake's Island was discovered in 1796. It had been repeatedly searched for, but not seen. In the Vincennes, we were fortunate enough to discover it, by pursuing a route some 15 miles to the north of that of Beechey. This led us directly on its parallel, and enabled us to re-determine its position and make an accurate survey of the island.

Our observations were made on shore, placing it in latitude 19° 15′ north, and longitude 166° 30′ east. It is a low coral Island, in shape an obtuse triangle, its length or base lying east and west. The length of its longest side is 4 miles, and that of the two others, 2 miles. Its south side has a narrow fringe of coral, while on the north it extends upwards of a mile. Its vegetation is quite stunted, and the island has the appearance of being at times submerged, which would cause it to resemble an extensive reef rather than an island. There are no inhabitants, but quantities of birds, and in the season, turtle. There is no water, and the stunted growth does not afford any wood.

WAKE'S REEF.

Wake's Reef, which is reported to lie some distance east of Wake's Island, having been searched for without success, I have but little doubt may have arisen from the appearance of that island at a time when it was partly submerged, and through an error in the position of the vessel, assigned a more eastern longitude. The position of Wake's Reef is given in latitude 17° 40′ north, longitude 172° 40′ east.

HALCYON ISLAND.

Halcyon Island, I believe, has no existence. Two of the vessels of the Expedition passed over its site, and on the same parallel on which it is said to be, but saw nothing of it. The only supposition I can offer for its existence being reported is, that it may have been Wake's

Island which was seen, and an erroneous position to the westward of that island assigned it, as has been the case with Wake's Reef to the eastward. Both of these I have omitted on the chart of the Pacific Ocean, but it may be advisable to give also the supposed position of Halcyon Island, that navigators may, when passing, sail on other parallels in search of it. Its latitude is given as 19° 13′ north, and longitude 163° 30′ east.

FOLGER'S ISLAND.

Folger's Island was searched for by the squadron in the locality assigned it, viz., latitude 18° 21′ north and longitude 155° 19′ east, but no signs of land were discovered, or any indications of its existence. It is impossible to account for the many erroneous positions of islands which are found on the charts, and still remain there after a careful search has disproved their existence. Folger's Island is one of these, which lies in the route of vessels bound to China from the coast of South America, and must, if it had existed, been frequently encountered by them. Our search extended on the parallel some degrees to the eastward and westward of its assigned position.

BIGINI ISLAND (PESCADORES).

Bigini Island was discovered by Wallis, in 1767. The island is nearly of a triangular shape, of coral formation, and has a lagoon. Its eastern side trends north-northeast and south-southwest, 10 miles; its western nearly north-northwest, 10 miles; and its northern side west-by-north and east-by-south, 8 miles. Its greatest length north and south is 10 miles, and it is also 10 miles east and west. There are three large and seven small islets; the first are situated at or near its angular points. The reef or rim of coral is nearly awash, except near the islets or where a low sandspit rises above, on its western side. This makes it a dangerous island to approach, particularly as its north and south points project; it cannot be seen over 6 or 7 miles in clear weather. The vegetation on the islets consists of but a few low bushes: there was not a cocoanut or pandanus tree on either of them at the time of our visit. At the northwest side there is a boat-opening into the lagoon, and another about the middle of the north

side. Anchorage is found within. The island affords nothing on which human beings can subsist. It has no inhabitants, and is probably only resorted to by the natives of the neighboring islands during the turtle season, or while in pursuit of the pearl fishery. At this island Captain Dowsett and his boat's crew were treacherously murdered by the natives.

RADOGALA AND KORSAKOFF ISLANDS.

Radogala lies 19 miles west of Bigini. Instead of but one island, as reported by Kotzebue, there are two. I have therefore determined to retain both names: Radogala to the largest and most eastern island, and Korsakoff to the smaller or western island. The island of Radogala is a low coral island, with a lagoon; it is above 20 miles on each side, and in shape approaching a square. The longest side is on the north, and trends nearly west-northwest and east-southeast; the west side trends north and south; the south side is parallel with the north; and the east side from its extreme east point trends southwest, which curves westward, forming a large crescent-shaped bay. The eastern side from Kumi Islet to the south extreme is a range or string of small islets and sandbanks, the latter not much above the reef. Rimsky Islet is the largest, and of some extent: it forms the southeast point; from it to Tufa Islet it is 12 miles, west-northwest, which is the extreme south and west point. Near the middle of the south side there is an opening, 1½ miles wide, into the lagoon, having a sand-islet on a reef in its middle, on either side of which there is a passage for vessels: the westernmost one is the best, and anchorage may be found within under either islet. Radogala is inhabited by a few natives, with whom no communication was had. The islets offer but little sustenance. Kotzebue reports that he saw some cocoanut or pandanus trees. None were seen on it by us; they have probably been destroyed.

Korsakoff Island lies 15 miles to the southwestward of Radogala; it is also a low coral island, with a lagoon. It trends east-southeast and west-northwest, is 14 miles in length, by 4 in width. There is an entrance into the lagoon on the south side, over a mile in width, which is bounded on each side by an islet. There are seven islets on its south side, connected by the reef, which is awash in places; the

north side is a bare reef, on which the sea breaks. No natives were seen on this island, and there is believed to be no permanent inhabitants, for it has not wherewithal to sustain life.

ASSUMPTION AND GRIGAN ISLAND, WITH THE MANGS.

Grigan lies to the south of Assumption, the northern island of the Marian or Ladrones. It is high, and makes from the northeast in the shape of a dome. As vessels generally pass between it and Assumption, I was desirous of fixing their true positions, and that of the Mang Rocks. According to Freycinet, the Mangs lie in the channel between them; but we found the Mangs to lie to the northward of Assumption, 20 miles. The north end of Grigan we made in latitude 18° 48′ north, and longitude 145° 50′ east. It was my intention to have sought a harbor on the west side of the Island of Grigan, to obtain water, and make it a magnetical station, but my time did not permit of the delay. The distance between Grigan and Assumption Island is 50 miles; this space is entirely clear. Assumption we place in 19° 43′ 30″ north, and longitude 144° 48′ east. Its height above the sea was determined to be 2090 feet.

When passing this group it is advisable for vessels to keep a middle course between Grigan and Assumption, by which they will not be subject to be becalmed, as would be the case by a near approach to either of these islands. The Marian Islands seem to intercept the course of the easterly winds, which prevail with steadiness from the eastward to their meridian, but after passing them vary to the southward and westward, and become uncertain.

COPPER ISLAND.

The Copper Island of west longitude, as before remarked, was sought for unsuccessfully. The charts place the position of the one of eastern longitude in 20° 05′ north, and 131° 50′ east. In this position it does not exist, for we passed directly over the place, in fine weather, and had a most favorable opportunity for the search, with a smooth sea and very clear horizon; but nothing like land or indications of it were to be seen.

ABAJOS ISLAND OR SHOAL.

The Abajos Island or Shoal is reported to lie about 3° to the westward of Copper Island, and some 20 miles to the southward of it. Although represented to be some distance apart, I thought it very probable they might be identical; its locality was therefore passed over, to make it certain that it did not exist there. It is difficult to conceive how so many of these islands and shoals should be reported to exist, in latitudes where the appearance of land must be always distinct, and the discovery of an island so remarkable an event that it could not be mistaken.

SABTANG, BATAN, AND RICHMOND ROCKS, IN THE STRAITS OF BALINTANG.

We passed through these straits, between the islands of Sabtang and Batan on the north, and the Richmond Rocks on the south. The islands are all high, and that of Sabtang has many remarkable peaks, rising between 900 and 1200 feet above the level of the sea. On the meridian of the west point of Sabtang we made the longitude 121° 50′ 11″ east. The transit bearing of Sabtang and the northwest point of Batan was north 18° east, that of the east point of Sabtang and Richmond Rocks, north 35° west. The latitude was found to be 28° 18′ north, being situated 9′ farther to the north than was given. The course steered through these straits was west-by-south. Strong currents prevailed, and many ripples were seen. The current was found to set to the northward and westward.

CHAPTER XV.

HAWAIIAN OR SANDWICH ISLANDS.

THESE islands have long been considered as holding an important position among the groups of the Pacific, and situated as they are midway in the North Pacific, will continue to be one of the principal resorts of our whaling fleet. From them a large part of the supplies are drawn for repairs, and the health of their crews is re-established. Besides these aids, they now afford recreation and amusement to our fellow-citizens, after having undergone for months their toilsome avocations. I therefore deem it necessary to give a full description of the facilities these islands offer to our shipping interest, their anchorages, and sailing directions to their different ports. For an account of their moral, social, and political condition, I must refer to the fourth and fifth volumes of my Narrative of the Exploring Expedition.

The Hawaiian Group includes eight islands, viz.: Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai, and Niihau, which are enumerated in order from east to west. There are besides three rocky islets, viz.: Kaula and Lehua, off Niihau, and Molokini between Maui and Kahoolawe.

The Island of Hawaii, the most eastern of the group, has a seacoast of 240 miles, and is nearly equilateral in shape. The western side trends north and south, while the other two sides towards the east, extend in a northeast and southeast direction. Hawaii is the most elevated of the Pacific Islands, its mountains rising to the height of 14,000 feet, nearly to the line of perpetual snow. It is of volcanic formation, and its shores are what may be termed iron-bound. Unlike the islands of the Pacific within the coral range, it has no reefs to form harbors, and has but one or two small bays partially protected by sunken reefs; that of Hilo is the best. There is no place

where a vessel can undergo repairs. Hawaii can be seen in clear weather at a great distance. Its rise is so gradual, that few are prepared to admit its elevation. It has four distinct elevations, Mauna Kea, Mauna Loa, Hualalai, and Kohala. The greater part of the island is covered with forest, except where the indurated lava has flowed over. But comparatively a small portion of this island is susceptible of cultivation. Nearly all the population reside on the seashore, where the climate is mild, and the productions of the tropics are obtained with little labor.

Hilo Bay is the only anchorage on the northeast side for vessels. It is much exposed to the swell of the ocean, being but litle protected by the sunken coral reefs, which lie to seaward of the anchorage. This bay is 3 miles wide by 2 miles deep. It is not difficult to enter, but requires some precaution. Vessels intending to anchor in Hilo Bay, should stand in for the southern part of Mauna Kea, if it can be seen. When the sea-breeze or trade-wind, which generally prevails, blows fresh from the northeast, steer directly for the gulch on the west side of the bay. A southwest course per compass will lead clear of the point of the reef, which lies east from it. On the reef the sea usually breaks. A vessel should not approach nearer the reef than ten fathoms, and if becalmed when on soundings, it is advisable to anchor until the breeze springs up. Soundings will be had within about a mile of the reef, in 30 fathoms; coarse gravel and sand, to the northward of the reef, but if to the eastward, fine sand. The sea-breeze seldom blows strong in the early part of the day, and generally fails when it encounters the land-breeze, about 3 miles from the shore. When Cocoanut Island bears to the eastward of south, steer in for the conical hill back of the town of Hilo; this course will lead clear of the west point of the reef. Cocoanut Island has three black rocks lying to the north of it. When Cocoanut Island bears southeast, steer for the mouth of Waiakea Creek, at the eastern point of the beach, and when the black rocks off Cocoanut Island and East Point come in range, anchor in 5 to 6 fathoms water, soft mud and sticky bottom. There is no occasion to moor, but the anchor should be dropped with a long scope of cable laid out to seaward: there is sometimes a heavy sea setting in, but the wind does not blow home, and a vessel will ride by the bight of her cable to all the other winds. The afternoons and evenings are usually calm. The sea-breezes are accompanied with rain showers. Water is obtained in the Waiakea River,

where it is to be had in abundance. There is sometimes difficulty in entering the river, on account of the surf which breaks across its mouth, and boats are liable to be swamped; they should keep the centre of the channel, and not attempt to enter unless it is smooth. Landing on the beach is always difficult. Opposite the town the surf at all times is heavy, but at Observatory Point, near Waiakea Creek, it is safe. Supplies can be had here, but not in such abundance as at Oahu. The latitude of the observatory was determined to be 19° 43′ 51″ north, and longitude 155° 03′ 06″ west; the variation 8° 50′ east.

The East Point of Hawaii (Kapoho), lies in longitude 154° 54′ west, latitude 19° 34′ north. The southeast side of the island is nearly a straight line, bounded by a rocky and iron-bound coast. There is no landing or shelter, even for small vessels, on this part of the coast. From Kalae to Pohue on the south, a distance of 20 miles, the shores are likewise iron-bound. The coast from Point Pohue to Point Kawili takes a northerly direction for 9 miles, then as far as Point Mano, a distance of 32 miles, it makes a considerable bend to the eastward, and within this distance lie the bays of Kealakeakua and Kailua, both being under the lee of the island. They were formerly much frequented by vessels touching at this island for supplies. The former, on account of being the place where the celebrated Captain Cook lost his life, will always be a point of interest to the navigator. It is seldom frequented now: vessels prefer to resort to the ports of Lahaina, on Maui, and Honolulu, in the Island of Oahu. The bay is half a mile in width, by the same in depth. The anchorage at Kealakeakua is exposed from the north by the west to south, but the sea is generally quite smooth and calm under the lee of this high island. The soundings extend off very gradually upwards of a mile, to the depth of 18 or 20 fathoms. The best anchorage is in about 10 fathoms, coral mud and sand, good holding-ground, with the village bearing east. At the head of the bay there is a small beach, on which the village is situated, but elsewhere the rocks rise perpendicularly from the sea. The landing is neither difficult nor dangerous. There is no water to be had here, except what the natives bring in their calabashes from the mountain springs; and those in search of provisions and fruit, had much better resort to the Islands of Maui or Oahu. Standing in for the Bay of Kealakeakua, it is necessary to avoid approaching too near the land, either to the southward or northward of it, as vessels are liable to be becalmed and detained for some hours. The best course

is to approach it directly from the westward, when either a favorable eddy breeze from the west or the light wind coming over the island, may be taken advantage of, to reach the anchorage in the least time. The latitude of Kealakeakua Bay was made in 19° 28′ 12″ north, and longitude 156° 00′ 00″ west. At Kealakeakua Bay, there is but little trade carried on; it is now seldom visited by vessels.

Kailua Bay lies 12 miles to the northward of Kealakeakua. It has a small harbor for native craft, and lies immediately at the foot of Mauna Hualalai. The shore is rugged and bold, with but little space for cultivation. It is not a good harbor, and offers little to induce a visit.

The village of Kailua is thriving; it is the residence of the Governor of the island. From Kailua the coast trends west-northwest to Point Mano, which is the most western point of the island. It lies in latitude 19° 43′ north, and longitude 156° 10′ 30″ west. From Point Mano, the coast again turns to the north 10 miles, to Wainanalu, thence it sweeps to the eastward 15 miles, to the roadstead of Kawaihae, which is situated in latitude 20° 03′ north, and longitude 155° 57′ west. Kawaihae is the port or bay nearest to Maui and the islands to the westward, and there are many small native vessels which trade to this island, which only frequent this port. This bay is readily known by the gorge in the mountains that is directly behind it, in which lies the town of Waimea, where a lively trade is carried on by the natives shipping their productions to Honolulu, consisting of hides, tallow, leather, beef, wood, &c. The mountains rise from the coast to a great height, and the country has the appearance of a parched or burnt district. This port was first brought into notice by Kuakini, well known under his English appellation of Governor Adams. The Bay of Kawaihae does not deserve the name of a port. Being under the lee of the island, it is difficult to reach; calms and light airs predominate; the trade wind sometimes blows very strong, rushing down the mountain side; vessels lying in the roadstead are frequently blown off. A peculiar squall, called by the natives *Mumuke*, sometimes bursts upon the bay a short time before sunset; its duration is not long, but of great violence; its coming is prognosticated by an illuminated streak, seen far inland, by the natives, who prepare in time to resist its violence; it is accompanied by quantities of sand. Oftentimes the native craft take advantage of it to escape beyond the region of calms that prevail under the high land

of the island. Navigators should also be on the lookout for these squalls in passing the island a little before and after sunset; they are felt some distance from the island, and extend into the southern part of the channel between Hawaii and Maui. The best anchorage off Kawaihae is with the gorge well open, in 12 fathoms water. Some supplies may be had here, but they are not as plentiful as at Maui or Oahu; wood can be procured of a good quality. As a place of resort it is by no means agreeable, the air being hot and stifling. The morning hours are the best to transact business in, and the shipment of cargo at that time does not meet with interruption from the weather.

From the Bay of Kawaihae the coast takes a trend due north to Cape Upolu, the northwestern angle of Hawaii, a distance of 16 miles. This is a moderately high cape, of a reddish appearance; it lies in latitude 20° 19′ 30″ north, and longitude 155° 58′ west. Near the cape is a sandy beach, but the surf seldom admits of a safe landing. From Cape Upolu the coast trends eastward to Waipio, 32 miles. It is a high and steep bluff coast, being much abraded and worn into deep ravines (called at the islands gulches), by the rains. At Point Niulu, 10 miles from Cape Upolu, is a coral sandbank; it extends some distance from the shore, but affords no shelter or anchorage. From Waipio the coast takes a southeastern direction to Hilo Bay, 37 miles distant, and continues to present the same perpendicular and iron-bound character, with many gulches, and black volcanic rocks lying within them and along the shore, on which the sea continually breaks. Some of these ravines present the appearance of being accessible, but they afford no shelter or landing, and are for the most part quite dry, the remains of mountain torrents that have for ages passed through them during the rainy season.

The tide in Hilo Bay rises 3 feet; high water, on full and change, at 1 P. M.

MAUI AND KAHOOLAWE ISLANDS.

The Island of Maui lies to the northwest of Hawaii, divided from it by a channel 19½ miles wide. Maui is a high volcanic island, formed by two oval-shaped mountains; the easternmost is the largest and highest: in one point it reaches the altitude of 10,000 feet above

the sea: while that to the west is smaller, rising to the height of only 5000 feet. There are several well-defined peaks, projecting above this mountain range, from its eastern to its western end. They are joined by a sandy plain, 3 miles east and west; it is quite low, and from a distance to the north, appears as though there was a passage between them. Many navigators have mistaken Western Maui for Molokai Island, and have hauled up, as they supposed, to pass through the Pailolo Channel, which lies between Molokai and Maui, leading into Lahaina Roads. This error resulted, in one case, in the entire loss of a vessel. West Maui, though the smallest, is of the most importance; and Lahaina, at its western end, is one of the principal ports of this group. To anchor there, vessels either go to the south of Kahoolawe, through the Avau Passage, or round the north and west end of West Maui, through the Pailolo Channel, and approach Lahaina Roads from the west. If a vessel wishes to anchor in Lahaina Roads, coming from the eastward, she ought, after leaving Hawaii, to steer so as to clear the west end of Kahoolawe. There is a passage to the north of Kahoolawe, between it and Maui, through which a vessel may sail. The Islet of Molokini lies in the middle, between the two, and is the only danger; but I cannot recommend this route to any vessel. The land of both islands is high, and a vessel may be becalmed in passing through, and experience much detention from baffling airs from all points of the compass, and not unfrequently be struck by heavy squalls, which from their suddenness as well as violence, would be very apt to cause the loss of light sails and spars.

The southwest point (Kealaikahiki Point) lies in 156° 42′ west longitude, latitude 20° 31′ north. A berth of 5 miles should be given to this point; off it lies Kuia Shoal, 1½ miles distant, on which there is but 1½ fathoms water.

A vessel may pass close to the shore within this shoal, but it is advisable to go outside farther to the south. The more room a vessel gives the west point of Kahoolawe the better; the breeze will be stronger, and cause the least delay in reaching the roadstead of Lahaina. When to the west of Kealaikahiki Point some 6 miles, the easterly breeze will be lost. Then the most western peak of West Maui will bear north 25° east (true); steer directly for it. About noon the sea-breeze sets in daily towards Maui, which will carry a vessel onward to the anchorage. Care, however, must be taken not to ap-

proach too near to Maui. When far enough in to open out all the high land of Molokai, steer for Lahaina; having the Palace and Fort in sight, head directly for either of them. The best anchorage is within a mile of the shore, in 17 fathoms water, the Palace bearing south 76° east; High School, north 43° east, and Point Halawa on Molokai just shut in. The anchorage is not of great extent, but a vesel during the fine season, from April till December, is perfectly safe. In the months of January, February, and March, the southwest winds prevail, when it is dangerous for vessels to ride out a gale there. Of these gales, timely warning is given by the long swell from the southwest; then a vessel should prepare to leave, and by no means attempt to remain at the anchorage. The north side of Maui offers a good lee during these gales, and it is advisable that vessels should take advantage of it when driven from the roadstead. This is the mode adopted by the ill-found native craft, who continue under the lee until the return of fine weather permits them to resume the anchorage. The duration of these gales is some three days, but they seldom happen more than once or twice during a season, and years pass when none are experienced. Lahaina is the only place for vessels to anchor at on the shores of Maui, an island having a sea-coast of 100 miles, the greater part of which is an iron-bound shore, along which a heavy surf breaks over sunken and outlying coral reefs.

Intending to visit Lahaina Roads, and approaching from the north, care should be taken to be sure of the correct bearings of the west end of Maui; it lies in latitude 21° 03′ north, and longitude 156° 39′ west. The appearance of the west end, in coming from the northward, is a high, black, and knotty bluff, gradually rising to the eastward in mountainous land. Molokai, the next island to the west, has the appearance of a high, narrow, and level headland, stretching to the southwest, and of a much less altitude than West Maui: from this description it would appear almost impossible that the one could be mistaken for the other; but having felt a doubt myself, I can easily understand that it may occur. After the trade has been blowing for some hours, towards the afternoon, the whole highland is obscured by a thick haze, which envelopes both islands, quite impenetrable to the sight, with or without the aid of telescopes, and gives the low isthmus the appearance of the strait between Maui and Molokai. By taking the bearing carefully, it will at once lead to a correction of the error, the apparent passage being nearly south, while the true one leads

southwest. After passing into the Pailolo Passage with a strong trade, it is advisable to keep close to its eastern side. There are a few outlying rocks, but nothing beyond half a mile from the shore. When turning round the point of the island, the shore may be approached nearer, and as soon as the anchorage is opened, haul up for it, reducing sail as occasion may require; by this means a vessel will reach a berth without making a tack.

The town of Lahaina is the residence of the king, and has a population of 3000. The roadstead is one of the principal resorts of our whale ships, where they recruit their crews and obtain a supply of provisions and water. The landing at low water is bad; the tide falls below the coral reef, which extends from the shore. A narrow and tortuous channel for boats leads through it. At high water, boats can pass over the reef and land at almost any point on the beach; the principal landing, however, is close to the Fort. The supplies consist of beef, potatoes, taro, fruits, and wood; the water is pure and abundant. There is here a Seamen's Chapel, built by the contributions of our whaling fleet; in this, one of the missionaries usually officiates on the Sabbath. The police of the place is good, and there is freedom from annoyance to masters of ships in consequence of it. Grogshops are comparatively few, and there are no enticements for sailors to visit the shore. The place is healthy, and well fitted for the re-establishment of health.

The current at Lahaina usually sets along the line of the coast, running northwest 16 hours out of the 24; it sometimes varies in direction and velocity, according to the prevalence of winds. It is high water, full and change, at 2·30 P. M.

Rain seldom falls at Lahaina, in consequence of its being on the lee side of the island, but scarcely a day passes in which showers do not take place upon the mountains and descend in rivulets on the west side, affording every opportunity to irrigate the land. The soil about Lahaina is generally dry, and driven about in all directions by the violent flurries of wind, which sweep down the mountain side, and make it an uncomfortable place for a few hours in the day.

The Island of Kahoolawe offers no harbor or anchorage, nor has it any inhabitants except a state prisoner or two, who are exiled there for high crimes and misdemeanors.

LANAI.

Lanai is of an oblong form, rising to the height of 3000 feet. It lies 10 miles on the southwest of West Maui, and shields its roadstead from the Southern Ocean. It is but a mass of volcanic rocks, 20 miles in length, northwest and southeast, and with an average breadth of 8 miles. Its shores rise abruptly from the ocean. The strait between it and Maui is known by the name of the Avau Passage. It affords little ground for cultivation, and is only inhabited by a few fishermen, who have some temporary huts at its eastern end. It is alike destitute of cattle, water, and wood, and is generally capped with clouds, which give it at times a picturesque appearance. Its southwestern side is the most abrupt, rising in perpendicular escarpments, of a red ochre color. In passing to leeward of it, a vessel will feel the effects of its influence in the calms, a distance of 20 miles.

MOLOKAI.

Molokai lies nearly east and west, in length 30 miles, with a mean width of 6 miles. It is separated from Maui by the Pailolo Passage, 10 miles wide. The eastern half of the island is 2700 feet high, rising abruptly from a narrow strip of land between it and the sea, where cultivation is carried on. The western half is composed of low sand-hills, and defies all efforts at cultivation. Molokai has some 600 inhabitants, and is the residence of a missionary. Its inhabitants have had but little intercourse with foreigners. The surplus produce is carried to Lahaina, to be disposed of to the shipping; it amounts to but a small quantity. Vessels bound to Oahu, coming from northward or eastward, generally run through the Pailolo Passage, which is advisable, particularly if the day is far spent. The western end of Molokai offers a good lee to lay by under during the night. It is almost needless to say that this island has no harbors, or any certainty of obtaining supplies beyond a few fowls and some vegetables. When the trade-wind blows, it rushes through the Pailolo Passage with great strength, and violent flaws of wind are experienced, which renders caution necessary, in order to save the lighter spars and sails.

It is entirely free from rocks or shoals. Kalaua Point, the western point of Molokai, lies in longitude 157° 18′ west, and latitude 21° 06′ north. Its western coast trends north-by-east, and is but 5½ miles in length.

OAHU.

Oahu Island lies to the west-northwest of Molokai, distant 27 miles. Its form is an irregular four-sided figure, the northeastern side being 30 miles in length, while the remaining three sides are not over 20 each. Its surface is much diversified by two ranges of mountains, which run parallel to its longest side. They rise to the height of from 2500 to 4200 feet, having a valley between them, contracted on the north, but which gradually widens and opens into an extensive plain: this occupies the whole of the south side, bounded by coral reefs, to some distance from the shore-line, and watered by many streams, forming the safest and best harbors in the group; to these Oahu is indebted for its advantages over the neighboring islands.

The streams descend from both the mountain ridges, and joining in the centre of the valley, pursue an eastern course, and empty into the harbor of Ewa, which is capacious, when all its many branching arms are taken into consideration, and affords a depth of water sufficient for the largest vessels. Unfortunately, there is a bar across the mouth, which does not admit of vessels drawing more than 12 feet water. This could be removed, when Ewa would be superior to Honolulu as a port. Vessels would find no difficuty in entering and departing from it at all times of the day. This is not the case with the port of Honolulu, the entrance into which is only to be effected early in the morning, as the prevailing wind hauls a few points at that time. The eastern end of Oahu is readily known by the peculiarity of its headland, which is high and broken into numerous conical peaks, rising to a considerable elevation. Its easternmost point, Makapua, lies in 157° 40′ west longitude, and 21° 19′ north latitude. The coast from this point trends northwest 30 miles, and southwest 8 miles, to Kawaikua Point; from the latter, Leehi or Diamond Hill is distant 6 miles. Between these two, there is a considerable bay, but it offers no anchorage for vessels. In approaching Oahu from the eastward, Leehi or Diamond Hill may be distinguished

by its peculiar oblong form. It is one of the craters that are so often met with in the volcanic islands of the Pacific. The apex of Diamond Hill lies in longitude 157° 49′ west, and latitude 21° 15′ north. Diamond Point is low, and bounded by coral reefs of from ½ to 1½ miles in width, along which there are soundings and safe anchorage at the eastern part; from it the coast makes a sweep to the westward to Laeloa Point, a distance of 18 miles. Waiakea is at the foot of Diamond Hill, and was the place of anchorage when the island was first visited; but since the port of Honolulu has become known, few vessels have dropped anchor there.

The port of Honolulu is situated 6 miles to the northward and westward of Diamond Hill. The outer anchorage is safe in all months except those of January and February, during which southwest gales may occur; they always give ample warning of their approach, by the heavy swell setting in from that quarter, and sufficient time is afforded to leave the anchorage. The situation of this port may be readily recognized by the Punch Bowl Hill, a remarkable crater peak, which lies directly in the rear of the town; the best berth for anchoring in is to the eastward of the entrance to the harbor, with the Flagstaff on Punch Bowl bearing north 30° east; Diamond Hill, south 75° east; Bethel Church, north; Point Laeloa, north 85° west.

The harbor, as I before remarked, is formed by the coral reef. It is divided into an outer and inner one, neither of which is large, but for a small number of vessels it is sufficiently commodious. The bar is just within the outer line of the reef. To enter, the following directions should be followed. Vessels must anchor in the outer roads, if they reach the port after the morning has advanced. Before daylight, hawsers for warping should be prepared, and an anchor ready to drop under foot, and at early dawn to be under way. The breeze is usually light, but being to windward of the entrance, all sail is to be made, and everything prepared to shorten sail as quickly as possible. Stand down for the buoy, which is on the starboard hand, at the end of the coral reef to the eastward of the channel, in 10 feet water; run quite near to it, luffing up close to preserve full headway as long as possible, for the wind will be found too scant when in the channel for the sails to draw; they ought then to be at once clewed up, to avoid stopping the headway. The pilot has boats prepared to take out the hawsers, with many natives on the reef, to warp the vessel the mo-

ment the headway ceases, and to prevent her dragging on the lee reef. When the elbow between the outer and inner harbor is reached, the sails may be again used to pass into the inner harbor. The inner harbor, though not large, is convenient and safe. It is necessary to moor head and stern, on account of the smallness of space. The depth of water on the bar is sufficient to admit vessels drawing not more than 17 feet water. At the entrance of the passage there is a small shoal, called the Middle Ground, on which there is but 5½ feet of water: if there is any swell on, this ought to be carefully avoided. While in the act of entering or passing through the channel, if the ship's headway is stopped, and she begins to fall off, the anchor should be instantly dropped, and hawsers run out to the buoys on the reef. The authorities at Honolulu are always particular in having assistance ready on the reef to warp men-of-war, and they are in other respects extremely obliging in affording aid. The pilots are skilful and attentive, and perfectly competent to manage a vessel; their fees include services both for entrance and departure. Although there is no kind of difficulty in the latter, yet it is advisable to make use of them.

Honolulu offers the most convenient port for repairs among the islands in the Pacific. Very good mechanics are to be found there, and almost all kinds of supplies, excepting large spars, can be procured. Fresh provisions are abundant and good; they consist of beef, mutton, and all kinds of poultry; vegetables and fruits are plenty. Water is conveniently obtained up the creek, which empties into the harbor at the west end of the town, and it may also be had at the wells, but there it is not so good. It can only be obtained at high water, the water falling too low upon the ebb to admit boats to pass over the reef to the creek. It is believed that better arrangements have been made since our visit to supply vessels with this necessary article. The port of Honolulu is now the general resort of the whale ships that require repairs. With the exception of the enticements held out to crews, it is the best port for this purpose. Many of our vessels will hereafter resort to our own ports, in Oregon and California, which are certainly better adapted for refitting and refreshments.

As before remarked, Pearl River, or Ewa, does not afford sufficient depth of water for vessels. The time, however, may come when the Hawaiian government will be induced to remove the obstruction,—a

work of no great difficulty, as the bottom consists of irregular coral formations. It might be deepened to admit vessels of any draft of water.

From Laeloa Point, the coast trends northwest 18 miles to Point Kaena, on which no harbors are found, the shore being bold, and the spurs from the western range rising abruptly in many places from the sea, forming small coves, where landing is quite easy and safe. Kaena Point lies in longitude 158° 15′ west, and 21° 35′ north latitude.

From Kaena Point the coast trends northeast 16 miles to Kahuku Point. This portion of the coast is also protected from the prevailing winds. At Waimea, there is a good anchorage on a bank, in 12 fathoms water, but it is not used, except by small vessels, or those which may be in distress, and unable to reach the harbors to windward. The village of Waimea lies at the western end of the valley: it enjoys a good climate, and the neighborhood is productive. Its produce is similar to the rest of the island, and goes to the town of Honolulu for a market. The eastern coast trends northwest and southeast for 30 miles; it is the windward side of the island, is for the most part an iron-bound shore, and particularly towards its northern end, where the spurs join the coast. Farther to the southward, the principal range retires from the coast line, leaving an extended flat, of several miles wide, which is susceptible of cultivation. The line of this part of the coast has some coral reefs, which, though affording no safe protection for vessels, give some shelter for anchorage. One of these is Kaneoho: this is partly formed by the jutting out of the peninsula of Mokapu on its southeast side. South of Waimanalo, the mountainous range again approaches the coast, and forms an iron-bound shore. The highest points of Oahu attain the altitude of 4200 feet. The average height of the eastern range is 3000 feet, those of the western being less. The Island of Oahu may be seen at a considerable distance in the early part of the day, but when the trade wind sets in, it is usually enveloped in clouds. Vessels falling to the leeward would do well to beat up during the day, under the lee of the island; according to our experience, there is less current than beyond the range of the island, but after nightfall it is advisable to stretch well to the southward, and be in a situation to take advantage of the breeze, which after midnight varies to the southward and eastward a few points, and enables a vessel to make a good board to the northward and eastward. The latitude of Honolulu is 21° 18′ 40″ north, longitude 157° 52′ 15″ west.

KAUAI.

The Island of Kauai lies 64 miles to the west-northwest of Oahu: it is nearly circular in form, being 24 miles in diameter, and rises to the height of 4000 feet. It has several peaks, but none that are very pointed. From a distance, it appears somewhat dome-shaped. Spurs lead from the high land to the coast, where they form many barren and steep cliffs, with valleys between them, though of small extent, yet of great fruitfulness, being well watered from the numerous streamlets which descend from the mountain peaks, and receive their supplies by the continual depositions of the clouds. The indentations of the shores formed by these valleys, in a few instances, offer small havens, which, though not deserving the name of harbors, admit the embarkation of produce in the small vessels of the islands, and may be used as temporary stopping-places for vessels in want of supplies.

On the south and southeast are the small bays of Waimea and Kaneohe. Waimea Bay lies in latitude 21° 56′ north, and longitude 159° 43′ west. The harbor of Halelea lies on the north: it is the best port to obtain beef at, which can be purchased at moderate prices. This small bay is somewhat exposed to the sea and wind, but its landing is safe. It lies in latitude 22° 13′ north, and longitude 159° 34′ west. Both wood and water can be obtained at this island, but little else, and vessels may readily be supplied with them on a temporary visit; the natives prefer sending to Oahu to dispose of their products. The supplies derived from Kauai are very considerable.

NIIHAU.

Niihau is distant from the western part of Kauai (Kolo Point), 12 miles, and is divided from it by the Kaulaka Passage. This island lies northeast and southwest, 20 miles in length by 7 in width: it is of volcanic formation, and at first appears almost a barren rock, having little or no wood upon it. When compared with the other islands of the group it may be called low. It is remarkable for its yams and fruits, which come here to great perfection. At times there is a great scarcity of water on the island, rendering the cultivation difficult. Formerly, ships were in the habit of calling off the

island to procure a supply of yams, but it is seldom the case now, as vegetables may be had in plenty at the islands where vessels are obliged to stop and have intercourse. The southern and western end of Niihau lies in latitude 21° 45′ north, and longitude 160° 21′ west. There is anchorage in the bay, on the northwest side of the island, from one-half to three-quarters of a mile from the shore. Vessels intending to have communication with it, may stand boldly into the bay, until the west point bears southwest-by-west (true), and its north point northeast. The landing abreast of this position is practicable,—taking care to pass sufficiently clear of the Islet of Lehua and the rocks which lie off its northwest point, about 1¼ miles from the shore. Off the west point there is a reef, which extends upwards of a mile. To the south and west of the south end of Niihau lies the barren rock Kaula. It bears southwest-by-west, and is 16 miles distant. It may be closely approached and readily avoided. It lies in latitude 21° 40′ north, and longitude 160° 35′ west.

CHAPTER XVI.

OREGON TERRITORY.

STRAIT OF JUAN DE FUCA.

In approaching this strait, I have elsewhere mentioned that the coast, to the southward of Cape Flattery, is a dangerous one, on account of the numerous outlying rocks, and the prevalence of the almost daily fogs, which prove of serious difficulty and anxiety to all navigators. Many of these rocks are isolated, lie at the distance of several miles from the coast, and surrounded by water of the depth of 10 to 15 fathoms. The coast is high and iron-bound. On account of the currents, it is desirable to avoid this part of the coast, as they set for the most part on it from the northwest. I therefore deem it preferable, for vessels bound into the Strait of Juan de Fuca, to make the land of Vancouver's Island to the northward, which is visible a long distance to seaward, and can be perceived before that of the mainland to the southward of Cape Flattery. Having attained the latitude of 48° 30′ north, a due east course will lead a vessel to the centre of the Strait, into the fair channel-way, with the highland visible on both sides. Off Cape Flattery lies Tatooch Island and the Duncan Rock. Between these there is a safe passage. We passed through it in the Vincennes. It is well, however, not to attempt it unless with a favorable tide and a commanding breeze. Duncan Rock is a few feet above the water: when the sea is high it breaks entirely over it. To the north of the Duncan there is a small shoal, with three fathoms on it. When the tide is strong, it shows the position by whirls. From Tatooch Island, at the distance of five miles east-southeast (true), lies Scarborough Harbor, formed by a small bay and Neah Island, which lies off its eastern point. This harbor is protected from all but north and northwest winds, to which it is entirely exposed. It affords temporary anchorage for vessels bound in or out.

Water may be procured in small quantities. For large vessels, the anchorage to the eastward of Neah Island, between it and Sail Rock Point, is to be preferred; it is more easily reached than the harbor, where the flow and reflow of the tide is regular. Whilst lying within or at the mouth of the harbor, a vessel is liable to foul her anchors unless moored. The set of the tides outside is parallel with the shore. During the summer months fogs prevail after midday, which prevent or rather shut out the sight of the land from seaward; but if the latitude has been obtained, there is no need of apprehension: a vessel may stand on without fear. The wind is generally from the westward in the strait, but dies away a short time after sunset. The nights are calm. The fogs are indicated by a heavy bank of clouds to the westward, which, as the afternoon advances, gradually rises, and is driven in by the westerly breeze; they continue, or it remains hazy throughout the night. On the north shore of the strait, at its mouth, is the harbor of St. Juan. It is nearly opposite to Scarborough Harbor, and is exposed to the southwest winds; it is 1 mile wide by 3½ deep. Off Quadra and Makomek Points lie clusters of rocks, the Kaset and the Mush Rocks. The depth of water to anchor in is 9 fathoms. The holding-ground is good. Wood and water may be obtained at the head of the harbor, from a creek, near Siki Point.

In entering the Strait of Fuca, it must be borne in mind that the prevailing winds are either up or down the strait. If they happen to be in the eastern quarter, they will become more easterly, and the same if in the western quarter. The cause of this is, the high lands which traverse the length of Vancouver Island, on the north, and the Olympic Range, on the south. They attain the height of several thousand feet, and act as a funnel, through which the wind draws either way.

The direct course up the Strait of Juan de Fuca is east-by-south (true). It will lead to New Dungeness Point, which is 80 miles distant.

The Strait of Juan de Fuca is 95 miles in length, and has an average width of 11 miles. At the entrance, abreast of Duncan Rock, it is 8 miles wide. The Vancouver's Island shore is rocky, everywhere composed of a conglomerate and a reddish granite, containing several fine harbors, which have been lately surveyed by officers of the English government.

It was not in our power to survey either the north or south shore of this Strait, between Scarborough Harbor and New Dungeness. All

that we had time to do, was to make recognizance of the points, and to connect them. For the outline of the shore we are indebted to the Spanish surveys. There is a small harbor within Point Angeles, but its mouth is barred by a sandspit, which does not permit any but a vessel of small draft of water to pass in. The shores of the strait on the south is composed of perpendicular sand-cliffs, which rise gradually into high land, covered with forests of various species of pine. Mount Olympus is conspicuous to the south, rising to the altitude of 8138 feet, and is capped with snow.

The navigation of the strait by night is perfectly safe. The shores are bold; a vessel would almost strike her spars before her keel could touch. It is better to navigate on the south shore than on the north. The tides are more regular, and may be taken advantage of. They flow in a direction with the course of the strait; seldom with much velocity until they reach its eastern terminus, where they divide, a part running towards and through the Canal de Arro, and another to the south into Admiralty Inlet. A strong westerly wind on the ebb produces a heavy cross sea.

NEW DUNGENESS ROADS.

New Dungeness Roads is the first safe anchorage on the south shore. The point is low and sandy, extending from the high bluff, in the form of a sickle, to the eastward, between 3 and 4 miles. This sand-point forms the protection to New Dungeness Roads on the north-west, and vessels desiring to anchor there, must double around it, from a quarter to half a mile distant, standing into the roads from 1, to 2, and 3 miles, and anchor in from 10 to 15 fathoms, 1 to 1½ miles from the shore. Should it be the intention to proceed at once into Admiralty Inlet, stand on for Point Wilson, the high land of which will be visible to the east, on the starboard bow. A direct course may be steered for it, if the wind will permit. But if seeking some of the harbors to the northward through Ringgold's Channel, steer for Watmaugh Head, which lies northeast, which course will lead clear of Blunt's Island. Should night overtake, it would be advisable and is deemed more prudent to seek anchorage in Argus Bay and await daylight, than attempt to pass through Ringgold's Channel at night, where the tides are strong and set in various

directions through openings between the different islands. If this be decided on, then stand for Mount Erie, on Perry's Island, which will lead directly into that bay. The only dangers lying off are the Williamson Rocks. Wood and water may be obtained at an Indian settlement in the bay, and some provisions.

NAVY ARCHIPELAGO.

Navy Archipelago is a collection of 25 islands, having the Straits of Fuca on the south, the Gulf of Georgia on the north, the Canal de Arro on the west, and Ringgold's Channel on the east. They have been named from distinguished officers late of the U. S. naval service, viz., Rodgers, Chauncey, Hull, Shaw, Decatur, Jones, Blakeley, Perry, Sinclair, Lawrence, Gordon, Percival, and others. Most of them are of moderate elevation. Mount Constitution, on Hull's Island, rises to the height of 2356 feet. Hull's Island is the largest; it is indented by two deep bays, one of which has been called Ironsides, the other Guerriere Bay. It is composed of reddish granite and conglomerate; in some places the granite is seen to crop out. Both Rodgers and Chauncey Islands partake of the same character. On the north of Rodgers Island, and between it and Hull's, is President's Passage, 8 miles in length, by 1 to 2 in width. This passes into Ontario Roads, between Rodgers and Chauncey Islands, and again communicates on the south with De Fuca Strait, by the Little Belt Passage; on the north, the waters flow through Frolic Straits, into Ironsides Bay, and around the Macedonian Crescent, between Blakeley and Obstruction, Decatur and Blakeley Islands, again into Ringgold Channel. The soundings throughout these waters are very deep, seldom less than 30 fathoms.

RINGGOLD CHANNEL.

Ringgold Channel leads from the head of the Strait of Juan de Fuca to the Gulf of Georgia. It is 19 miles in length, by from 1 to 3 miles wide. On the east it is bounded by McLaughlin, Sinclair, Cypress, and Perry Islands; while on the west it has Hull, Blakeley, Decatur, and Chauncey. This channel trends nearly north and

south; a north-by-east course from off Point Watmaugh will pass clear of James's Island. The water is deep. There are but two dangerous reefs, the Bird and the Peapod Rocks, which lie near mid-channel; the first about 1½ miles south-southeast of James's Island; the former, between Hull's and Sinclair Islands.

CANAL DE ARRO.

The Canal de Arro lies between the Archipelago of Arro and the east end of Vancouver's Island; it is the shortest and most direct route into the Gulf of Georgia, from the Strait of De Fuca. The distance from Point Gonzalo, the southeastern extremity of Vancouver Island, to Java Head, the northeast point of the same island, is 22 miles. Henry, Stuart, Speiden, John's, Waldron, and Gourd Islands, lie near to and on the east side of the channel course, which is north half west: this passes to the west of Stuart Island, and between it and Noon Island; thence north 60° east, 9 miles, brings abreast of Java Head; then steer for Gourd Island, and stand over to the east for Point Roberts, on the mainland, to anchor in Drayton or Birch Bay. Point Roberts is 7 miles south of the boundary line. The Canal de Arro is free from dangers. The tides set very much in the channel course above indicated, which may be called the Fairway. The prevailing winds permit vessels to steer this course through it both ways. Should the wind be ahead, there is ample room for beating, and no dangers unless close to the shores of the islands. There are few places where an anchor can be let go, on account of the depth of water and the rocky bottom; but anchorage need not be resorted to, unless in case of absolute necessity, and those places indicated on the chart are the best.

DRAYTON AND BIRCH BAYS.

Drayton Bay lies east of Point Roberts, and has an irregular outline; its northern part is filled with mud, and bounded by a low marsh, through which one of the branches of Frazer's River formerly discharged. There is a cove on the east side, a snug harbor for small vessels. A small peninsula divides Drayton from Birch Bay. The

latter may be said to be included in Drayton Bay, which embraces the waters between Point Roberts and Point Whitehorn; the distance between them is 10 miles. The anchorage in all parts of Drayton Bay is safe, though somewhat exposed to the southwesterly winds. I prefer to anchor in the south part of it or Birch Bay.

Birch Bay forms a part of Drayton Bay; the water in it is not deep, ranging from 5 to 10 fathoms. The shores are low, and in places marshy. Water and wood may be procured here.

SANDY POINT.

The coast trends southeast. From Point Whitehorn to Sandy Point is 7 miles. The shores are moderately high, and the coast clear. To the south of Sandy Point lies Point Migly, the north end of M'Laughlin's Island, which is separated from the main by Hale's Passage.

HALE'S PASSAGE.

Hale's Passage is 6 miles in length by three-quarters of a mile wide; it leads into Bellingham Bay. The depth of water through it, ranges from 4 to 12 fathoms, and the current sets through it northwest and southeast.

M'LAUGHLIN ISLAND.

M'Laughlin Island is 8 miles in length by 1 in width; it is elevated, with abrupt shores. On the west side it is bounded by Ringgold's Channel. The Viti Rocks lie off Point Carter, its southern end; these rocks are visible at all times of tide. The water is deep close to the shore, which may be approached with safety.

BELLINGHAM BAY.

Bellingham Bay is 12 miles in length, northwest and southeast, and 4½ miles in width. Point Francis and Point William, which embrace the bay, are but 7 miles asunder. There is good anchorage in Bellingham Bay, in from 4 to 20 fathoms water. At its northern and southern ends are extensive mud-flats. The shores surrounding

these are low and marshy; but towards the centre the land rises and forms a bluff. Point Francis projects from the north shore in the form of an oval-shaped peninsula. Point William, the south point of the bay, is elevated; a tongue of land joins it to the main land, and separates it from Penguin Harbor. Near the centre of this bay, and between the two points, lies Eliza Island, triangular in form, one mile in length, by half a mile wide; it is separated from the south end of M'Laughlin's Island one mile. The entrance to Bellingham Bay is between Point Carter and Point William. Vendovi Island, three-quarters of a mile in diameter, nearly circular in form, lies between the two; either side of it may be taken. The Viti Rocks lie in the passage, but there is ample room to sail on either side.

PENGUIN HARBOR.

Penguin Harbor lies southwest of Bellingham Bay; it is formed by Point William and Vendovi Islands on the north and east; Lawrence Island bounds it on the south and west, and Sinclair Island covers it on the northwest; it is nearly 3 miles square. Jack's Island lies near the centre of it. The anchorage is convenient and safe, with a depth of water not exceeding 20 fathoms.

CYPRESS ISLAND.

Cypress Island lies on the west of Lawrence; its length is 4 miles, and greatest breadth 2 miles; its surface is much broken, and rises higher than those in its immediate neighborhood. On its west side is Strawberry Bay, protected by Hautboy Islet, and contiguous to Ringgold Channel. It is a convenient stopping-place for a tide. Good water and wood may be procured there. Leading north, between Cypress and Lawrence Islands, is a safe and deep passage through to Bellingham Bay. On the north end a conical hill rises to the elevation of 780 feet, and off its north point there is a small islet and rocks, half a mile from the shore.

SINCLAIR ISLAND.

Sinclair Island is also high, and separated from Cypress about three-quarters of a mile; it bounds Ringgold's Channel on the east. Between Sinclair, Cypress, and Lawrence Islands, are the Cone Islets.

HORNET HARBOR.

Hornet Harbor affords good anchorage; it has Perry Island on the south and Lawrence Island on the north; is 4 miles in length, east and west; its shores are bold. At its head there is a mud-flat, covered at high water; on the south is a small creek, 6 miles in length, which is passable for canoes: this communicates with Saratoga Passage. The marsh through which the creek runs is from 2 to 3 miles wide. There is a connection between Penguin and Hornet Harbors on the north, through Levant Passage; the water is deep and the tide runs with great velocity between the three islets and the east end of Lawrence Island, the flood setting in the direction of the arrows.

ARGUS BAY.

Argus Bay is situated on the west side of Perry Island, and protected on the west by Burrow's and Allan's Islets. The form of the bay is nearly semicircular, 3 miles long by 2 wide. Mount Erie lies due east of the anchorage. The Williamson Rocks lie off this bay, to the south of Allan's Islet, and nearly abreast of Sare's Point. Young's Islet is between Burrow's and Allan's. All these islets are rocky, and much broken. There is deep water between them, and likewise between Burrow's and Perry Islands; this latter passage, which leads into Boxer Cove, is narrow. Sandford Cove is near the entrance; it is formed by a long sandspit; the opening is on the west.

The Ringgold Channel, between Watmaugh Head, the south end of Chauncey Island, and Perry Island, is 6 miles wide; ample room for ships to beat in. Mount Erie is a good landmark for vessels intending to seek Argus Bay.

PERRY ISLAND.

Perry Island lies next to and south of Lawrence; is of an irregular shape, 10 miles in length by 6 wide. On the east, between it and the main land, there is a marsh, which is bare at extreme low water. The western part of the island is a bluff shore, falling towards the east, where it sinks into the marsh. Mount Erie stands isolated in the centre.

SARATOGA PASSAGE.

I have called Saratoga Passage, the strait leading from Deception Passage to Admiralty Inlet, at the south end of Whidby's Island, 35 miles distant; it has Whidby's Island on the west, and M'Donough Island on the east. Within is Penn's Cove, Holmes Harbor, Port Susan, and Port Gardner. Throughout Saratoga Passage the water is of sufficient depth for the largest class of vessels; it is well protected from all winds. The tides are strong, and their direction generally north and south. The southern end of this passage enlarges into Possession Sound before it joins Admiralty Inlet.

DECEPTION PASSAGE.

Deception Passage is intricate and narrow, separating Perry from Whidby's Island; its length is 3 miles; in some places it is not over 500 feet wide. Ketslum Islet lies at the west entrance; Hope, Skait, and Kiket Islets, at the east. The three in the passage are called Stam, Big and Little Tenif. These all have deep water close to them. This passage ought not to be attempted without a commanding breeze, which generally prevails from the westward. Small, quick-working vessels may beat out with a favorable tide, but it would not be safe for those of any burden.

BLUNT'S ISLAND.

Blunt's Island lies north-northwest of Point Partridge, distant from it 6 miles; it is of small elevation, lies nearly east and west, and in length from its west end to the outer part of the shoal to the east, 1½ miles. There is a considerable bank at its western end, on which there is kelp. A temporary anchorage may be made near it, but it affords no shelter; elsewhere the water is deep.

WHIDBY'S ISLAND.

Whidby's Island extends from Deception Passage on the north to Scatchet's Head on the south, a distance of 35 miles. On the west it is washed by Admiralty Inlet; on the east by Saratoga Passage. It

has many indentations and small bays and coves on the eastern side; but its western side, from Deception Passage to Point Partridge, a distance of 12 miles, is a high and nearly level bluff.

Point Partridge is the northern and western point of Admiralty Inlet, and can be seen a long distance down Fuca's Strait; the shore is bold and the water close to it deep.

From Point Partridge to Red Bluff, is 5 miles, southeast; thence to Point Leavitt, is 8 miles, and Ariel Point is 4 miles from Point Leavitt. From Ariel Point to Scatchet Head is a distance of 6½ miles; here the shore makes a sweep, forming Useless Bay, with very deep water; and with the prevailing winds it is a lee shore, affording no protection for vessels.

NEW DUNGENESS ROADS.

New Dungeness Roads is the best temporary anchorage for vessels, as they are well protected from the prevailing winds, easy of access, and if need be, water may be filled up. It is probable that here, in future, pilots for Admiralty Inlet may be obtained, and supplies in any quantities that may be required. To vessels requiring repairs, this will be an important stopping-place, on account of its vicinity to Budd's Harbor.

BUDD'S HARBOR AND PORT DISCOVERY.

Budd's Harbor might be designated as an extension of New Dungeness Roads, being separated from it only by a narrow tongue of land, which lies across, and renders the harbor entirely land-locked. The narrow entrance is on the west side. Vessels drawing 12 feet can pass over the bar at low water. The rise and fall of the tide is 6 feet. The extent of this fine harbor is 3 miles north and south, by a mile wide. The water is from 4 to 20 fathoms deep. The shores are of moderate elevation, and covered with timber. There is a good watering-place at the head of the harbor. It is believed that the entrance may be deepened and improved at small expense.

Port Discovery lies 4 miles east of Budd's Harbor, and New Dungeness Roads; its form is serpentine, 7 miles in length by 1¼ miles wide. Protection Island is situated 1½ miles off its mouth, and covers its entrance from the northwest winds. The great depth

of water is disadvantageous and very inconvenient for anchorage. The banks rise abruptly. The port is easily distinguished by the east and north bluffs at its entrance. Protection Island is of moderate elevation; on either side of it Port Discovery may be entered. The best anchorage is off Carr's Point, in 20 fathoms water. Wood, water, &c., may be obtained without difficulty.

Five miles east of Port Discovery lies Point Wilson, the western point of Admiralty Inlet; it is a low, sandy point. Red Bluff, on Whidby's Island, is directly opposite to it, distant 3 miles. Point Hudson is low; it bears due south from Point Wilson, 1¾ miles; near it, is a red-colored clay bluff, 80 feet high; it is the north point of Port Townshend.

PORT TOWNSHEND.

Port Townshend lies between Dickerson and Craven Peninsulas. It extends to the southwest 3 miles, and then to the south and east the same distance; at its entrance it is 2 miles wide, but within increases to three. This port is capacious, and has ample depth of water for vessels of any size, and room for a large fleet; towards its head it is entirely land-locked. It is separated from Port Lawrence on the south by a very narrow isthmus of sand, joining Craven Peninsula to the main. The anchorage in Port Townshend is safe at all times; the soundings throughout are from 9 to 15 fathoms; for vessels bound up Admiralty Inlet, it affords a much better anchorage than Port Discovery. Wood and water may both be procured here in plenty.

DICKERSON AND CRAVEN PENINSULAS.

Dickerson Peninsula rises abruptly on its north and west sides, where it bounds on Port Discovery and Fuca Strait; to the south and east its elevation is less, falling in gentle declivities towards Port Townshend. Its surface is for the most part open prairie; it is 5 miles in length by 2½ wide, and separates Port Townshend from Port Discovery. The soil is a sandy loam, and easy of cultivation.

Craven Peninsula has an extensive sheet of water, called Kilisut Harbor, enclosed within its area, which communicates with Port

Townshend by Walan Entrance. The greatest depth of water within is 6 fathoms. The shore of Craven Peninsula bordering on Admiralty Inlet, from Point Ringgold to Liplip Point, is low, trending nearly due south 6 miles.

PORT LAWRENCE.

Port Lawrence lies close around Liplip Point. To enter it, haul up immediately after passing the point, when the port will be open to view, extending to the northwest 2 miles. The best place to anchor in, is to the northward of Ship Point, on the western shore, and at the southern extremity of the port. The depth of water is 21 fathoms, with good holding-ground. It ought only to be used as a temporary stopping-place.

PORT LUDLOW.

Port Ludlow is 4 miles due south from Port Lawrence; between them is Point Kanawi and the Colvos Rocks, four in number, all visible: these are not dangerous and are easily avoided. Klas Rock lies between Olele and Kanawi Points; it is about half a mile from the shore. Port Ludlow, though of small extent, offers many facilities for vessels, particularly those wishing to make repairs; it is situated at the mouth of Hood's Canal. From its locality and the extent of agricultural land in its neighborhood, advantages are afforded to settlers, and supplies, such as the country will produce, may be raised in abundance.

The directions for entering are simple and few. Pursue a south or mid-channel course, between Jones's Bluff and Point Tala; when within the sandspit which makes out from the western shore, drop anchor, in from 6 to 8 fathoms, off Bull's Head; a vessel will there find a safe and convenient berth.

GREAT PENINSULA.

The Indian or Great Peninsula divides the waters of Admiralty Inlet and Puget Sound on the east, from those of Hood's Canal on the west. The extent of this tract is 45 miles in length by 25 in breadth; it is indented by numerous bays on the east and south, and several islands lie in close proximity to it, forming roadsteads and harbors.

Its elevation is generally about 120 feet above tide, and composed of a sandy, light soil, and for the most part covered with timber.

Suquamish Head, its extreme northern point, is a bold bluff, and readily distinguished after passing Point Wilson.

The course from Liplip Point, in proceeding up Admiralty Inlet, is southeast: this will carry a vessel off Point-no-Point, after passing which, the first anchorage is at Pilot's Cove, 3 miles distant, where a vessel may stop to await a tide. Admiralty Inlet at this place is 6 miles wide.

McDONOUGH ISLAND.

McDonough Island bounds Saratoga Passage on the east. It is 15 miles long, and at the northern part it is 3 miles wide, but diminishes in width, being little more than a narrow strip of land at its southern termination. Its eastern side forms a considerable curve. It is low land, productive, and susceptible of cultivation. There is little wood on it, but water can be obtained at Triangle Cove, on its east side.

PORT SUSAN, PENN'S COVE, HOLMES' HARBOR, PORT GARDNER, AND POSSESSION SOUND.

Port Susan is on the east side of McDonough Island, between it and the mainland. At its head is an extensive marsh and mud-flat, through which a creek passes around the north end of McDonough Island, joining Saratoga Passage, opposite Point Polnell. The water in Port Susan is deep, except at its north end, where it decreases from 14 to 2 fathoms. From Point Allen, the south point of McDonough Island, to the head of Port Susan, is 9 miles, north-northwest. It is completely land-locked. At its greatest width it is 3½ miles.

Penn's Cove lies on the west side of Saratoga Passage. It is formed by an indentation of the eastern side of Whidby's Island, immediately to the east of Point Partridge. In shape it is a parallelogram, 3 miles east and west, by 1 mile wide. Off the south point of its entrance is a sandspit, extending half a mile from the shore. In Penn's Cove there is good anchorage, in 8 to 15 fathoms, which is a safe and convenient harbor; and the usual supplies can be obtained.

I have named the extent of water between Penn's Cove and Point Polnell, Duncan's Bay; it is 3½ miles wide by 1 deep. On the west

side is Kalamut Island, which is surrounded by a reef of rocks. The anchorage in the bay is from 8 to 12 fathoms in depth.

Holmes' Harbor lies in Saratoga Passage, 10 miles south of Penn's Cove, 6 miles deep by one wide, an indentation which nearly divides Whidby's Island. The water in it is deep, but anchorage may be found at its extreme south. It offers but few advantages.

Port Gardner lies at the south end of Saratoga Passage. It is 6 miles square. On the east side of it Fresh-water Creek empties, at the mouth of which is a broad mud-flat. The anchorage is on the southeast side. Gedney's Island lies in the middle of Port Gardner: it is one and a quarter miles in length by one-third of a mile wide, and trends northwest and southeast. There is a shoal off its southeast point.

Possession Sound joins Saratoga Passage at its southern termination. It has the south end of Whidby's Island on the west, and divides it from the mainland on the east. It leads from Admiralty Inlet into Port Gardner, a distance of four miles; it is two and a half miles wide. Vessels seeking anchorage at Port Gardner, must pass close to Point Elliott, and anchor under and near to the south shore, as the bank drops off very suddenly.

Between Possession Sound and Elliott Bay, on the east side of Admiralty Inlet, there is no anchorage or harbor for a distance of 16 miles. The shore trends a little to the westward of south.

Five miles above Pilot's Cove, on the west side, there is another good anchorage, at Apple Cove; though small, it is very convenient for vessels passing up and down the inlet.

ELLIOTT BAY.

Elliott Bay is embraced between West Point and Point Roberts, the south bluff. From West Point the shore trends southeast 5 miles, to the head of the bay, has a sweep of 2 miles to the southwest, and thence northwest the same distance to Point Rand, which is 1½ miles from Point Roberts. The anchorage is of comparatively small extent, owing to the great depth of water, as well as to the extensive mud-flats; these are bare at low water. Three small streams enter at the head of the bay, where good water may be obtained. I do not consider the bay a desirable anchorage; from the west it is exposed to the prevailing winds, and during their strength there is much sea. Admiralty Inlet at this point is 3 miles wide.

PORT MADISON.

Port Madison is 5 miles to the southward of Apple Cove, on the west side of Admiralty Inlet; it is one of the best anchorages, capacious and safe; is 2 miles wide by 3 deep. The head of the bay communicates with Port Orchard, through Agate's Passage, a good, though narrow channel, dividing Bainbridge Island from the Great Peninsula. The north and south points of Port Madison were named Jefferson and Monroe; under the latter a vessel may anchor, but it is better to enter the port, and there await a favorable tide to proceed up the inlet.

PORT ORCHARD.

The southern entrance to Port Orchard lies to the south of Port Madison 9 miles; it has three arms, stretching to the southwest, west, and northwest; the latter communicates, as before stated, with Port Madison. The waters of Port Orchard are separated from Admiralty Inlet by Bainbridge Island, 7 miles in length, north and south, by 3 wide. Towards its southern end, on its east side, are two small coves, Eagle Harbor and Port Blakeley. The main entrance to Port Orchard is through Rich's Passage: this lies between the south end of Bainbridge Island and the Great Peninsula, trending in a northwest direction, 2 miles in length, by half a mile wide, when it takes a sharp turn to the southwest, of one mile. Properly speaking, Rich's Passage is a part of Port Orchard, but as there were so many branches, I thought it necessary to give the arms which lead into it different names, reserving the name given by Vancouver to the largest; the others we called Dye's, Sinclair's, and May's Inlets. Port Orchard offers all that could be desired for the safety and equipment of vessels. It will be a convenient place of resort for supplies as well as repairs. It is needless to point out any particular place of anchorage; every part of it may be used, and that resorted to will depend upon future settlements that may be formed. There are several rocks at the entrance of Rich's Passage, situated near mid-channel. Vessels may pass on either side of them, but the south shore is to be preferred, offering more room and a clearer passage. If it is not the intention to enter this harbor, good anchorage may be had in Barron's Bay, between the land and Blake's Island at its mouth.

BLAKE'S ISLAND AND COLVO'S PASSAGE.

Blake's Island is triangular in form, with deep water around it; its sides 1 mile in length, and the island elevated. It forms the protection to Barron's Bay, where good anchorage may be obtained. It lies a mile north of the entrance to Colvo's Passage, which is bounded by Vashon Island on the east, and the Great Peninsula on the west: it is 12 miles in length by half to a mile in width. Throughout its length the water is very deep, with few places where an anchor can be dropped. The shores are bold, and the largest class of vessels may approach close to them. A vessel should not drop anchor, unless from necessity, until she arrives at the southern end, where anchorage may be found in 13 to 17 fathoms, very close to the shore. Should the wind be from the west, which is generally the case, it will be very difficult to get under way on account of the eddies of wind under the bank, 300 feet high. If the tide serves through the Narrows, or the breeze be a commanding one, it would be advisable to stand on and pass through them.

Colvo's Passage is the shortest and best route to the Narrows. That on the east side of Vashon Island is broad and safe, though a much longer route; it affords better anchorages than Colvo's Passage, but it is not advisable to take it, as the wind draws through Colvo's Passage, and is more favorable than when passing round the eastern side of Vashon's Island.

VASHON'S ISLAND.

Vashon's Island divides Colvo's Passage from the eastern channel of Admiralty Inlet; it is 13 miles in length by 3 miles at its greatest breadth; it rises to the elevation of 700 feet, tapers from its middle north and south, in which direction its length lies. It is composed of rough masses of rocks, and is well covered with timber.

MAURY'S ISLAND.

On the east of Vashon's Island, and near to it, is Maury's Island. It is 4 miles in length by 1 wide; trends northeast and southwest. Between it and Vashon's Island is Quarter-Master's Harbor, which is safe, and of moderate depth. A small neck of land extends from the

upper or northern part of Vashon's Island, where it forms a snug cove. At extreme low water, Maury's and Vashon's Islands are joined by a sandbar. Vessels wishing to pass up the inlet on the east side of Vashon's Island should steer for Point Robinson, the eastern point of Maury's Island. Point Robinson may be closely approached, but if the tide should be favorable, it would be advisable to keep a mid-channel course. After passing Point Robinson, Admiralty Inlet turns to the southwest and west, and again joins Colvo's Passage, at the south end of Vashon's Island, abreast of Point Defiance.

COMMENCEMENT BAY.

Opposite the southwest point of Maury's Island, on the main, lies Commencement Bay, an indentation on the southeast, 3 miles deep by 2 wide. The water is too deep for anchorage, except around the borders of the bay, on its south shore. The head of the bay has an extensive mud-flat, where several small streams enter, among them the Pugallop, which takes its rise in the Cascade Range of Mountains. The distance of this bay from Point Defiance is 5 miles.

THE NARROWS.

The distance through the Narrows is 4 miles; at its narrowest place it is nearly a mile wide, though from the height of the shores it appears much less. Point Defiance, on the left, is a flat bluff, 250 feet high, of yellow sandstone, and horizontal stratification. It completely commands this pass. Opposite Point Defiance is Gig Harbor, which has a sufficient depth of water for small vessels.

For passing the Narrows, the young flood is deemed the best time; both ebb and flood run with great velocity, the flood on the eastern shore, while the ebb generally prevails strongest on the west. With the wind from the west, it will be free until Puget Sound is opened, when it generally draws ahead, and compels a vessel to back and fill, along the east shore. The strong flood will carry a vessel through in a short time. Great care should be taken not to stand too far over towards the west shore, where an eddy current prevails with equal strength on the flood and ebb in the opposite direction; if a vessel stand too far over, and be caught within this eddy, she would be carried back from whence she came.

There is, however, no danger to be apprehended, provided care be taken, and the vessel kept under sufficient sail to command her movements. The tide, though extremely rapid, has the line of demarcation between its currents clearly pointed out by the whirls and ripples, which an attentive eye cannot fail to notice.

PUGET'S SOUND.

Puget's Sound embraces the extent of waters lying within the Narrows, which is the only channel by which it can be reached. The whole area comprised within its limit is about 400 square miles. Its length, northeast and southwest, is 27 miles, while its breadth extends 15 miles at right angles to the length. By an inspection of the Chart, it will be seen that this includes many islands, peninsulas, rocks, coves, passages, and inlets; forming safe harbors, and free from dangers. The land surrounding these is similar to that heretofore described, being an elevated table-land, covered sparsely with timber.

After passing the Narrows, the first island is Fox's, which lies in a southeast and northwest direction; it is 4 miles long by 1 wide, and forms the south side of Hale's Passage, which leads to Vanderford's Harbor and Carr's Inlet, both indenting the Great Peninsula on the south end. Vanderford's Harbor is of small extent, 1¼ miles north and south, by one-fourth of a mile wide. Five miles to the west is Carr's Inlet, a large and fine sheet of water, 8 miles long by 2 wide. On its east side lies Allshouse's Islet, and two small coves; at its head is a mud-flat, with a small stream entering into it. Anchorage may be obtained under 20 fathoms water, with good holding-ground, anywhere abreast of and above Allshouse's Islet. The route up Puget's Sound, for vessels, leaves Fox Island on the starboard hand, keeping well over towards the Nisqually shore, in order to avoid the Toliva Shoal, which lies a mile off Point Gibson, the southeastern point of Fox Island. This shoal is of small extent; it has 18 feet on it at low water, and requires attention only by vessels of great draft of water. The following ranges give its position, viz., the north end of Ketron Island on with Nisqually Bluff, the Islands of M'Niel and Anderson just touching, and the east end of Fox Island with the bluff on the west side of the Narrows.

The east side of Puget's Sound trends from the Narrows south-by-west; it has but slight indentations in it, and the depth of water

precludes any anchorage, except close to the shore. The bank both above and below water-line is very steep. The distance from Day's Island, at the south opening of the Narrows, to Nisqually Bluff, is 10 miles. M'Niel's Island lies above Fox's, to the southwest. It is nearly oval in form, its longest axis being east and west, 3 by 2½ miles. Between it and Fox Island is Brackenridge's Passage, 1½ miles wide. This leads to the northwest, into Carr's Inlet, of which it may be said to form a part. Ketron Island is high, rocky, and barren; it lies north and south; it is a mile in length and a quarter of a mile wide. Between it and the shore is a tolerable harbor; but when the wind and tide are opposed, a sharp and disagreeable sea prevails. The island affords the only protection from the westerly winds, which blow strong. The depth of water and the steepness of the bank, with the strength of tide, does not permit me to recommended it as a good anchoring-place. The sound abreast of Anderson and M'Niel's Islands is 2 miles wide. Wood and water may be easily procured. Three miles to the south of Ketron Island is the landing of Fort Nisqually. From the bank shelving very rapidly, the anchorage is of very limited extent; within a cable's length, a change of from 17 to 44 fathoms takes place. The anchorage of the Vincennes, at Nisqually, was directly opposite a fine stream of water; we found it very convenient for our purpose, but it is very unsafe in the winter. The steamer of the H. B. C. usually discharges her cargo here, but it is more for the convenience to Fort Nisqually, that it was chosen, than as a safe port. The bank rises abruptly 210 feet, at which height there is a plateau extending for many miles to the eastward, forming one of the prairies of Oregon. Fort Nisqually lies 1¼ miles from the sound, on the prairie. A mile beyond the anchorage to the south is the north bluff to the Nisqually River, called Kwaatz Point. Close to it the river empties into the sound; its mouth is upwards of a mile wide, occupied by an extensive mud-flat, which is bare at low water. There is another small and tortuous channel into the river on the southwest side, near Loa Point. From the mouth of the river to Point Moody, the shore trends northwest 6 miles; thence it turns to the south into Henderson Inlet; thence passing the south end of Hartstene Island it divides into Budd's, Eld's, Totten, and Hammersly Inlets, all capacious, and affording every facility for vessels of any size. These inlets are separated from that of Case's by Jack's, Hope, and Hartstene Islands; and Pickering's, Dana's, and Peale's Passages lead into them. Case's Inlet stretches up towards the north, until it

approaches within a short distance of the waters of Hood's Canal, where there is a portage. This is a low marshy strip, 1½ miles wide, forming a narrow isthmus, which joins the Indian or Great Peninsula to the main land. In Case's Inlet, there are two small islets, viz., Herron and Stretch's; the former lies just within its entrance, and the latter where the waters of the southern inlets join it. From the mouth of this Inlet to its farthest point is 12 miles; its width at its entrance is 1½ miles, but it decreases gradually towards its head. There is good anchorage throughout in a moderate depth; the banks are not so high, and the shores more shelving than the other inlets.

Anderson's Island lies opposite to Nisqually, distant 1½ miles; its form is nearly oblong, 3 miles in length, north-northeast and south-southwest, and 2 miles wide. On the eastern side is the Bay of Oro, lying opposite to the anchorage at Nisqually: it is nearly semicircular, and half a mile deep. Anderson's and M'Niel's Islands are separated from the Great Peninsula by Drayton's Passage. The eastern branch of Drayton's Passage divides Anderson's and M'Niel's Islands: in it lie also Ned and Tom's Islets; they may be passed close on the north side, where there is sufficient water for the largest vessels, as well as ample space for manœuvring in. Puget's Sound and its inlets offer every advantage for naval or commercial purposes. The rise and fall of the tide is sufficient for dry docks of large dimensions, and there are many localities where they could be established, and built at a moderate expense.

HOOD'S CANAL.

Hood's Canal branches off from Admiralty Inlet at Suquamish Head, where it is 2 miles wide. Its direction is south-southeast, 5 miles; it then turns to the south-southwest, 6 miles; thence to Squaller's Point, southeast, 6 miles, turning again to the west-southwest, 3 miles, to Nukolowap Point, the south point of Toandos Peninsula, which divides the north branch from the Canal. Continuing on this course, across the mouth of the north branch, for 4 miles, is Quatsap Point, passing the Harbor and Point of Seabock on the east, thence southwest, 3 miles, to Triton Head, continuing to Point Cummings, Ayoch's Point, to Point Neelim. Throughout this distance, 30 miles, the shore is elevated and well wooded. There are several small streams

of fresh water: the one near Point Cummings is the largest; at its outlet there is a mud-flat.

The eastern shore, from Sandy Point, opposite Quatsap, though not so elevated, is more precipitous. From Sandy Point to Point Musquiti, which lies nearly opposite to Neelim Point, the shore is of the same character, and the width of the Canal throughout the distance varies but little; the points are all low and sandy, while those on the opposite side are high. The anchorage on the west side is better than on the east, where the water is too deep in many places to admit of it. From Neelim Point, the Canal takes a sharp turn to the east-northeast. Between Neelim Point and Point Crowlie lies Anna's Bay, into which empties Black Creek: the distancebetween the points is 2 miles, the bay 1 mile deep, the eastern part of it being filled by an extensive mud-flat. From Point Crowlie to Sister's Point is 3 miles. Here the northeast arm contracts to half a mile in width, whence it changes its course to the east-northeast, 8 miles, ending in Lynch Cove, which, as is usual in all these harbors, has an extensive mud-flat at its head.

The harbors in Hood's Canal are, Port Ludlow, at its entrance, heretofore described, Port Gamble, Suquamish, Seabock, Hoo-et-zen, and Col-see-ed Harbors; Dabop and Anna Bays; Tzu-sa-ted and Lynch Coves.

Port Gamble lies 6 miles within Hood's Canal from Suquamish Head, on its eastern side; it is 2½ miles in length, north and south, and half a mile wide at its entrance. The channel lies through an extensive mud-flat, to the northward of its two points, Totten's on the west, and Point Julia on the east. To enter, bring Point Julia to bear south half east, and steer due south, taking care to keep it open on the port bow. The bottom is quite soft, and a vessel cannot be injured if she grounds on either side; but those drawing less than 20 feet can find no difficulty in passing through it, even at low water, with a fair wind. Within the harbor there is from 5 to 7 fathoms water; the bottom is of mud and sand, and the holding-ground good; the shores are moderately high. At the south end, there are two or three small streams of water, but they are not at all times to be relied upon for a supply. In entering the Canal, steer for Point Hannon, a sandy point on its western side; thence for Point Salisbury; but to enter Suquamish Harbor, it is better to keep the western shore aboard, passing round the Sister Rocks, off Point Termination, and anchor on the east side, avoiding the sandbank

off the western shore. The Sister Rocks may be avoided by not shutting out the land to the southward of South Point. There is no other danger to be apprehended, and these are usually visible.

The next harbor is that of Seabock. It lies on the eastern side of the Canal, directly south of Nukolowap Point, distant from it 3 miles. It is one of the most convenient anchorages in the Canal. Its shape is triangular; its shore is bordered by a sand-beach, from which the hills rise: these are well-covered with wood. The distance between the two points of the harbor (Samum and Wikat), is 1 mile; it is also a mile deep towards the southwest. Near its head is an extensive sand-flat, dry in places at low water. The watering-place can be approached by boats at half tide: the landing is on the southeast side, at Makak Point. The best anchorage is near the centre of the harbor, Samum Point bearing northwest, with a gray sandy bottom.

Opposite Seabock Point is the entrance to the north branch of Hood's Canal, which lies between the Toandos Peninsula and the western shore: it is 9 miles deep and 2 miles wide between Sylopash and Tskulusco Points. It contains three harbors, but there is no anchorage in it, the water being very deep.

Hoo-et-zen Harbor is the next. It lies on the west shore of the north branch, 3 miles above Sylopash Point, and forms a segment of a circle, three-fourths of a mile in diameter; its shores are rocky and elevated, except on the northwest side, where there is a sand-beach, with the usual mud-flat. Pulali Point lies on the east side, from which to the double heads the shore is a rocky bluff. The west side, from Weewa to Naika Points, is of a similar character. At the head of the harbor is Musam Place, where a small creek enters, from which good water may be obtained. The best anchorage is in 11 fathoms, about the centre of the harbor. To enter, either shore may be closely approached. After rounding Nukolowap Point, steer directly for the harbor; the course is north-northwest.

Two miles to the northward of Hoo-et-zen, you enter Col-see-ed Harbor, between Bramblebluff and Rose Point; they are half a mile asunder. The harbor is 2 miles in length, including the extensive mud-flat at its head, which occupies nearly one-half the space, and is generally bare at low water, the upper part being a salt marsh, with creeks running through. Both shores of the southern part of the harbor are steep, hilly, and well covered with wood. The anchorage lies off Point Yakso, half a mile above Rose Point, in 7 to 10 fathoms

water, with muddy bottom. At Point Yakso, there is an Indian village. Water may be obtained at half tide from the streams and creeks at the head of the harbor. Col-see-ed Harbor is separated from Dabop Bay by Bolton Peninsula, which is 4 miles long, by 1 mile wide. In Dabop Bay, the water to the southward of Pilash Point, is too deep for anchorage; to the north, it is necessary to anchor very near the shore at the head of the Bay, which terminates in a small muddy and useless cove. The land which borders this bay is high, and covered with woods; into it several small streams discharge themselves. As a harbor it is not to be compared to the others before spoken of. The shores in this arm, as well as those of the Canal, are well supplied with shell-fish.

Anna's Bay lies at the southern extremity of the Canal, where Vancouver supposed it ended. Black Creek enters into this Bay, by which the Indians make the communication with the Chekeeles and the country to the south. The anchorage in Anna's Bay is on the western side, under Point Neelim, where there is a moderate depth of water. A large Indian village is situated on Point Neelim.

A mile to the north of Quatsap Point lies Tzusated Cove. Its position may be readily known by the Jupiter Hills, which lie just above it. The best anchorage is off Boston Point, a rocky bluff, distant 1 mile from Olo Bluff; between the two lies the cove: an anchorage may be obtained in any part of it. On the southwest, there is a narrow entrance between Palisi and Slik Points, into the basin, which is half a mile long, by quarter of a mile wide, and secure from all winds. The depth of water in it is between 5 and 6 fathoms. In the entrance there is but 2¼ fathoms at low tide. It is well marked by Palisi Point, low and sandy, on the west side, and the rocky bluff of Slik Point on the east. In anchoring in this cove, it is necessary to look out for the heavy flaws of wind which come down from the Jupiter Hills.

Lynch Cove is situated at the farthest point of the northeast branch. The land about it is low and marshy on the east; on the west it rises, and is sparsely covered with wood. At the head of this cove is also an extensive mud-flat. There is good anchorage, in 5 and 6 fathoms, between the two small sandspits, which lie on opposite sides of and form the cove.

In closing my remarks upon the intercommunication these waters afford, it might be deemed desirable that I should point out the

localities which afford the best positions for future settlements. These at first will be selected more from convenience for present supplies, than with a view to future trade. But the positions which must claim most attention, are those at the head of the inlets, affording facilities for trade as well as internal communication. The waters within Cape Flattery offer an extent of safe navigation unsurpassed in any country, and every facility that can be needed for carrying on the most extensive commerce. But a few years will elapse before this estuary will be overrun by the tide of emigration, which is now flowing so rapidly toward the western shores.

Our surveys did not extend to the north of Frazer's River, in the Gulf of Georgia; I omit therefore to give any particular description of it. It may be stated, however, that the tides are very strong, that there are many detached rocks, that the shores are bold and iron-bound, and that there is great difficulty in navigating through Johnson's Strait, and little security to shipping against the dangers. Fogs prevail for a large portion of the year, which throw great difficulties and impediments to its ever being used as a route for navigation, even when assisted by steam.

FRAZER'S RIVER.

The mouth of Frazer's River lies 7 miles to the north of the 49th parallel. Like all the other rivers of Oregon, it is barred by an extensive mud and sand flat, extending for some 6 miles to the west; this is partially bare at low water. The channel in the river is of ample depth; its course is serpentine. From its north bluff outwards, towards the bar, the depth decreases to 12 feet, which is the greatest draft of water that can be carried in: this renders the entrance impracticable for vessels of large size. The bar bears southwest from the north bluff, and west-southwest from Cowitchen Peak. Point M'Leod, at the mouth of the north channel, now nearly filled up, is 4 miles distant. During freshets, the river discharges a part of its water through it, and then it may be passed through by boats and canoes. The south bank of the river is low and marshy. At high water the tide flows through several small inlets into the river; these once formed a delta, but they are now too much obstructed and too small to be so considered. The posi-

tion of the north bluff, where our observations were made, is 49° 07′ 05″ north, longitude 123° 08′ 57″ west, and the variation 21° 14′ 41″ west. The trade of Frazer's River will be considerable when the country becomes settled; it is navigable for steamboats to its falls, 80 miles from its mouth. It has a fine salmon fishery; though the fish are not so large as those of the Columbia River, yet they abound in greater number. The principal settlement is Fort Langley, twenty-five miles from its mouth, which is one of the posts of the Hudson Bay Company.

CHAPTER XVII.

COAST OF OREGON AND CALIFORNIA.

On leaving the Straits of Juan de Fuca to pass to the southward, there are no ports along the coast until Gray's Harbor is reached, a distance of 90 miles. The trend of the coast is south three-quarters east. It decreases in height, and the sea-shore is bordered by low land. In some parts there are low cliffs, but the land rises towards the interior to a considerable elevation.

The Flattery Rocks lie 10 miles south of Cape Flattery. They are detached from the shore, worn by the sea into many fantastic shapes, and lie at various distances, 4 to 5 miles from the coast. They are columnar in form, black in color, and rise to the height of from 50 to 100 feet.

Destruction Islet is 30 miles to the southward of Cape Flattery. It is low and flat, one-third of a mile in diameter, quite barren, with a few dwarf trees on it. A reef extends from its northern end, on which the sea usually breaks.

Point Grenville is elevated. It may be known by the three small rocky islets lying off the coast: one of them, the southern one, is perforated. There is anchorage off this coast, during the fine season, in from 16 to 20 fathoms, on sandy bottom. There is no shelter; the coast may be considered dangerous, from the outlying rocks and the set of the currents, which we experienced; it ought not to be approached nearer than the depth of 15 fathoms. Several vessels, both English, Russian, and Japanese, have been wrecked in the neighborhood of Point Grenville. Formerly, great danger was to be apprehended from the Indians, who massacred all of those who were shipwrecked near this Point. There is no longer any danger, as they have become sufficiently civilized not to sacrifice the lives of those who may have the misfortune to fall into their hands. One of

the best guides along this coast, is the *green water*, taking care to keep without it during foggy weather. The most advisable course is to keep beyond the depth of 70 fathoms. The current generally runs to the northward, but it sometimes sets directly on the coast, and oftentimes a high sea prevails.

Gray's Harbor lies 20 miles to the southward of Point Grenville. The land is comparatively low, till within a short distance of the entrance of the harbor, then a few low sand-hills rise up. Point Brown forms the north point of the harbor, Point Hanson the southern. They are 2¼ miles asunder, and bear south-by-west (true) from each other. Both these points have extensive sandspits, projecting some 3 miles to seaward; between these is the entrance.

The bar lies just beyond the outer end of the sandspits. It has been reported that it is a shifting one, but I have reason to believe it not to be the case. The see breaks heavily upon both the sandspits, and at times extends entirely across from point to point. Fogs prevail generally every afternoon, during the summer months, on this coast.

On the northern sandspit lies Eld's Islet, from which rise several hillocks. The channel between the sandspits is deep, and 2 miles in length. To enter the harbor there is little difficulty. When off the bar, bring Stearns Bluff Islet to bear south 85° east, on with the side of Eld Islet. This course will lead through the channel. The wind is usually fair, and it is only necessary to keep clear of the breakers on either side; but to depart from this port, is as difficult as the entrance is easy. The tides are irregular; it is high water, full and change, at 11 h. 45 m., with a rise and fall of 8 feet.

Gray's Harbor, though apparently capacious, is more than half filled up by mud-flats and sandspits. Its length lies east and west. As a port it is only suitable for vessels of a small draft of water. The land bordering it is low, with the exception of Brackenridge Bluff on the east, and Stearns Bluff on the south. Both are covered with pines.

There are several anchorages, but they are very limited in space; that under Point Brown on the north, and another under Point Hanson on the south, are the most convenient at which to procure supplies. Elsewhere it is difficult to find a place where a landing can be effected, in consequence of the mud-flats; most part of these are bare at low water. The northern part of the harbor I have designated as Useless Bay; it is entirely filled by a mud-flat.

The Chikeelis empties into the harbor on the east. For nearly its whole length it is very narrow and serpentine, and is navigable for 8 or 10 miles for small vessels; the greatest depth of water is 12 feet. In this river there is an excellent salmon fishery, and vast numbers are taken during the season. At the time of the passage of the wild fowls, they are also very numerous in the harbor. Some few Indians frequent this harbor, but none make it their permanent home. The lower banks during freshets are overflowed.

On the south of the harbor the land is low, extending for some distance into the interior, with salt marshes. The soil is a mixture of red and white sand and pebble-stones, and is unproductive.

From Gray's Harbor to the mouth of the Columbia River is 40 miles. This is a low and sandy coast, having a deep indentation in the land, which is called Shoalwater Bay, from its shallowness and the many obstructions within. From its exposure to the prevailing westerly wind vessels can find no protection.

The Columbia River has been long known for its dangers and the difficulties attending its entrance. These, in my opinion, have not been exaggerated, and it may be truly said to offer very few advantages as a port. The land near and in the rear of it is well marked: far in the interior rises Mount St. Helen's, with its regular and conical peak always capped with snow; on the right is Katalamet Head and Tongue Point, and the Coxcomb Hills, lying in the rear of Astoria, and extending down to where Young's River enters the Columbia from the south, separating Point Adams from the high land. On the left lie the Pillar Rock Heights, extending to the high hills of Gray's Bay, and the rocky and bold bluff, rising above Point Ellis and the Chinook Hills, which turn and trend to the north, having several well-defined gaps and peaks, which gradually approach the coast, and enclose the waters of the river, bounded by Cape Disappointment, the highest point of which is 500 feet above the sea level. On it are many lofty spruce and pine trees. A few of these have been trimmed up, leaving tops which form well-marked objects.

Point Adams is the southern boundary. It is low and sandy, and covered in part by a recent growth of spruce and pine trees.

These two points are 5 miles asunder and have sandspits projecting from each. That from Cape Disappointment stretches to the south, whilst that from Point Adams makes out to the west; they are, consequently nearly at right angles; their nearest approach is one mile.

The South Sandspit overlaps the North, extending beyond it to the west. They have been formed by deposits of sand brought down by the current of the river, and from the abrasion of the capes by the sea; the water being checked by the ocean, causes the sand, which it held suspended, to be deposited. Whilst this cause continues, it must result in constant changes to the channels, and the shifting or increase of the bar.

The greater part of the mouth of the Columbia is occupied by a sand island and the spits above mentioned. They are daily undergoing changes, although composed of hard sand. The former occupies the middle of the river.

The bar lies 1 mile outside of the spits. On it there is from 4 to 4½ fathoms depth of water. There is no danger or risk in passing it when the sea does not break.

On both spits there are usually heavy breakers on the flood; but there are times when there is little or no break on either spit.

The south end of the North Spit has to be closely approached, if intending to take the old channel into Baker's Bay. This is the point of greatest danger, and here most of the accidents have happened to vessels and boats entering the river. The cross-tides to which a vessel is subjected, their velocity, the influence of an undercurrent, together with a heavy swell and oftentimes the loss of the breeze, renders this point and part of the channel exceedingly difficult. The leading marks are so distant that they are of little use in guiding a vessel; but when they become indistinct from the mistiness of the weather, it is attended with great danger. Although the channel has materially changed since the survey of the Columbia River by the Expedition, it may yet be useful to give the precautions and sailing directions which I drew up at the time, in order to show the changes which have taken place, and may be expected to occur.

It is safest to enter the river on the ebb tide, with the westerly wind, which sets in about 10 or 11 o'clock A. M., during the summer months. As a general rule, the entrance should never be attempted with a flood tide and northwest wind, unless the Clatsop Channel is used and the sea is quite smooth. After making Cape Disappointment, if to the southward, lead in for it on a northeast bearing; if to the northward, stand in until you have that bearing on. A saddle

hill to the northward on with the outer part of the cape, will notify that you are on the bar, in 4½ or 5 fathoms water. From this position, in ordinary weather, the outer line of the North Spit will be perceived; the inner line of demarcation is at all times perceptible by the ripple. When Young's Point is open with Point Adams you are to the northward of the end of the North Spit, in which case, stand to the southward until these two points are in range. If intending to take the old channel by the cape and Baker's Bay, then haul in for Point Ellis, or the light-green patch visible on Chinook Hill.

When Leading-in Cliff is well open with the inner point of the cape, haul up for the latter and stand on; you will then have doubled close around the North Spit, in 7 fathoms water. It is better then to keep the North Spit close aboard, if the wind is not too scant to make a tack necessary, or to beat up for Baker's Bay; but it will not be found necessary to tack, if the ebb tide is strong on the lee bow; it will keep a vessel sufficiently to windward, and on the direct course for the inner point of the cape. If, however, a vessel should open Green Point, she must go about, as it is not safe to approach nearer the Middle Sands than this range.

In standing in, take care to avoid the sandspit which stretches off from the Middle Sands towards the cape. The two *outer* bluffs of the cape in range will strike it; and until this range is passed, the cape side should be kept close aboard, but do not approach so near as to be subjected to be becalmed. If through negligence or otherwise this should happen, the only resource is to come to anchor, and await a favorable tide. Both ebb and flood are strong, but particularly the former, which sometimes flows at the rate of 5 and 6 miles an hour,—a perfect mill-race; no boat can make way against it. After the range of the bluffs is passed, stand in for Baker's Bay, and having opened a broad clearing of the woods on the cape, anchor in from 7 to 10 fathoms.

If it be the intention to proceed up to Astoria, and a pilot is not to be had, stand up, keeping the small islet in the cove of the cape open until the *dead trees* on Point Adams bear nearly south-southeast, per compass. Steer for them. If young flood, take care to keep on the starboard, or Sand Island side, whilst crossing over to the Clatsop Channel; if near high water, give the Sand Island a wider berth, as there is a liability to touch on the sandspit making off

from it. When in the Clatsop Channel, steer up for Young's Point, keeping in from 5 to 6 fathoms water. The sandbanks on either side of this channel are bold; keep the shore of Young's Point close aboard, and when abreast of Astoria, anchor, and moor with an ebb and flood anchor.

Should it be determined to make use of the Clatsop Channel, the same directions are to be observed for passing the North Spit, but when the Leading-in Cliff opens, instead of hauling up for Cape Disappointment, steer direct for the Clatsop village on Point Adams, which leads in the fair channel way. The breakers on each side will be visible. Keep in the middle, and steer directly for Young's Point.

Entering the Columbia River should never be attempted when the passage between the North and South Spits is not well defined. It is equally dangerous whether it be concealed by the breakers all the way across, or so smooth as not to show any ripple or break. Oftentimes the wind fails or becomes light in the channel between the North and South Spits, especially when it does not exceed a moderate breeze, and this is a position wherein a vessel is subjected to a strong tide and heavy swell. The best time both to enter and depart, is after half-ebb or before quarter-flood; the tide then flows through the channels and is confined to them. It is always dangerous to drop an anchor in the channel, between the cape and the end of the North Spit; it should only be done in case of absolute necessity, and not a moment ought to be lost when it is possible to lift it, to proceed in or out. The sea-breeze or westerly winds blow at times very fresh. A hazy bank in the western horizon is a sure indication of a breeze from the west. When waiting in Baker's Bay for a favorable time to get to sea, the state of the bar may be judged of by its appearance from the top of the cape, and the surf beating on the cape is also a good guide.

There was little doubt in my mind, but that the North and South Spits were undergoing constant changes at the time of our survey. In the memory of many persons whom I met, Cape Disappointment has been worn away some hundred feet by the tide which flows at its base. The Middle Sands, which lie within the two spits, are subject to still greater changes. During our stay there, a large part of what was a dry sand-island, part of the Middle Sands, and 2 feet above the highest tide, was washed away. On the western edge of it there are usually heavy breakers.

Baker's Bay is the usual anchorage of vessels, but it is by no means well sheltered. During the winter months it is much exposed to the southeast winds.

The New or Clatsop Channel leads directly from the bar to Point Adams. Changes in both these channels have taken place since the surveys of the Exploring Expedition.

The alteration in the *Old* Channel is thought to be caused by the wreck of the Peacock; in the Clatsop Channel, by the great deposit of sand round the wreck of the Shark, and from the failure of the usual spring freshets, which causes the sands to be deposited in the channels, instead of being swept farther to seaward; and in many cases a slight obstruction causes the water to flow off and make a new outlet through the sandy spit.

I have carefully compared the chart of the mouth of the Columbia, by the Exploring Expedition, with that of the South Channel, by Lieut. McArthur, of the Coast Survey. The changes have apparently occurred from the causes that I have adverted to; and, although there is much greater facilities for passing in and out of the Columbia, by the establishment of beacons and marks, and the organization of regular pilots, still these have not obviated, though they have much lessened, the difficulties and dangers which nature has placed upon it, and which all the art of man will not be able to remove.

In the Clatsop Channel, the water having been diverted, has cut through the South Sandspit, which extends from Point Adams to the west: this makes the entrance less difficult. The sea is smoother, and the channel shielded somewhat from the ocean, by the head of the South Spit.

To improve and afford facilities for entering the Columbia, Government have erected a lighthouse on Cape Disappointment, which affords the best direction to the navigator, and permits him to run boldly for the land; and a blockhouse, on the Middle Sand Island, with a staff 85 feet above high water mark, with a white flag, which can be distinguished plainly 12 miles at sea; thereby obviating oftentimes great delays and detention by adverse winds. The blockhouse staff on with the highest peak westward of Chinook Hill, and Point Adams open with Pillar Hill tree, are the ranges for 12 fathoms. With the usual wind, this south channel can be used at all times, and may be easily passed through either with a fair or head wind. The depth of water on the bar is 16 feet at half-flood, making 20 feet at high water; it deepens to 5 fathoms inside the point of the Spit,

and thence up to Sand Island, through the Clatsop Channel. In my opinion, there are no means by which the entrance into the river can be made feasible in the hours of darkness.

The Columbia River is navigable for vessels drawing 12 feet water, to within 1 mile of the Cascade Range of mountains. To this point it was surveyed by the Exploring Expedition, a distance of 120 miles from its mouth. At the low stage of the water, owing to the numerous sandbanks and bars, its navigation is intricate, and for vessels of large size, extremely tedious.

The channel leading to Astoria is on the south side of the river: it is narrow and very close to the shore. That on the north shore is much broader as far as Point Ellice, above which it is encroached upon by the Lower Flats, and contracted to very narrow limits off the western point of Gray's Bay, yet there is room and depth of water for ships to pass up through Kutzule Bay into the Pillar Rock Channel. The Columbia is 3¾ miles wide between Astoria and Point Ellice, which lie nearly opposite to each other. The middle of the river is almost entirely occupied by sandbanks, which in some places are dry at low water; in others, there are bights with deep water. These sandbanks I have distinguished on the first sheet of the chart of the river, as Upper, Middle, and Lower Sandbanks; on the second sheet, as Upper and Lower Flats. Between the Upper and Middle Sandbanks is the passage leading up and across from Baker's Bay, before described; and abreast of Tongue Point there is another, leading across the river from the south to the north shore, called Tongue Point Channel, in which there is a very narrow and intricate passage, from which circumstance it was called the Pishak Pass. Tongue Point Channel lies on a line between Tongue Point and the Yellow Bluff, on the east side of Kutzule Bay. That part of the channel called Pishak Pass, is not over 300 feet in width, and one-third of a mile in length; it lies opposite to Kutzule Bay.

Tongue Point is a high bluff, projecting into the river from the south shore a mile; it divides Swan Bay from the lower river: the extreme point is 3 miles above Astoria. The channel up to it is close to the shore, and half a mile wide. Until the survey by the Exploring Expedition, it was the belief that there was no other channel above, than by the Tongue Point Channel across the river. I was satisfied that, from the great flow of water towards the south shore, a channel must exist; and the examination resulted

in the discovery of a broad and almost straight channel from the Termination Islands to Tongue Point, a distance of 5 miles; it proved to be one-third of a mile wide: it was named the Boston Channel. After arriving abreast of Tongue Point, in 6 to 7 fathoms water, either the Tongue Point or Boston Channels may be taken. The latter is to be preferred. To pass through it, having reached the position indicated above, steer for Little Finger Island (the most northern of the Termination Islands) an east-northeast course, which will carry up through mid-channel. When abreast of the dead tree, above the Little Finger, the eastern end of the Upper Flat will be passed, then haul over for Bee Point, on the north shore, and steer for Point Eagle.

To sail up the North Channel, steer so as to pass close to the western point to Gray's Bay, from thence a direct course for Red Bluff will lead across Gray's and Kutzule Bays into the Pillar Rock Channel; continue to follow close to the north shore, passing between the Pillar Rock, a square basaltic pillar, rising 62 feet above the water, situated on the northern point of the Upper Flats: the channel continues to Bee Point, where it unites with the Boston Channel.

There are two small streams of fresh water emptying into Kutzule Bay at its head. Gray's and Kutzule Bay are unfit for anchorage; the water is shallow, with mud and sandy bottom. Swan Bay, on the south shore, lies between Tongue Point and the Termination Islands. It is 3 miles wide by 2 deep, is shallow, has a muddy bottom, which in places becomes visible at extreme low water.

The Termination Islands are six in number. They are separated from the south shore by Dick's Run, 5 miles in length, which joins Swan Bay to the Swash. The western or lower islands have been named the Fingers; they are all low and swampy. Katalamet Head is a high and remarkable bluff, which may be seen from the coast: it borders the river, and is the most northern point of the hills which stretch to the south.

From Eagle Point, the river takes a sweep to the east and southeast, passing round Capsize and Katalamet Islands; the main channel follows the north shore until it passes Sand Islet, off the north point of Katalamet Island; thence to Sunday Point, the northwestern point of Puget's Island, where it divides, passing on the north and south side of Puget's Island. There is a passage to the south of the Katalamet Island, called the Miami Run: it opens into the Swash, lying between Katalamet and the Termination Islands: it

is one-third of a mile wide and 3 miles long,—a good passage for very small vessels, barges, and boats. From Eagle Point to Sunday Point is 5½ miles: the channel is half a mile wide, with deep water. Two creeks enter on the north shore, the Pimeca and Oluman. They afford good water: at this part the banks are low and marshy, but soon rise in hills. If desirous of taking the channel south of Puget's Island, after passing Rogue's Islet, steer for Framboise Bluff; but if it be the intention to take the channel on the north side, stand on until nearly up with Sunday Point, and when Lotiva Head bears east, steer for it, avoiding the shoal which lies off Sunday Point. From Lotiva Head the channel runs under the high bluff of the north shore, with deep water; when half a mile above Bag Island, near the east point of Puget's Island, haul over to the shore of Kintshotsh Island, to avoid the shoal which extends from Bell's Bluff to the west a mile, the outer edge of which is half a mile from the north shore. Having brought Bell's Bluff to bear east, you will have entered St. Helen's Reach; then steer for Oak Point. In taking the south side of Puget's Island, you pass under Framboise Bluff, which rises 600 feet above the river. It is better to keep the shore of the island abroad until the high bluff opens out, then to cross to the south shore, until you pass Ataki Creek, which flows round Kintshotsh Island; you have then entered St. Helen's Reach, and can steer for Bell's Bluff, keeping mid-channel: this will carry clear of the shoal off Yupat's Island, which extends beyond Kotze Island, and thence to Oak Point. Natsox Run passes between Yupat's and Kotze Islands and the south shore: it has only depth of water sufficient for small barges and boats.

St. Helen's Reach extends from the eastern part of Framboise Bluff to the upper end of the Basaltic Cliff, opposite Oak Point, a distance of 11 miles. The western part is bounded on the north by Puget's Island, which is low and marshy, 4 miles in length, by 1½ miles in width, and by Kintshotsh Island on the south, of like character. It is 6½ miles in length, separated by Ataki Creek from the prairie beyond. The eastern part of St. Helen's Reach has the high Basaltic Cliff, extending from Bell's Point to opposite Weaquus Islet, on the north, and the low prairie ground of Oak Point, on the south, as its boundaries. The river expands and contracts in width, but the channel preserves its dimensions from one-third to half a mile wide. The depth of water varies from 3¼ to 11 fathoms. The tide is felt as far up as Oak Point, but its rise and fall here is only 3 feet. At Oak Point,

the Columbia again turns to the southeast, and continues the same course up to Smoke Island, a distance of 25 miles. Five miles above the turn the prairie terminates, where a high basaltic bluff rises, which I named Waldron's Bluff; it is 3 miles in length, and rises 800 feet above the river. Above the turn at Oak Point there are two islands, Gull and Weaquus; the former is 2 miles long, by one-third of a mile wide, separated from the prairie land by the Kinak Passage, one-eighth of a mile wide. Off its northwest end is a shoal, which must be avoided. Weaquus Island lies to the north of Gull: it is quite small, one-third of a mile long; it has a shoal surrounding it. The main channel passes to the north of Weaquus Island. When Plumondon Island, which lies opposite to Waldron's Bluff, opens, steer for it. This course will lead into the deepest water, and avoid the shoals which make off the north shore, opposite to the upper end of Gull Island. Wala Creek here empties into the Columbia. From it to the mouth of the Cowlitz River there is an extensive prairie of several miles in width, on which, near to the river bank, is situated Mount Coffin, a regular cone, rising to the height of 720 feet. It is the only high land on the north shore in this distance.

Opposite to the upper part of Waldron's Bluff lies Walker's Island, one-third of a mile from the shore: it is 1½ miles long and one-sixth of a mile wide. The best channel lies between it and the south shore, but that on the north may be used, care being taken to avoid the shoal making off from the east end of it. The shoal which lies above the island has a small sandbank on it; bare at low water.

Latap Bluff lies on the south side of the river, and extends from opposite Mount Coffin to Sandy Island, a distance of 11 miles; it is 450 feet high. The river from Waldron's Bluff to above the mouth of the Cowlitz, I have named Mount Coffin Reach. Its average width is nearly a mile.

The mouth of the Cowlitz is 4 miles above Mount Coffin. At its entrance into the Columbia it is one-sixth of a mile wide; off its mouth lies Taney's Island, low and at times submerged; it is one-third of a mile long. The Cowlitz is serpentine, and cannot be navigated, except when there is a freshet, or when its waters are backed up by those of the Columbia; then barges may ascend the Cowlitz a distance of 18 miles.

Kanem Island lies 1 mile above the mouth of the Cowlitz, on the northern shore, is 1½ miles long, and one-sixth of a mile wide. The

channel runs on the south side. Two miles above this island the river contracts in width to half a mile. On the north shore there is a fine salmon fishery, near the Mitlait Creek, which is just opposite to Coffin Rock, where the Columbia is 30 fathoms deep. The river continues of the same width 1½ miles, to Holmes Point, when it again enlarges to upwards of a mile in width, Sandy Island occupying the centre of it. The best channel is near the south shore; that on the north, though wider, has less depth. The Lalu Islets lie along the north shore: a narrow passage divides them from the land. Five miles above Holmes Point is Brown's Point. On the south shore the Kalukau Creek forms Deer Island, 3 miles long. The creek is much used by boats and barges when the river is high. Opposite to Brown's Point lies Smoke and Paia Islands: these are formed by Stiak Run. At the upper end of Paia Island lies Porpoise Shoal, on which that vessel grounded for several hours; we borrowed too much on the north shore. It is better to keep a mid-channel course, avoiding the shoal which makes off from the Deer Island side. The course of the Columbia here varies to nearly south, and continues to Cazenove Point, 4 miles below Fort Vancouver. The river contracts above Deer Island, and its south shore rises to 150 feet for a distance of 5 miles. To this I have given the name of Wyeth Bluff, which extends from Kalukau Creek to the Wapautoo or Lower Branch of the Willamette River, which enters from the south-southwest, dividing Multnomah Island from the south shore, and forming Multnomah Island. At Warrior's Point, the lower end of Multnomah Island, the river maintains the same course. Opposite to Warrior's Point two small creeks enter, one from the southeast, called Calapuya; the other from the northeast, called the Snas Creek: the Nut Islets lie in front of them. One branch of the Calapuya, called the Piscou Creek, unites with the Columbia, 3½ miles above, separating a large part of the low prairie land into an island, called Pasainks. Another branch runs up to within a mile of Vancouver, and affords a safe and convenient passage for boats and canoes when the river is high; at its upper end it approaches within a few hundred feet of the river, at which place there is a short portage. Above Piscou Creek, the river is not over one-fifth of a mile wide, and continues so until Ramsey's Island is passed; it then widens to over half a mile, forming the Willamette Reach, 5 miles in length, as far as the upper mouth of the Willamette, which flows into the Columbia, between Billy Bruce and

Johnson's Islands. From this point, the river takes a bend to the southeast, increasing in width: McTavish, Joe, and Barclay's Islands lie on its south shore. There is a channel on the south side of these islands, but it is very shallow. From the Willamette River to McLaughlin Point, above the landing at Fort Vancouver, is called Vancouver Reach; it is 5 miles long. The deepest channel during the lowest stage of the river lies on the Vancouver side. Obstructions are formed, and changes occur in the channels annually. At high water the river at Vancouver rises 19 feet above its low water mark. It attains its highest point in May and June, its lowest in October. The rise and fall of the tide is perceived at Vancouver, but the current does not change its direction.

The shores of the Columbia near Vancouver are low. The river bank is a kind of levee, which is several feet above the river, at its highest flood; were it not for this, it would spread over the whole extent of prairie. On this levee is a thick growth of trees and shrubs, which binds the earth together, and prevents a break.

The course of the Columbia above Vancouver is to the southward and eastward. Its average width is three-quarters of a mile; this includes the islands which have been formed by its deposits and serve to contract its channel. From Point McLaughlin to Frost Island, a distance of 10 miles, the river is nearly straight, and the channel is along the north shore. The hills which bordered the river prairies below, here approach the bank. Along the south shore lie Smith, Rower, Sandy, and Douglass Islands. The water is too shallow for even small vessels to use the passage between these islands and the south shore. Boats and barges may pass through. The channel passes from the north to the south shore, between Douglass and Frost Islands, and again seeks the north shore beyond Frost Island, between it and Bachelet Island, the river changing its course more to the eastward. Frost Island is 2 miles long; it lies near the north shore. Abreast of it the river is one-third of a mile wide. To the north of the east end of Frost Island is Evert's Bay, nearly circular, a mile in diameter. Bachelet Island is of an oval shape, 1¼ miles in length. Palle Creek, which passes between it and the south shore, is only used for boats and canoes. Above Bachelet Island the river again widens. Point Broughton lies two miles above the island. The channel again crosses to the south shore, is very narrow, and runs very close to it. On approaching Vancouver's Island the river is contracted; the channel occupies the

width between that island and the Square Rock. Vancouver's Island is three-quarters of a mile in length; it has a conical hill on its east end. Square Rock lies opposite to it on the south shore, and a mile above it is the Obelisk. From the latter the channel passes to the high bluff on the north shore, called the Natural Wharf. Three miles above this, on the same shore, is Cape Horn; the bluff continues 2 miles beyond. Hermit Islet lies below, near the middle of the river; the channel is between it and the north shore, where the water is deep. On the south side the shores are low and sandy, the river quite shallow and filled with shoals and small sandbanks. Grist Point, is a low sandy point. The point next above Grist Point is Rounding Point, situated directly opposite to the east end of Cape Horn Bluff. Here the channel is the whole width of the river; as it approaches Long Island it turns towards the south shore. Long Island lies close to the north shore, is composed of sand, with a very few bushes growing on it. Between it and the shore there is a narrow passage for barges and boats, which may be used to avoid the strength of the current when ascending the river. Seven miles above Long Island is the head of navigation, near what was named Castle Rock, at Observatory Point, on the north shore. Holmes and Eld Island lie at the foot of the Cascade Range, and near to Observatory Point are the Rapids, the highest point of the survey. Above this, the river flows with the velocity of a mill-race, where the first portage occurs. At this place there is a small inlet.

The Willamette, though a much smaller stream than the Columbia, is one of its most important branches: it is navigable for 23 miles to its falls, by small vessels: 3 miles above its mouth the western or Wapautoo branch turns off, forming Multnomah Island, joining the Columbia, as before remarked, between Warrior's Point and Wyeth's Bluff. The course of the Willamette and its branch is serpentine. Its lower reach is to the south 3 miles; thence it turns to the southeast 6 miles, to Willow Island; again south 5 miles, to the Oak Islands, varying beyond them for 3 miles to the southward and eastward, where it makes an elbow to the southward and westward of 2 miles; thence a south-southeast course of 4 miles to Goat Island, at the mouth of the Klackamus; it then turns to the southwest, 1 mile to the falls. Its banks are composed of bluffs and low prairie. The channel is narrow, and at places intricate, particularly abreast of the islands; the Oak Islands lie on its east side. The Wapautoo branch is also navigable,

and partakes of the same character as the Willamette. Its length is 17 miles. In making use of it much time and distance may be saved. When there is a freshet in the Columbia, there is little or no current in the Willamette, the water being backed up nearly to the falls; then it affords a slack-water navigation, and appears very much swollen. Some of the richest lands in Oregon lie on the borders of these streams. Wood and water may be obtained in abundance.

The navigation of the Columbia and its branches requires care and attention, particularly at those parts of the river where an abrasion of its banks is liable to take place, and deposits of its sands are made. These parts I need not point out, for they will readily occur to the intelligent navigator.

In proceeding southward from the Columbia River, the first remarkable land is Killamook Head, a bold chalky bluff. It is 18 miles south of Point Adams: the low land connected with that point reaches to it. The coast is a sandy beach. Killamook Head may be readily distinguished, and, during the winter season, should be sighted by vessels bound to the Columbia, in order to be to the windward of their port, the period when the southwest and southeast winds prevail.

Cape Lookout lies 30 miles to the southward of Killamook Head. It is described by Vancouver as having four rocks lying off it; one of them perforated. The coast between it and Killamook consists of a sandy beach, rising almost immediately into well-wooded hills. The same line of coast continues to Cape Foul Weather, which is situated 31 miles to the southward. It is a high, conspicuous bluff, projecting from the coast, remarkable for a flat top hill to the north, while on the south there is a round bluff. The coast continues to trend nearly north and south, being a succession of sandy beaches, interrupted occasionally by perpendicular cliffs: a few rocks lie about a mile outside of the line of coast. The high land approaches within a short distance of the sea. The coast-line to Cape Perpetua has the same direction and character. This cape is a high, rocky bluff, on which the ocean dashes with violence. Here, too, the coast is iron-bound, the sandy coves giving place to high rocks and barren cliffs.

Cape Gregory lies 35 miles to the southward of Cape Perpetua. It is somewhat conspicuous, when seen from the northward, and resembles a mound or hill, on the top of which are white, rocky cliffs. The land between it and the coast range of hills, is low, giving it the appearance, at a distance, of an island. The rocky and iron-bound

shore about Cape Gregory, is different from Cape Perpetua. Nineteen miles south of Cape Perpetua, lies the mouth of the Umpqua River. It may be known by the position of its headland, which is the first to the northward of Cape Gregory.

The Umpqua River enters the ocean between sandspits. The northern one is 1½ miles in length. The southern spit may be distinguished by a rock on it. The bar of the river lies outside of these spits, and on it there is but 2 fathoms of water; but the depth between the spits and inside varies between 6 and 11 fathoms, but it does not continue, for the Umpqua is not navigable for vessels drawing over 12 feet water, more than 10 miles, if they could cross the bar.

Cape Blanco is a conspicuous low point, and may be known by its cuneiform shape, projecting from the high, rocky coast. Between Cape Gregory and Cape Blanco the distance is 20 miles; it is a high and rocky coast, trending a little to the westward of south. To the southward and westward of the cape, there is a line of rocks, which extend some 8 or 10 miles from the coast; vessels should keep outside of them. The coast to the southward of Cape Blanco is high for 40 miles; its trend is nearly due south. There are one or two coves where anchorage may be made in the summer, but they are exposed to the south wind. The mouth of the Rogue's River lies 30 miles south of Cape Blanco. Its course is between high and abrupt mountains: it is inaccessible for vessels of any kind; to the northward of it there is a range of rocky islets, trending from the coast-line southwest-by-south; they extend a distance of 10 miles. To the south of Rogue's River the coast is lower, and appears to be inhabited by the Indians in greater number; it trends to the southward and eastward to Pelican Bay, which is situated to the north of Point St. George; it is 45 miles south of Rogue's River. Point St. George is easily distinguished by the reef of rocky islets, which lie off from it in a northwest-by-north direction 8 miles. There is a passage into Pelican Bay between these rocky islets and Point St. George. This bay affords no shelter for vessels; temporary anchorage may be made there in summer, as well as along the coast. Round the southern point of Point St. George there is a small cove; off the point forming it there are very many rocky islets. Twelve miles south of Point St. George lies the Klameth or Tootootutness River; it enters the sea between high bluffs. This stream is very rapid, and is reported to have 15 feet water on its bar. From the velocity of the current, the narrowness

of the entrance, and the swell of the ocean, none but small vessels can safely pass in. From the Tootootutness, the coast continues high until the Bay of Trinidad, and along it there are many rocky islets, which should be avoided by the navigator, not only at night, but during the day, as the wind often falls light near the coast; it will be found stronger in the offing. Redding Rock lies 8 miles from the coast, and 15 miles southwest of the mouth of Rogue's River. Trinidad Bay offers little or no protection. During the fine season it may be used, as other parts of the coast, for anchorage, but it cannot be considered a port.

From Trinidad Bay to Cape Mendocino is 18 miles; the coast is low and sandy, rising in the background into high hills. The usual anchorage is to be obtained off this part of the coast in summer.*

Cape Mendocino is high and rocky. The cliffs continue as far as Point Arena, a distance of 110 miles to the south-southeast. Five miles west of the pitch of the Cape lie Blunt Rocks. From Point Arena to Punta de los Reyes, the trend of the coast is more to the eastward; they are distant from each other 60 miles. Along this part of the coast there are quantities of kelp and many rocks, though not far from the coast-line. As a general rule, it may be advisable not to pass through kelp,—it indicates rocks; though on them there may be sufficient depth of water to float the largest vessels, yet it is better to avoid it. Eighteen miles to the north of Punta de los Reyes is Port Bodega; it is a small and inconvenient bay, and cannot be entered except by vessels of light draft of water; the anchorage outside is rocky and dangerous. Wood and water may be obtained there with difficulty.

Punta de los Reyes is somewhat remarkable, forming a small peninsula, projecting from the coast some 5 miles south-southwest. The sweep of the coast from Punta de los Reyes to the southeast forms Sir Francis Drake's Bay. It may be known by its white or yellowish cliffs. This bay is entirely open, and exposed to the south and southeast. During the fine season, when the winds prevail from the westward, vessels may anchor in it. It cannot be considered as a safe port.

The coast to the mouth of San Francisco Bay trends to the south-

* A more particular examination has since been given to this part of the coast by the United States Coast Survey; a bay was ascertained to exist, which has been called Humboldt, 15 miles south of the Bay of Trinidad. For a description of it, see Coast Survey Papers.

east; the whole is high and bold, but less elevated near the sea-shore. The Farallones de los Frayles lie off the entrance to San Francisco; they consist of two groups of rocks and islets, the South, and the Northwest, and lie from each other northwest, 8 miles distant.

The South Farallones consist of two rocky islets: they bear from the entrance of San Francisco south 66° west, 28 miles, and south 3° west from Punta de los Reyes, 18 miles. The largest is a mile in length, lying east-northeast and west-southwest. It is of volcanic formation, and has a knob or hill on each end; these are 250 and 300 feet high; from the southward or northward it has a resemblace to a saddle. The land between them is covered with volcanic scoria and pumice: there is no fresh water upon the islet. There are soundings off the southeast side in 15 fathoms water, with good holding-ground. On this side a landing may be easily effected. In clear weather it can be seen 25 miles. The smaller islet is one-third the size of the larger: it lies on the west side of it. The northern cluster consists of several naked rocks, extending in a northwest and southeast direction 3 miles. Between the Northwest and South Farallones there are soundings in 25 to 40 fathoms. When the weather is thick and foggy, which is often the case, if sighted, it is better to approach them and anchor until daylight, rather than stand in toward the coast.

The entrance to San Francisco is distant from Punta de los Reyes 30 miles. To the north, Table Hill rises 2430 feet, descending in lesser hills to Boneta Point, the north and outer point of the entrance; to the south lie the heights of San Bruno, not so elevated, but quite conspicuous, sloping down towards Point Lobos, which forms the southern point. Off the entrance to San Francisco there is a bar, which extends from the north shore south-by-east 4 miles, and lies outside Boneta Point 5 miles. The shoalest part is near the north shore, gradually deepening towards the south. The least depth of water on the bar is 4½ fathoms; as it is approached from seaward, it shoals gradually; after passing it, the depth again increases to 10 and 30 fathoms. On this bar there is usually a long swell, but at the full and new moon very heavy breakers are met with, even on its southern part, in 7 fathoms. Those which we experienced in the Vincennes were entirely unexpected. At sunset, from its falling calm and the tide having changed, we anchored,—the sea then was quite smooth: a few hours afterwards, the swell arose gradually, until we found ourselves riding at anchor among heavy breakers, several of

which broke over the ship, as high as the foretop, and swept the deck fore and aft. Our situation for several hours was very dangerous; there was no wind, and it was impossible to change our anchorage. When the signal was made to anchor, part of the squadron got beyond the bar, in 12 fathoms water, and only experienced a heavy swell. It is better, therefore, for a vessel when off this port to drop anchor in a depth of water above 10 fathoms, either within or outside the bar, particularly at the full and change; at these periods of the moon, there is always a heavy surf on the coast. It is safer to approach the entrance on the southern side, as the soundings are deeper, and what dangers exist are above water. In steering for the entrance, keep the opening to bear to the northward of northeast-by-east. On that bearing, you will pass the bar in 6 fathoms water, and if towards the south of that bearing, there will be 7 to 9 fathoms, with irregular bottom.

The entrance to the bay is very striking; on each side bold and rocky cliffs. It is 1 mile wide and 3 miles in length, with deep water and no obstructions. The bay expands and extends north and south beyond the visible horizon. Its length is 36 miles, by an average width of 6 miles; a large part of its southern, eastern, and northern shores are bordered by wide mud-flats, preventing the landing at low water of even a boat, for nearly the whole distance. The eastern shore may be said to be inaccessible for a distance of 30 miles. In this extensive bay lie several islands; that of San Angelo is the highest and largest, covered with vegetation to its top. The next in size is Yerba Buena and Alcantras, besides several rocky islets covered with guano, which makes them conspicuous: they usually have immense numbers of sea-fowl hovering over them. To the east is the Coast Range, and beyond rise the lofty Californian Mountains, capped with snow, brilliant with all the beautiful tints which the atmosphere of this climate gives. The southern extremity of the bay contracts and ends in several creeks, which make up towards the Embarcadero, Santa Clara, and San Juan. On the north, the bay is bounded by the Straits of San Pablo, which divide it from the bay of that name.

The Bay of San Pablo is nearly circular, 10 miles in diameter. A channel runs on the east side of the bay to the Strait of Karquines, the mouth of the Sacramento River, where there is sufficient depth of water for large vessels. On the west is an extensive mud-flat, with

only a few feet of water on it, forming a large segment of the bay, which renders its shores quite inaccessible.

The best anchorages are off Yerba Buena Island and at Sausalito Bay: they lie on opposite sides of the entrance. The former is now occupied almost exclusively by the trading vessels to San Francisco: it is exposed to the prevailing winds from the northwest, which blow at times very strong. The accommodations for trade have been very much improved, since the cove in front of the City of San Francisco has been filled in.

Sausalito or Whaler's Harbor lies under the high land of Table Hill, which protects vessels from the prevailing westerly winds.

On the north, inside of Boneta Point, we have Cavallos and Lima Points; on the south, Point Lobos and Fort Point, and outside of Point Lobos is Mile Rock. Point Boneta appears like three dark hillocks. A reef of rocks extends from it to the southeast, on which the sea usually breaks: to the north of it there are some rocks which appear white, being covered with guano. In entering and departing from the Bay of San Francisco, the tide must claim attention, particularly when leaving. The wind usually draws in from the westward, and makes it less necessary in the first case, as there is usually sufficient breeze to keep a vessel under command.

The best course going in is northeast-by-east half east, to keep the middle of the entrance, with the Island of Alcantras on with Fort Point. If the south shore has been hugged, on deepening the water inside the bar, and changing the soundings to red sand, haul to the northward, until you bring the above range on, and then steer in: this will lead into a mid-channel course,—it matters not whether the tide be flood or ebb; on both shores the tide makes ebb some two hours before it changes in the middle. It is extremely rapid: the flood-tide of the south bay runs 5½ hours, while that to the north is half an hour less in duration: where the tides meet, they form extensive ripples. The ebb tide is very strong. The tide sets most strongly from the southeast and northwest. The ebb tide from the southern bay sets over towards Lima Point, opposite to Fort Point, whilst that from the north bay sets from off Sausalito towards Fort Point and Mile Rock: hence the necessity of steering a course to guard against being carried towards either side among the rocks. Those under water are well marked by the kelp growing on them; although there is frequently water enough for a large ship to pass

over them, yet generally it is dangerous to approach too near, or through the kelp on any part of this coast.

After the Bay of San Francisco is entered, and all the islands are in sight, if bound to San Francisco, steer for Yerba Buena Island direct. If the flood tide is in its strength, shorten sail in time, and anchor in a clear berth. The vessels usually anchor between the city and the Island of Yerba Buena. A vessel may drop anchor anywhere within Fort Point and Alcantras, avoiding the shoal which lies off the Presidio. If the intention be to anchor in Sausalito Bay, steer for the Island of Angelos, and after having opened out the Bay of Sausalito, haul in for it gradually, to preserve the wind, and avoid the set of the ebb, if it should have made, which might carry a vessel back, and prevent her reaching the anchorage, which is well up the bay, in from 5 to 7 fathoms water.

Ships making the Southern Farallones should steer for the coast an east-northeast course, if the wind is to the southward of west: this will bring them sufficiently to the southward, and will enable them, after making out the entrance, to steer in for it, on a northeast-by east half east course, which leads over the bar in the deepest water, 6½ fathoms. On the south end of the bar the soundings are deeper, and all the dangers are in sight. On the above bearing, Alcantras will be seen nearly on with Fort Point, which course may be pursued, taking the precaution not to be set too near the Fort. If entering on the ebb, steer for mid-channel, in order to avoid being set upon either shore. If swept into Lobos Bay by the ebb, it would be advisable to anchor. There is a passage inside of Mile Rock, but it ought not to be used except in cases of necessity. The wind from the north and westward is the most favorable time to enter and depart. It seldom blows from the east, and when it does, it rarely reaches beyond the entrance: a vessel is then left to the tide, and liable to be carried among the rocks on either side: the depth of water is too great to anchor. With the westerly wind a vessel may beat out, but it will take some hours to get beyond the capes. This bay is often enveloped in dense fogs, and generally a thick haze prevails, which renders the land indistinct to a stranger. There are no dangers, except those above mentioned, and it is not difficult to feel one's way into this fine port, through the aid of the soundings, during the continuance of fogs, or in the night time.

The surveys of the Expedition extended up the River Sacramento to the highest point of boat navigation. At this late period, I do not deem it necessary to give the outline of its navigation. The chart that was published soon after the return of the Expedition is referred to as containing all the necessary information of the state of the river at that time, which will be found in the Hydrographical Atlas.

CHAPTER XVIII.

MANILLA AND SOOLOO SEA.

SOME general remarks under the head of Passages have been given respecting the route from Manilla through the Sooloo Sea to Singapore. I shall enter more particularly into the subject in this chapter. My instructions contemplated a full examination of this sea, to enable me to draw up sailing directions. As my time did not permit of this, I confined myself to the most essential parts,—the entrances to the Sooloo Sea, including the different islands, reefs, and shoals, with the passages through them, and to an examination of the charts which had been placed in my possession by Captain Halcon, of the Spanish Navy: these enabled me to save much time, and afforded me the opportunities I desired.

A knowledge of the entrances to the Sooloo Sea has become more requisite, in consequence of the new route from the China Seas towards the islands, whaling-grounds, and ports in the South Pacific, which offers such facilities and the saving of much time and expense for vessels bound to the eastward, avoiding thereby the circuitous routes around New Holland, or through the North Pacific. This route I have named the Equatorial Passage; to take advantage of which, it is necessary that vessels should pass through the Sooloo Sea, the Straits of Macassar, or some of the straits to the southward or westward of it.

MANILLA.

With the port of Manilla there is considerable commerce, and we think it may, when the Equatorial Passage is used, cause many vessels to seek its fine bay for supplies, as well as trade. The season which is considered the finest, and in which it is most visited, is from the month of December till May. The Bay of Manilla then

offers safe anchorage. There are several routes towards Manilla, which have been pointed out by Horsburgh, whose directions to avoid the numerous shoals in the China Seas, when passing from the west to the east, should be followed, viz.: to keep to the north of 12° 30′ north latitude, on which parallel the most "*northern danger*" is situated. This the winds will generally permit from Pula Sapata. It is better to make Point Caponi on the coast of Luzon, than Cabras or Goat Island, particularly during the pendency of the northeast monsoon, whence a course may be shaped for Point Hornos and Miraviles; when up with the former, the Island of Corregidor, which lies at the entrance of Manilla Bay, will be seen. From Point Caponi the wind will generally draw off the land; and although it is not advisable to keep too close, on account of the outlying rocks, yet it is better to hug the land, and if at night, it would be well to guard against the southerly current, which sets off this point with some rapidity. During the northeast monsoon, the wind blows often very strong out of the Bay of Manilla. As the bay is approached, the breeze will often be found to draw off the land; the north shore should be hugged, as it will aid a vessel in beating up; and oftentimes an eddy wind prevails under the highland. To the west of the Island of Corregidor, two and a half miles, lies the Morja or Nun Rock: it is nearly the same distance off the Cochinos. These latter lie off the southwestern point of the port of Miraviles. This port is 1½ miles deep and 1 mile wide. It is quite safe, and is seldom affected by any sea, being exposed only to the southeast. The anchorage is in 15 fathoms, towards the head of the bay. Good wood and water can be easily obtained. In entering the Bay of Manilla, a vessel may pass either side of the Island of Corregidor; the channel on the north is usually preferred, and it is the best, though there is more room for a vessel to beat up in the south channel, between the Cavallo and the Friar Rocks or Islets, which are distant from each other 4 miles, on a south quarter east bearing. When passing through the north channel, the shore may be closely approached on either side, as the water is upwards of 25 fathoms deep close to the shores. The anchorage off the city of Manilla lies 25 miles northeast-by-east from the Island of Corregidor. The sailing directions are simply to keep the Nun Rock open with the Corregidor, until the fortress or steeple of Cavite bears east; the St. Nicholas Shoal will then have been passed, the only one which exists in this extensive bay. It would be very desirable to have the point of this danger buoyed. In beating up, I felt this omission: it prevented my ap-

proaching it. The water is deep close to it, but it cannot be seen: some doubts were raised in my mind as to the accuracy of the charts of this bay; many of our bearings would not fall on the Cavallo, though repeatedly tried, yet the other points, islands, and rocks, seemed well established. The Bay of Manilla is a beautiful sheet of water, in form nearly a circle, of 25 miles diameter; the depth of water generally averages 16 to 18 fathoms in its centre, whence it gradually decreases towards the shore to 5 fathoms. The anchorage off the city of Manilla is an open roadstead, and during the periods of the typhoons, it is very unsafe for vessels to remain at anchor there. The city of Manilla is situated on the southeastern side of the bay. The land around the bay to the northward is high, rising into many peaks, while to the south and east, it is low, extending many miles inland; to the foot of the mountains, around the Laguna de Bay, the outlet of this lake is called the Pasig River; on its banks the city is built. Through this river, many of the supplies and much of the produce of the country is brought. Vessels obtain their water from it, which is good if taken above the wash of the city. The port of Cavite, 9 miles to the south-southwest of Manilla, is protected, and forms a safe port for small vessels; it is the naval dockyard.

Navigators may know before they open the Bay of Manilla, whether the northeast wind prevails strong: during it a misty cloud forms an arch to the southwest; if this is not observed, there will be a sea-breeze in the after part of the day. The north passage, between Corregidor and Miraviles Point, is the one ordinarily used during the northeast winds; there is no anchorage in this passage, the depth being too great, but after getting within the Bay good anchorage may be obtained. If the sea-breeze dies away at sunset, it will be better to drop an anchor. In the north channel, the ebb tide sometimes is strong, and often flows out 18 hours; at such times it may be advisable to use the south passage. The anchorage off Manilla is a mile distant from the mole. The best berth is with the north bastion bearing north 35° east; southwest bastion, north 70° east; the cathedral, north 35° east. Although the velocity of the tide setting out is great during the northeast wind, yet as the wind moderates it returns with great force. The usual rise and fall is between 3 and 4 feet; high water, full and change, at 6·15 A. M.

During the bad season, the Bay of Manilla is occasionally visited by

typhoons: the anchorage then is unsafe; these may happen from May till September, but they are more liable to occur at the time of the equinoxes; during this period of the year there is little trade carried on by the coasting vessels.

The winds on the west coast of Luconia, in the northeast monsoon, are oftentimes from the north and northwest, and during the southwest monsoon it not unfrequently veers from the south to southeast; the land and sea-breezes often prevail, advantage of which is taken by vessels on their passage up and down the coast.

In proceeding to the southward to enter the Sooloo Sea, a preference should be given to the route through the Embarcadero Passage, between Lucon and Mindoro, on the east side of Mindoro, believing it will be found to be generally the best and shortest; but it is necessary to point out to navigators both routes, and permit them to judge and choose for themselves, for there are many times when one route would be preferable to the other; the season and prevailing wind, and the prospects of the weather, will render it easy for the navigator to determine which to take.

ISLAND AND STRAITS OF MINDORO.

Passing the Isle of Cabras, or Goat Isle, 5 miles to the northwest of Luban, stand to the south-southeast, rounding Calavite Point, 10 miles to the west: the land near it rises to the height of 2080 feet, called the Peak of Calavite; when abreast of it, in the season of the northeast monsoon, the wind will draw off the land, oftentimes in puffs of some force: if too near the land, the breeze will be light; eddy winds will be experienced, inclining to calms. As the peak is passed, its influence on the winds will be lost, and a moderate breeze prevail from off the land, which rises in a broken surface from the sea, ridge after ridge, until the highest is reached, which by measurement we made to be 3126 feet: these breezes will enable a vessel to steer for Pandan Islets, pass through the Pandan Channel, and avoid the Apo Shoal. The coast of Mindoro, on its west side, has a low, sandy beach, except at the points, which are rocky. Soundings extend off the coast but a short distance: the sea is generally smooth. South of Calavite Point, 9 miles, is Palaon Bay, where vessels may anchor, and obtain wood and water. The anchorage is off the village. The bay is nearly circular,

and 5 miles in diameter, and easy of access. Point Tubuli lies to the southward of it, and the coast between it and the bay lies north and south 8 miles. Between Tubuli Point and the Pandan Islets, the distance is 37 miles: the coast makes here a considerable indentation. Talabasi Point lies half way between Tubuli and the Pandans. When abreast of Pandan Point, the Apo Shoal lies west 12 miles: it has deep water close to it; on the eastern side it seldom shows any ripples, but when the water is low, the small sandspit on its eastern end may be seen.

Steer so as to pass a mile or two to the west of the Island of Ambolan. The passage to the south of the Pandan Islets is clear. The distance to Ambolan is 35 miles, and the coast trends south-southeast. In close proximity to the Island of Ambolan, lie two others, East and West Ylin: these cover the Bay of Usnariga, which indents the southwest coast of Mindoro: it is said to offer good anchorage and supplies, but our time did not permit us to examine it. It is an extensive sheet of water; but those desiring to enter it should be cautious about approaching its points too closely, as there are many outlying rocks, some distance off, and under water.

The passage to the west of the Apo Shoal is usually called the Northumberland Channel, or Strait: this is bounded on the west by the Calamines Islands; on the east by Apo Islet and Shoal. This channel is wider than the Pandan; and if it be the intention to take it, vessels, after coming up with Calavite Point, should steer for the centre of Busvagan Island, which will lead clear of the Apo Shoal; if not seen when abreast of Pandan Point, then haul to the southsoutheast, to clear the eastern coast of the Calamines Islands, or, if desirous of closing with the southern point of Mindoro, steer directly for it: there are no obstructions in the way. The Island of Ambolan may be approached within a mile. To pursue the safest, though more tedious, route towards Panay, it will be necessary to turn to windward of the Island of Semarara, but if the weather is favorable and with daylight, I would advise continuing to the southward, with a good lookout for shoals from aloft. The principal shoals to be avoided are the Falmouth Bank, Vincennes, Camden, and Siam Shoals, having 12 to 21 feet water on them: these may be passed, with care, in safety. There may be a few others on which a ship of large size would touch, but I think, as the route is so much shorter, and the delay great in pursuing the one to windward of Semarara, it

is better to run the risk, if there be any. I have further to remark in taking this route, that if the wind should be from the westward, I should prefer and advise the Northumberland or Western Channel to be taken, but if to the northward and eastward, the Pandan should be chosen: this will place a vessel to windward of all the shoals, passing them more easily, and be enabled to clear them in the shortest possible time. From Ambolan steer south-southeast: this course will lead between the Vincennes Shoal and Falmouth Bank. A vessel may pass either to the westward or eastward of the Camden Shoal, and when the Island of Caluhia is in range with the centre of Tablas Island, all these dangers will have been passed. If the wind is from the westward, the Cuyos Islands may be hugged: Quiniluban is the largest and most northern. If, however, the wind should be from the eastward, it will draw down the Tablas Channel. I think it then would be advisable to pass close to Caluhia Island, standing well over to the Panay shore, and pass to the southward along it. The distance from Ambolan to the shore of Panay is 70 miles, south 35° east. The Camden Shoal lies 30 miles from Ambolan.

The route through the Embarcadero to the east of Mindoro is to haul to the eastward, after passing Luban Island and between it and Mindoro, giving Point Santiago, the south point of Luzon, a good berth, to clear the Minerva Rock, stretching over to the Mindoro side; for the wind will generally be found to draw from the eastward, consequently it will be a dead beat. The length of the Embarcadero to pass Mindoro is 50 miles, and averages 10 miles in width. When up with the Isle Verde, a fair wind may be expected. This route is then free from danger, and may be navigated in the night. Anchorage may be found in Calapan Roads, and within the Bacos Isles; and the south end of Luzon also affords many temporary stopping-places, if desired. It is high water, full and change, at 7 A. M. The tides flow through with some strength.

In the Embarcadero lie the Island of Maricoban, the Bacos Silunay Isles, and the Isle Verde; in their neighborhood the channel is comparatively narrow, but there is ample room to work a large vessel.

ISLAND OF PANAY.

The Island of Panay is of similar formation to Mindoro, and like it,

its hills are generally devoid of forests, though there appears to be abundance of wood growing in the valleys or gorges which separate the broken surface of this island. The highest ridge visible on the western side was found to be 3000 feet; those on the east side were not visible, from clouds, and undoubtedly are much higher, though I question their being as high as they are reported to be: if their altitude had been 7000 feet, I think we should have seen them during our stay off the island. The channel on the west side of the island is from 12 to 20 miles wide, and entirely free of shoals; by keeping within it, the wind will be more or less favorable, either up or down the coast: its trend is north and south, and has but few indentations. The small island of Bagbatan lies 30 miles south of Point Potol; from thence to Antique Point, is 45 miles. The coast takes a sweep to the eastward, making a considerable indentation, but there is no anchorage or even soundings to be obtained until close to the shore. The island is dotted with neat villages; the steeples of the churches are conspicuous, and the telegraphic stations occupy all the prominent peaks. At Antique Roads there is anchorage close to the shore. The point of land projects a small distance, and with a small creek, gives shelter to the native coasting vessels. Larger vessels may anchor in the roads, but it is necessary to stand in under short sail, and to be ready to drop anchor the first cast of the lead: the bank is very steep. At the village of San Jose, where there are a few troops, vessels may be supplied with some few refreshments. The chart of the survey of this small bay in the Atlas is referred to, as well as the Narrative, Vol. V, for a description of it. The longitude, as determined by our chronometers, places the Point of Antique Roads in 121° 59′ 30″ east, and 10° 40′ north latitude. This coast I understood is rarely visited by the typhoons, as they seldom extend south of this parallel. Antique Roads lie 18 miles north of Nasog Point, the south point of Panay, which is a bold, high bluff, off which are two small islets. In navigating along the west shore of this island, great advantage may be taken of the land and sea breezes, which generally prevail throughout the year.

From Point Nasog, the coast of Panay trends to the eastward as far as the Island of Guimari, which occupies a large part of the strait between Panay and Negros, on which side the greatest number of the inhabitants of this island dwell. Yli Yli is the principal town, and lies at the northward and eastward end of the strait. There is good

anchorage off it, and supplies may be had in abundance. During the northeast monsoon, the current sets to the westward, which it will be well to guard against in proceeding to the southward, as a vessel might be set by it towards the Golconda Shoal or the Cagayanes. If proceeding south, steer for Point Baloganon on Mindanao, distant 150 miles due south: the winds are generally from the northward and eastward; but if bound to the northward from Mindanao, the course should be more to the eastward, hugging the Island of Negros closely, where the winds will be more favorable, and enable a vessel to take advantage of any variation in the winds that may occur under the islands, as well as of the land and sea breezes. The coasts of these islands are all bold, and have no outlying rocks which are not visible.

The Golconda Shoal, which lies to the southwest of Point Nasog, 35 miles, is of coral and low: on it the sea sometimes breaks, but it is not in the way of vessels, if they do not fall to leeward. The Cagayanes lie to the west, on this route: they are two low islands, of considerable extent, covered with bushes and a few trees: a reef surrounds them, projecting off from their northern side 1½ to 2 miles. A passage is said to exist between them, but it is obstructed by reefs, and is useless. To the west of these islands lie the smaller ones of Cabreja and Cavalli: the former lies at the distance of 15 miles, and the latter at 45: they lie in range with others, which extend across the Sooloo Sea, in an east-northeast and west-southwest direction.

ISLAND OF MINDANAO.

The Island of Mindanao should not be approached too closely, for fear of losing the breeze. The land is very high, rising to 3000 feet, but more even and regular than the islands to the northward: unlike them it is covered to the very top with woods.

The Straits of Basillan are entered from the north when Damoloo Point is passed. Should the wind be favorable, I would advise a vessel to proceed forthwith, notwithstanding the tide may be unfavorable. The tides are very irregular in their flow, and are much governed by the winds. It is better to hug the Mindanao shore of the Strait, as the winds are generally from the northward and westward, and often there is a strong land-breeze, which makes it favorable for vessels

bound eastward. Care should be taken in passing to the south of Santa Cruz Island, off which there is an extensive reef, projecting to the westward: this requires to be avoided, and in order to do so, I would prefer to take the inside of that island. This, I believe, is the only danger. The tides, though irregular as to time of running, set through the strait, the flood to the northward and westward, and the ebb to the southward and eastward. In the small port of Caldera, their velocity by the log was found to be 2 miles an hour, but they must be much stronger than this in the strait. It is high water, full and change, 9h. 30m. A.M.

In opening out Caldera Bay, if the time is not favorable to proceed through the Strait, an anchorage may be sought there: its position is well known by the Square Fort. It requires no direction for seeking this harbor, except what the chart furnishes. The anchorage is in 7 to 10 fathoms, coral-sand bottom. The land immediately round the bay is low, with a sandy beach. A heavy growth of wood rises from it, with all the luxuriance of the tropics. Eight miles east of Caldera is Samboangan, the convict settlement of the Philippine Islands. The coast between these two places is low and well wooded. There is anchorage off Samboangan, but the cross-tides render a vessel liable to foul her anchors in the rocky bottom. It is tolerably well protected by the Island of Santa Cruz, which lies 2 miles from the shore, is 3 miles in length including the reef, by which it is surrounded. The anchorage in the roadstead is with the steeple bearing east a little northerly, from half to three-fourths of a mile distant, the east end of Santa Cruz Island, south-by-west, and Point Balota south 50° east. Supplies may be obtained here, but unless there is a necessity for it, I would not advise stopping, particularly if the weather should be favorable for passing through the strait. In case the navigator should prefer it, he may pass into the Sea of Celebes, to the southward, through the Pilas Channel, at the west end of Basillan, and thence towards the Tolour Islands.

SOOLOO ARCHIPELAGO AND ISLAND.

This archipelago consists of some 80 islands, great and small; they lie scattered across the space between the Islands of Borneo and that of Mindanao and Basillan, and form the southern boundary of the

Sooloo Sea. The two largest islands of the archipelago are Sooloo and Tawitawi: the former being the most important, the seat of government, and principal point of trade, was visited by the Expedition. Its length is 33 miles east and west, and its extreme breadth 13 miles, but will average about 9 miles, its broadest and highest part lying to the west. In our examination, we were much aided by the Spanish charts. I have little doubt but that the parts which our time prevented us from scrutinizing are as trustworthy as those which we examined. The best harbor of the Island of Sooloo is that of Soung; it lies on the northwest side of the island, and is protected by a group of low coral islands covered with mangroves; there are several coral shoals on the north: the smallest of these is 3 miles distant; it is partly exposed on the west. The best anchorage is with Observatory Point bearing east, in 10 fathoms water, Datu Point southwest, and Point Dyangappik northeast. The Road embraces the area from Datu to Dyangappik Point, a distance of 2 miles, and is 1 mile wide: beyond this boundary the soundings increase to a great depth. Soung Road may be reached either from the west or by the northeast channel. The currents which prevail in the Sooloo Sea are much governed by the monsoons, but tides prevail near the islands, and have their regular ebb and flood, with a rise and fall of 4½ feet. In approaching the anchorages or departing, they must claim attention, and be taken advantage of.

The seasons are divided into wet and dry, corresponding to the monsoons, the former from May till September, the latter from October to April. Although the winds correspond in part to the monsoons of the China Seas, yet they more frequently prevail from the north and south, enabling vessels to sail both east and west through the Sooloo Sea. In all cases the sea is comparatively smooth, and not subject to typhoons, which so often cause such devastation in the China Seas. For an account of the trade and political character of the inhabitants of this archipelago, I must refer to my Narrative of the Exploring Expedition, Vol. V.

Tawitawi is the next island in size to Sooloo. It lies about 50 miles to the west, and its trend is a little to the southward of west and northward of east: it is 30 miles in length and 10 miles wide. On its south side there are many smaller islands, and there are several lying between it and Sooloo: the largest are Siassi, west of it, and Parangan. There is a broad channel, through which a strong current sets, during the southwest monsoon, to the northeast.

The channel to the west of Tawitawi, between it and Borneo, is also safe, but during the season of the northeast monsoon, the current sets with strength through it to the southward. If this channel should be attempted, care must be taken not to approach too near to the Pearl Bank, with its islets and shoals, which extend some distance around it.

The Island of Tawitawi is reported as having two extensive lakes, one of which is said to communicate with the sea, having at high water a channel of from 4 to 6 fathoms leading into it. The average depth of the lake is reported to be 8 fathoms. The channels among the small islands are shallow, and in places very narrow: this locality is considered the best pearl fishery of this archipelago, and is frequented at all seasons.

The small group of islands, lying to the northwest of Sooloo, and distant 20 miles, of which Pangootaran is the largest, are all low, with deep water between them: some have projecting coral reefs, but they may be easily avoided: it is better not to attempt to pass between them without daylight. They occupy an area of 40 miles in length by 12 miles in width.

The smaller islands between Basillan and Sooloo are very numerous, and cover almost the entire space: they all appear to be accurately laid down; many were ascertained to be so by numerous cross bearings and angles, and I feel confidence in stating that, from my examination, our charts may be relied on. Most of the islands are high, and may be closely approached.

In passing through the Sooloo Sea, either to the east or west, the Island of Cagayan Sooloo, and the small islets near it, should be sighted: their position in latitude and longitude is well determined. Cagayan is moderately high and may be seen a considerable distance. I think it advisable for navigators to pass near it: its bearings from time to time may show the effect of the current. It is 5 miles long, east and west, by 3 miles wide. Several small islets lie off to the northward; the most northern one is Kanaposan.

Between Cagayan Sooloo and the Straits of Balabac, there are several coral-banks, on which an anchor may be dropped in 25 or 30 fathoms: they range east and west for a distance of 40 miles. The Vincennes anchored on Midnight Shoal: it is about half way between Cagayan Sooloo and the Straits of Balabac.

STRAITS OF BALABAC.

The Straits of Balabac lie at the western entrance to the Sooloo Sea, occupying the space between the Island of Balabac on the north, and the Islands of Banguey and Balambangan on the south, a width of 30 miles. The range of shoals and sand-banks, which extend across the entrance and between the above islands, were examined by the Expedition. It is believed that all the obstructions in these straits were surveyed, and are laid down on the chart of the Expedition; but as our time was limited, and we were unfortunately deprived of the use of the tender Flying-Fish, the examination was not so thorough as I could have wished. To the north, in range with the east side of the Island of Banguey, lie the largest number of these dangers to affect its free and safe navigation. The most conspicuous of these is the two Mangsee Islands (Great and Little Mangsee) with their reefs: these lie nine miles north of Banguey, and north and south of each other, extending parallel, two miles east and west, their reefs overlapping, with a passage between, in which there is anchorage, though in deep water. The islands are small, composed of sand, and thickly covered with a luxuriant growth of trees. Between these islands and Banguey, there are two very extensive coral reefs, one, the Helix Reef, lying within 3 miles of Banguey, oval in shape, with a sandy spot bare at low water; the other, the Cama Reef, triangular in shape, having its longest or hypothenuse side to the south, trending east and west 5 miles, while the other two sides trend northeast and northwest from the respective ends, the first a distance of 3, the last of 4 miles: near its centre it has also a bare spot, visible at low water. The distance between the Cama Reef and the Mangsee Islands is 2 miles: its outline is distinctly visible from the islands, and there is usually a ripple on its edges. Due north of the Mangsees, 3 miles, lies the small islet of Salinsingan, resembling the Mangsees, though smaller, but without wood. To the east of Salinsingan, and within 3 miles of it, is another island, called Sinanahan. The reef surrounding it is of a curved shape, 5 miles in length by 1½ wide; the sand-island on it is 1½ miles in length by one-fourth wide: it has scarcely any vegetation on it. Its bearing from the Mangsees is northeast 5 miles. The channel between is 2 miles wide, and free from dangers. Two miles to the north-northeast of Sinanahan lie the Beche de Mer Shoals, occupying

an area of 10 miles north and south, by 4 miles wide: they have several small sand-banks bare at low water, and a depth of 20 to 25 fathoms near them on the east and west sides. To the west of the most northern part of these shoals, lies Turtle Shoal, nearly circular, 3½ miles in diameter: there is also a sand-bank on it, visible at low water. The small Island of Lamboogan lies 5 miles farther to the north, and due east of the south point of Balabac 10 miles: it is surrounded by an extensive coral reef, which projects a mile to the east, and 2 miles from its west point to the southwest. Landalaman Islet lies 5 miles to the north of Lamboogan.

The only remaining danger is Sandy Isle, which lies off to the west, on a bearing of south 66° west, 20 miles from the south end of Balabac, and north 45° west, 65 miles from Point Seeaggoot, the north point of Balambangan. The range of the Monmouth Isles, on with the Peak of Banguey, will strike it. Throughout these straits the soundings range from 25 to 40 fathoms. I conceive there is little need of anxiety on the part of the navigator in approaching and passing through these straits: there is ample room for turning to windward if the wind should not permit a direct course through, and if night approaches or calms should ensue, an anchor or kedge may be dropped, to await the breeze or the turn of the tide. It is high water, full and change, at the Mangsee Islands, at 10h. 30m. A.M.: the tide rises and falls 9 feet.

The route in passing in or out through the straits, must be left optional to the navigator, but I should prefer the southern one, towards the Mangsee Islands. All the shoals may be closely approached, and their outline will be quite visible from aloft. It is my impression that the wind will prove generally favorable to pass either way, and that but a few hours will suffice to place a vessel beyond all danger, either of accident or delay. The great preference the route through the Sooloo Sea has over the other routes is, that whilst it is free from the calms and currents of the Macassar Straits, it likewise avoids the necessity of encountering the dangerous shoals and strong winds of the Palawan Passage, in the contrary monsoons, both causing great anxiety to the navigator, and wear and tear to the vessel; besides, there is no route so short or direct towards the new Equatorial Passage to the East in the Pacific Ocean. The reefs are bare at low water. Most of the time at our anchorage between the Mangsee Islands, we experienced little or no current, but twelve hours before the moon changed, it ran to

the south-southeast, from 1½ to 2 knots. There is no running fresh water on the Mangsee Islands, but in case of necessity it may be had by digging wells. All the island reefs and shoals in this strait are much frequented by turtle in their season, and beche de mer are also found on the reefs.

EQUATORIAL PASSAGE.

The Equatorial Passage may be said to begin off the south point of Mindanao; thence steer for the Serangani Islands, passing to the northward of them, or between them and the Tolour Islands, into the Pacific, and onwards towards the equator. If the wind should be from the northeast, it is advisable to keep as far to windward as possible, to weather the north cape of the Island of Morty, and allowance ought to be made for the current which sets sometimes through Morty Straits to the southwest; but most frequently, as these straits are opened, it will be found setting to the northward and eastward. When in 2° 30′ north, the westerly wind will be fallen in with, and may be preserved by passing just to the northward of the Admiralty Islands. The wind may be found at times from the northward and westward, as well as southward and westward; and extend as far to the east as the longitude of 170° east. Before reaching that longitude, it will be well to borrow towards the Solomon Group, passing along to the eastward of it: this may be readily done during the season of the westerly monsoon, from September to March, but a favorable wind will be found to prevail during all seasons, and enable the navigator to proceed, without interruption, over this route, which shortens the time and distance between the ports of the China Seas, and those of the South Pacific, New Holland, New Zealand, the Pacific Islands, and the whaling-grounds, to which our vessels are continually passing by the circuitous routes around New Holland and through the North Pacific.

The Equatorial Passage, it will be perceived, is closely connected with the Sooloo Sea, and is favorable for vessels from the southern part of the China Seas, by passing through the Straits of Balabac, the western entrance to the Sooloo Sea, whence a direct route across that sea may be steered for the Straits of Basillan, and thus enter it. The distance of one strait from the other across this sea is but 300 miles, and few shoals interrupt the navigation. There are many coral-banks, but they all have sufficient depth of water to pass safely

over them. This route may be followed at any time of the year, while the others are precarious at all times; it is therefore preferable for vessels bound to the eastward, even during the favorable monsoons, to adopt it.

The map annexed to the Chapter on Winds will point out this route, and those that may be advantageous for vessels, when desirous of taking the Equatorial Passage. During the northwest monsoon any one of the southern routes may be taken which lead towards it; then a quick and pleasant passage may be secured. I am inclined to believe that it will be found much more expeditious to take this route home, through the South Pacific, and so towards Cape Horn, than by the way of the Cape of Good Hope. Although the distance is somewhat greater, yet the winds will be found favorable and strong during the whole distance, and safer, especially during the seasons of the typhoons.

The route across the China Sea between Singapore and Balabac Straits is practicable at all seasons of the year. I need not give any directions relative to it; they will be found fully treated of by Horsburgh, in his valuable work, "The Sailing Directions for the China Seas." There is no great difficulty of beating up or down the China Sea against the monsoons in a well-found vessel. Much depends on the qualities of the ship, and the judgment of the navigator. The monsoons vary at times several points from the direction whence they are supposed constantly to blow, and from which their name is derived.

The route we passed over from the Straits of Balabac to Singapore, was to the north of the North Natuna, and near to the Hercules Rock. The Viper Shoal, reported off the Straits of Balabac, marked on the chart as doubtful, was not seen by us, and I do not believe it exists, certainly not in the place where it is laid down. We passed to the north of the Anambas Isles, made Pulo Pisang and Pulo Aor, and from thence stood down the coast to Cape Romania, and entered the Strait of Singapore, to the north of the Pedro Branco, and between it and the Cape Romania Reef, then stood directly up the channel for the Island of Singapore, where we anchored. On the eastern side of the China Sea we experienced a current, setting to the northwards 22 miles in the twenty-four hours, which is not noticed in Horsburgh; as we approached the west side we found it setting to the west 13 miles. During the northeast monsoon, and particularly towards the end of it, this current is found to prevail;

therefore the route to reach the Straits of Balabac, the entrance to the Sooloo Sea, is by sailing over to the east coast of Borneo, from the coast of China. The distance from the entrance of the strait is 30 miles. The tide is a great assistance when it is favorable, but its flow is extremely irregular. It is high water at Pedro Branco at 11 A.M., full and change. The sailing directions of Horsburgh are so minute, that it leaves me nothing to add, and to his volume I must again refer. At Singapore, all the supplies that may be required can be easily obtained. Since it became a free port, it has become the great mart of the East, and is now sought by all the islanders in these extensive seas, who trade with it, bringing their produce to market in the native proas.

On leaving Singapore, I preferred taking the route through the Straits of Rhio, and to the east of Lingin. I was enabled to do this with advantage to navigation. The commander of a Dutch brig-of-war, Lt. Dittlof Jassen, on surveying duty in the Straits of Rhio, was obliging enough to permit me to take a tracing from his chart, of a part of these straits, which enabled me to ascertain its correctness, as well as to add to it my own examinations: to it I would refer the navigator who desires to pursue the route, which I believe is the shortest and best, both to and from Singapore, when the monsoons will permit. After passing the Strait of Rhio, the route by the Straits of Banca or those of Gaspar, may be taken towards the Straits of Sunda. To Horsburgh's directions for these routes I have nothing to add, except to bear testimony to their accuracy and prudent advice.

I deem it unnecessary to give any further remarks connected with the Hydrography of the places touched at by the Expedition. Table Bay, at the Cape of Good Hope, is treated of in Horsburgh, and so is the anchorage off James Town, at St. Helena; besides, there are many other works which give directions, much fuller and more complete than my experience would authorize me to publish.

CHAPTER XIX.

WINDS.

THE winds are so intimately interwoven with all that facilitates the intercommunication of the nations of the earth, that the subject must naturally claim the attention of every one, and although steam has in a measure become a substitute for them, in navigation, yet the winds must ever be the great motive power employed in commerce.

A true knowledge of the theory of the winds, the causes which produce and affect them, must therefore be of paramount importance.

The theory, which has hitherto been received to explain the circulation of the atmosphere, I cannot persuade myself, is either satisfactory in whole or in part. It will be my endeavor, in this chapter, to exhibit what I believe to be the true causes which govern and produce the effects of the winds, and which will be found more in accordance with the facts that have been accumulated, resulting in a theory, which, I feel satisfied is based upon the immutable laws of nature.

My own experience has fully confirmed it, in the voyage of circumnavigation, whilst in command of the Expedition, and, I trust, may afford all the facilities I anticipate to others, and be the means of directing the navigator to the shortest and best routes on the most distant voyages.

In order to place the subject more fully before the reader, I will briefly recite the versions of the present adopted Theory of the Winds, viz.: "That currents of air owe their origin to any circumstance which has a tendency to disturb the equilibrium of the atmosphere.

" Heat is the chief cause of the atmospheric currents; for, wherever there are two adjoining regions unequally heated, there is produced

an upper-current of air proceeding from the warmer to the colder region, and an under-current in an opposite direction. Now, as this state of matters exists on the surface of the globe, where the mean difference of temperature between the regions of the Equator and those of the Poles amounts to upwards of 82°, and as the inequality is nearly permanent, its effect is, to produce a constant interchange between the polar and equatorial regions."

"Thus a cold and dense under-current from the Poles replaces the rarefied air of the Equator, which, ascending and forming an upper-current, flows towards the Poles, north and south, in order to restore the equilibrium of the atmosphere.

"It is known that the earth revolves on its axis, in a direction from west to east, increasing from the Poles to the Equator, where it attains a velocity of 1000 miles per hour,—so that the air, in passing from the highest latitudes towards the Equator, progressively arrives at regions of increased rotary velocity; and, as they cannot keep pace with this increase of motion, they necessarily hang back, and form currents flowing in a direction opposite to that of the rotation of the earth, or from east to west, and thus by these combined efforts, the northern and southern currents of air are deflected and modified, so as to become the permanent northeasterly and southeasterly currents, forming the magnificent phenomena of the Trade Winds.

"The southwesterly winds, so prevalent in the Atlantic Ocean, between the latitudes of 30° and 60°, are produced by the upper-current being drawn down to supply the superficial current which goes towards the Equator; and as it has a greater rotatory motion than the earth in these latitudes, it produces a southwesterly wind. The same is the case in the southern hemisphere, where northwesterly winds prevail.

"The theory is summed up, that whenever the air has greater velocity of rotation than the surface of the earth, a wind more or less westerly is produced, and when it has less velocity, a wind having an easterly tendency results.

"Thus there is a perpetual exchange between the different masses of the atmosphere,—the warm air tempering the cold of the higher latitudes, and the cold mitigating the heat of the lower.

"The difference of temperature puts the air in motion, and the direction of the resulting wind, at every place, depends upon the difference between the rotary motion of the wind and the rotary

motion of the earth. The whole theory of the winds depends upon these circumstances.

"There are two currents of air constantly flowing from the Poles towards the Equator; and, in order to supply the Trades, the air which they keep in motion must return by some channel to the place near the Poles. If this were not so, these winds would soon exhaust the polar regions of atmosphere, and pile it up about the Equator, and thus cease to blow, for want of air to make more wind of. This return current, therefore, must be in the upper regions of the atmosphere, at least until it passes over those parallels between which the Trade Winds are always blowing on the surface. But it is held that the particles of air from the Poles travel in the upper regions of the atmosphere until they get near the parallel of 30°. Here they meet with the particles which are travelling from the Equator to the Poles. They press against each other, neutralize their motion, and produce a calm. Thence come out two surface currents, and the air to maintain them comes by the downward current, from the superincumbent air of this calm region."

I believe I have thus given the different explanations of the theories of the currents of air, excepting the theory of Dr. Halley, who ascribes the Trade Wind to the current of air following the sun in his diurnal motion to the west.

These theories seem to have resulted from the phenomena of the Trade Winds, which appear, from their vastness of volume, permanency, and apparent constant direction, to be considered the active and permanent cause of the circulation of the atmospheric currents, instead of one of the effects which heated or rarefied surfaces would naturally produce, thereby losing sight of the one great cause in which all agree, viz.: that heat is the great destroyer of the equilibrium.

The result has been, that arguments and hypotheses have been adduced to account for the supply to this great current from the colder regions. Currents and counter-currents, both above and below, have been assigned to carry back the accumulation, and to restore the lost equilibrium;—so that the facts connected with the phenomena of the Trade Winds appear to have been entirely lost sight of.

It will be my endeavor, in the sequel, to show how these theories will stand the test of facts; and to controvert them by adducing proof and reasons, that the causes which produce the effects witnessed in the movements of the atmosphere are different from what these theories

represent them, and that they are wholly independent of, and sufficient to account for and explain, the phenomena which exist, without having recourse to rotative causes—and are more in accordance with science, and in conformity with the simplicity, the beauty, the order of creation established by an All-wise Being, who directs and controls the winds, brings the seasons round in their due order, replenishes the earth with refreshing showers, and supplies the wants and conduces to the happiness of all His creatures.

Now, in order to make my views more clearly understood, they may be briefly expressed in the following axioms:

1st. That the atmosphere, when of equal temperature and dryness, will remain at rest, or a calm exist.

2d. That if the atmosphere is disturbed by any change of temperature, the denser and colder portion seeks the warmer, from every direction, to restore the equilibrium, in the most direct lines it can follow.

3d. That heated air, unless confined and forced, never tends towards a denser and cooler area; but when free, it always rises or falls to the area, where its gravity and temperature will restore the equilibrium.

4th. That currents of air may pass in opposite directions without mixing, provided they lie according to their specific gravities; but they can never pass through or cross each other without commingling.

5th. That currents of air are influenced and disturbed by electricity.

On this basis we think that all the phenomena of the Winds may be ascertained and explained.

Great stress, in the Theory of the Winds, has been attributed to the rotary motion of the earth, in producing the direction as well as the apparent velocity of the Trade Winds.

I cannot believe that this cause has an influence on any surface winds.

The origin of wind is at the area or line of greatest heat: in all cases, the flow of wind or currents of air, is retrograde from the point to which they blow, and towards the area of heat as it recedes. On those sides where the greatest density exists, the flow towards the heated area has more duration and greater velocity.

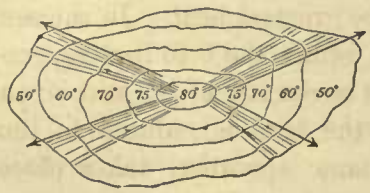
The land and sea breezes furnish a beautiful illustration of this. They begin at the shore, where the line of greatest heat is—thence they flow towards it from the sea, while the heated line recedes to the interior. When the limit of heat is reached, the breezes decline, and the equilibrium being restored, calm is produced. When the

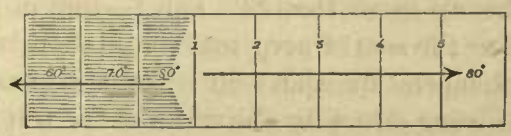
land breeze in its turn prevails, the same thing occurs in reversed order. It is well known that the Monsoons first begin near the intersection, or the separation of land and sea.

The Southwest Monsoon is felt at the heads of the Arabian Gulf and Bay of Bengal, and on the Coast of China, nearly a month previous to its commencement at the equator. As the heat of the land increases, the air follows the receding heated areas; while it flows in from areas yet more and more remote, retrograding towards the southwest or opposite side.

The Northwest Monsoon, in like manner, begins at the south nearly as much in advance as the Southwest Monsoon, though it retrogrades in a contrary direction; and it is well known that the northeast winds between Portugal and Madeira are first felt at the latter place—while the southwest winds are experienced on the coast of Portugal before they are felt at Madeira or the Canary Islands.

To make the progression of the winds more clearly understood, the accompanying diagram will exhibit the action of the currents of air. The central space is supposed to be at the temperature of 80°; the next outer line represents 70°; the next 60°, 50°, 40°. Now, the flow of air into the rarefied space of 80° will be from all sides—first from 70°, then the 60°, and then 50°, 40°; thus having a retrograde or backward motion from the centre. As soon as the temperature falls, the air will flow in with a less velocity, but it will continue until the temperature attains the minimum, when there will be an equilibrium, and consequently a calm. This is supposing the rarefied space to occupy a central position, but it may be oblong, or the area of heat extend over a whole country. In this case, as the temperature falls, the area of heat will recede, and the current of air will follow after the receding heat, whilst it flows from the quarter where it is colder and denser retrograding. The annexed diagram will more clearly exhibit my meaning:

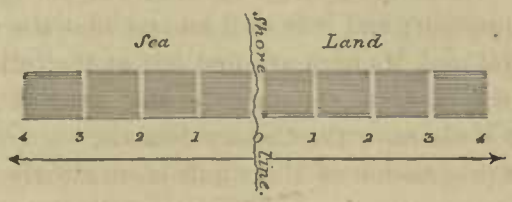




On the left the temperature diminishes, and the flow is first towards

the 80°; when it falls to 70°, the more rarefied space has receded to 1, which in its turn is reduced, the air following and flowing into 2; thence in like manner the flow of air follows to 3 and 4. In this way extensive tracts of country are swept over by the same winds, and according to the difference of temperature will be the velocity of the currents.

As the land and sea breezes are familiar to all, and are well known to be caused by the alternate heating and cooling of the atmosphere over the land and sea, an illustration of their action, perhaps, will make the progression more clearly understood:



The shore, or dividing line, is that of the greatest heat. In the sea breeze the flow is first from 1 to 0, which brings the 0 to its temperature; then 0 recedes to 1, followed by the cooler air of 0; and so on to 2, 3, and 4, until the temperature of the land is reduced to the temperature over the sea. Then, the same operation takes place from the land, and the air over the sea attains a like temperature; at the changes, be it of short or long duration, a calm ensues.

Before proceeding to the consideration of the subject of the winds and vapors, I shall show what is the actual state of the earth's surface as to temperature, the great cause, admitted by all, of the aerial currents.

For this purpose, I have divided the earth into five zones (see annexed map), viz.: two frigid, two temperate, and one torrid zone. The frigid zones are those from the Poles to the 60th parallel; the temperate zones are those between the 30th and 60th parallels, north and south; and the torrid zone embraces 30 degrees on each side of the Equator, or the space between the Tropics. The extreme difference between these is more than 80° Fah.;—that of the frigid zones being considered as the seat of perpetual congelation, while that of the torrid rises to a temperature above 80°. It is impossible to inspect this map without being struck by the width of the belt of heated water which surrounds the earth, comprising nearly the entire space within

the Tropics. At the same time, it will be observed that the preponderance of these heated waters lies in the northern hemisphere.

It would be foreign to the subject in this place, to institute the inquiry, Whence do these waters derive their heat? But the question may be so far answered, that this heat cannot be wholly from the sun; and it may be questioned if his heating rays have any other effect upon them than to increase the evaporation.

Many philosophers assert that what heat is derived from the sun's rays is again returned to the air by radiation. If such is the case, it is not by accumulation from that source that this heat can have been originated.

How great must be the evaporation which is constantly taking place, both by day and by night, from these heated waters; and what an immense rarefied area is here exhibited to view, to destroy the equilibrium in the atmosphere, and generate the vapors! In it we see ample cause for the wonderful effects which we witness in the phenomena under consideration, and which must continue so long as the same cause prevails.

It is thus evident that on this planet we have a continuous belt of heated water around the globe.

If we recur to authorities, we are informed that the air is an elastic fluid, acted upon by the same laws of gravitation as the more solid particles of matter. Consequently it will remain at rest from its vis inertia, provided an equilibrium of temperature is insured, and will be carried with the earth in its revolution.

That the rotary motion of the earth cannot have any effect upon the surface currents of air, is also fully evident, by the fact of the prevalence of westerly winds at the same time that we have easterly winds within the Tropics moving in opposite though parallel directions. Now, if this rotary motion was felt in one direction, it ought to operate in the other, and to produce a westerly wind, to be felt on the surface at the Equator, moving at the rate of 1000 miles per hour, it would be necessary for the wind to have greater velocity. This will be readily seen to be impossible; for the greatest velocity that wind has been known to attain in a hurricane, is short of a hundred miles in the same time. We therefore consider that the earth must carry with it in its revolution a large part of the atmosphere, which, undisturbed by heat, would remain quiescent, and be free to move in any direction. If this were not the case, none but easterly winds

would prevail. But it is known that we have strong breezes from the west within the Tropics and between the Trades, and in the Indian and Pacific Oceans from the west and northwest, where they continue for months together.

The hypothesis I have quoted assigns the rotary motion, combined with the aerial currents from the Poles, to give direction and to be the cause of the Trade Winds; in other words, forming the mighty engine which it is supposed acts to keep up the circulation of the whole atmosphere. Can it be possible that the same particles of air are carried from such great distances only to supply these great aerial currents, when we perceive that these particles must be subjected to the surface winds, calms, and heated areas, undergoing all the changes air is liable to, from moisture, as well as heat, in its passage?

Now, the direction of all winds is towards the heated areas of the ocean, and the same tendency likewise prevails towards these areas on the land, unless a high range of mountains should intercept their flow. And according as the difference of temperature existing in the near or remote regions is greater or less, will the currents of air or winds tend towards them with greater or less velocity. When the air thus induced becomes heated, it rises with the vapor to the upper and colder regions, the moisture is condensed, and the formation of clouds is the result, which are borne off in the direction of the currents of air.

The air of the upper regions, we conceive, seeks in like manner the nearest rarefied spaces which may exist, and passes off either to the north, south, east, or west, or changes its relative position in altitude, according to its specific gravity or temperature.

The ocean occupies three-fourths of the surface of the earth. It must necessarily have a greater and more extended influence than the land, and its mean temperature is 6° above that of the land.

If the great current from the Poles to the Equator, as assigned by the old theory, existed, we should find the whole course of the winds different from what they are known to be. In order to make this more clear, I will give the direction of the currents through the regions of the Trade Winds in the North and South Atlantic. On the confines of the Trade Winds, or between the latitudes of 28° and 30°, calms are very prevalent, both north and south, extending along their limits. Proceeding south, the wind, instead of coming from the north, is from the east. Advancing southward, it shifts to the east-northeast, then northeast, north-northeast, and finally it becomes north, or at

right angles to the Equator, and afterwards falls calm. Now, it cannot but be perceived that this is almost in opposition to the theory; for if the wind had derived its direction from the rotation of the earth, and its current towards the Equator, its curve would have been different, and the current of air would be unable to change its direction, having the same vis inertia as other matter. From this it is to be inferred, that the Trade Winds cannot be caused by the rotation of the earth, combined with surface currents of air flowing from the Poles to the Equatorial regions. Moreover, it would be the reverse of the direction which they now take, and we now know that the currents of air have not sufficient force nor the direction to combine, with the rotary motion of the earth, to produce or maintain a diagonal course of any current of air, much less one as great as the Trade Winds.

Let us now examine the extent or prevalence of the limits of the Trade Winds. The Northeast Trade Wind of the Atlantic is comprised within the space between the 9th and 28th degrees north latitude on the east, and the 12th and 25th parallel on the west, and between the meridian of 18° and 90° west longitude. Its northern edge passes westward, cutting the Tropics at 75° west, and thence along that parallel to 90°, where it ceases. Its southern edge, from the parallel of 9° north latitude, and 30° west longitude, tends towards the parallel of 12° in the longitude of 60° west; then passes along the coast of Guiana in a west-northwest direction through the Windward Islands, till it reaches the peninsula of Yucatan, in 87° west longitude; thence it passes into the Gulf of Mexico, and is lost.

The most eastern point of the Northeast Trade Wind of the Pacific Ocean is found on the meridian of 109° west longitude, and in 4° north latitude. From there it extends in a northwest direction to the longitude of 120° west on the parallel of 26° north latitude. Its northern boundary runs nearly on this parallel to the west until it reaches the meridian of 145° east, to the northward of the Ladrone Islands, where it is merged in or intercepted by the Northeast and Southwest Monsoons, prevailing in the Western Pacific. Its southwestern point is in 10° 30′ north on the same meridian. The width on its western end is 360 miles less than on its eastern. Its southern edge or boundary makes a slight curve between its eastern and western limits.

The Southeast Trade Wind of the South Atlantic has its southern

and eastern limit in 28° south latitude, and 10° east longitude. Its southern boundary tends westward to the meridian of 15° west longitude, where its western boundary begins; turning north, extending to where the 35th meridian west cuts the Equator, it thence continues as far as 3° north latitude. Its northeast terminus lies between the longitude of 15° and 36° west, in the latitude of 5° north and the Equator.

The Southeast Trade Winds of the Pacific are distant from the coast of South America 300 to 350 miles. The extreme southern limit may be given in 30° south latitude, in the longitude of 80° west. On its eastern boundary it has the same curve as the western coast of South America. It passes to the west of the Gallipagos to the latitude of 4° north. Its southern edge varies as much as 10° in latitude during the opposite seasons of the year. The southern limit runs from the parallel of 30° to 26°, and between the longitude of 90° and 180° west. This boundary is oftentimes much contracted and disturbed. It sometimes describes a curve as far as the parallel of 15° south, in the longitude of 140° west; thence towards the Equator in 170° east; there it is bounded by the Northwest Monsoons of the Pacific Ocean; and during the period of the Southeast Monsoon of New Holland, this Trade Wind becomes apparently merged in it. At times it may exceed these limits to the west, but does not so usually. The winds near the western terminus are light, with frequent calms, and variable at all seasons. The northern and western boundary extends across the Equator to 3° 30′ north latitude, and on that parallel easterly to the meridian of 95° west. Of all the Trade Winds, this is the most uncertain; it blows for several days together strong, when it intermits, and is succeeded by calms or light westerly winds.

The Northwest Monsoon, and the southwest wind of the Southern Pacific, when the sun is in southern declination, prevent these winds from extending to the south, and confine them to the limits above described.

The Southeast Trade Wind of the Indian Ocean is found to prevail at the distance of 350 miles from the west coast of New Holland, between 11° and 30° of south latitude. On the latter parallel, it continues to the west as far as 43° east longitude, or nearly to the meridian of Madagascar. Its northern limit describes a curve from the 90th degree of east longitude to the middle of that island, touching the 11th degree of south latitude; the north and south sides approach nearly to a point, forming the western terminus.

Having thus given the extent of the several Trade Winds of the Oceans, I shall give those of the Monsoons, which will also be found represented on the map.

The Monsoons differ materially in character from the Trade Winds. They are more equable, without the squalls, and undergo little variation during the day and night. They have their regular increase and decrease until they cease. They are more allied to the land and sea breezes, and result from the same cause. Indeed, they may be said to be such on a large scale, having a duration of several months, instead of occurring daily. Every one who has experienced the Monsoons, cannot fail to have been struck with the great difference between them and the Trade Winds. The most remarkable Monsoons are those of the China Seas and Indian Ocean, called the Northeast and Southwest. They prevail between the Equator and the latitude of 30° north, extending on the land as well as over the neighboring seas. Each, on an average, has a duration of five months in either direction; at the changes, which occupy two months, variable winds occur.

There appears to be much exaggeration about their constancy and their course. The cause assigned for them is undoubtedly the true one,—that of the heating of the immense areas of land of the Asiatic continent by the sun, rarefying them, and thus drawing towards them currents of air from the southwest to restore the equilibrium.

It may occur to others, as it has to myself, why should not this air be supplied from the cold countries of the north, which are nearer, and should be induced to seek these warm and rarefied areas?

By an inspection of the map, we find ample reason why this cannot take place. We will there perceive that the highest chain of mountains in the world stretches across the whole of Asia, from east to west, creating an insuperable barrier to the winds coming from the cold regions of the north beyond; and therefore the air is induced from the southwest, to flow towards the heated areas of Hindostan to restore the equilibrium; further it cannot go.

To the north of this range of mountains also lies the Desert of Gobi, and on the west is the high table-land of Iran, as well as that of Syria, and the Sahara of Africa. These all induce the denser and colder air from the mountains on the east, and from the north, to supply the rarefied area which exists in those places. On the sun's return to southern declination, these parts become cooled, when the

air flows back from the northeast to supply the areas, which in their turn become heated, forming the Northeast Monsoon.

The Northeast and Southwest Monsoons extend from the east coast of Africa over the China Seas, and as far as the Marianne Islands in the Pacific. The former has more strength than the latter. In the northern parts of the China Seas, the Southwest Monsoon is but feeble. There the cold and denser currents from the northeast seek the rarefied areas with more force. They prevail generally three-fourths of the year.

In the Gulf of Bengal, Arabian Sea, as well as the Bight of China, the Monsoons are not so regular as they are in the open sea. They are often light and changeable, and frequently calms prevail. This is particularly the case within the Straits of Malacca, where variable winds are almost constantly found.

The Northeast Monsoon is confined to the north of the Equator. It has many interruptions to its course from the high islands which lie within its range, and create many disturbing causes, diverting it from its direction, being at times influenced by the heated areas which prevail on the large islands.

Between the Equator and the eleventh parallel of south latitude, there are two other Monsoons, known as the Northwest and Southeast. These are coincident in point of time with the former, undergoing their changes about the same time of the year. They blow nearly at right angles to the direction of the first, but are divided by calms; though one appears to be derived from the other, that is to say, during the prevalence of the Southwest Monsoon north of the Equator, we have the Southeast Monsoon south of the Equator; and when the Northeast Monsoon blows north of the Equator, the Northwest Monsoon prevails south.

This latter Monsoon extends from the 50th degree of east longitude to the east, across the Indian Ocean, through the Banda and Java Seas, passes by New Guinea, and into the Pacific, at times as far as the longitude of 140° west.

The boundary of this Monsoon in the Indian Ocean is not throughout on the 11th parallel; but towards the Island of Madagascar, and at its extreme eastern limit in this ocean it extends several degrees farther to the south, forming a considerable curve; a calm belt lies between it and the Southeast Trade Wind. This

Monsoon, in part, is diverted towards the centre of New Holland, where a large rarefied area exists during the presence of the sun.

The Southeast Monsoon appears in like manner linked with the Southwest. That current of air extends from the Pacific Ocean, east of New Holland, and flows to the westward in the Indian Ocean, side by side with the Southeast Trade Wind. Although this wind is often designated as the Southeast Monsoon, its direction is not at all times from that quarter, but it frequently comes from east-northeast.

The Monsoons which prevail in the Mozambique Channel, between the Coast of Africa and the high land of Madagascar, lie between latitude 30° south, extending across the Equator to the north, along the east coast of Africa to Cape Jeddah, and half-way up the Red Sea. These Monsoons pass under the Northwest Monsoon to the west of longitude 50°; the winds are light, and calms often take place. The direction is from the north-northeast and south-southwest, parallel with the coast of Africa. Their period is nearly coincident with the Southwest and Northeast Monsoons, north of the Equator, which causes them to be considered by some as an extension of the former; but in reality they are separated by a region of calms. They ought therefore to be viewed as distinct.

Although the great Monsoons are confined to the Indian and Pacific Oceans and China Seas, yet there are several of lesser note and extent, which exist on the east and west coasts of North and South America. That which claims particular interest from navigators, is on the coast of Brazil. It is experienced from the neighborhood of Cape St. Roque to the Island of St. Catharine. Properly speaking, however, these are not Monsoons, though they have been classed and considered as such. They do not interchange their direction periodically, like the others, but only veer through several points of the compass. These changes on the coast of Brazil are from the north-by-east round to the south, on the southern parts of the coast. They show most conclusively that the currents of air are induced towards the heated areas of the land, which become rarefied from the action of the sun's heat upon the surface of South America.

As the sun changes towards the south, in declination, the land of South America becomes more and more heated. The air is drawn towards these areas from the north and northeast, along the whole ocean bordering on the east coast. It flows from the different points of the compass towards the land; in general, perpendicular to the

part of the coast, but always directed towards the heated area. This is what is called the Northeasterly Monsoon, which begins in September, and continues till February.

When the sun is returning to the north, the wind veers back again through the several rhombs of the compass, and becomes settled along the whole coast, from east-by-north to east-southeast; still blowing towards the heated areas, they flow in almost the same direction with the Southeast Trades, for which they are often mistaken.

In the immediate vicinity of the land of South America, there are also land and sea breezes. It is remarkable, when these coincide with the direction of the Monsoons, the latter are increased in strength, and the land wind which ensues after the sea breeze is also much stronger. It may be as well here to call attention to the fact, that the winds which flow into the large rarefied areas of South America, may be said to be constant, although they vary very much in strength and direction; unlike other areas, the land is never cooled below ocean temperature, so as to produce a return current from the land to the sea.

These heated areas are supplied from the north and south, as well as from the east. The high mountain range near the Pacific coast, like those of Asia, intercepts the current of air from the east, until it rises over their barrier.

Next in importance are the Monsoons on the west coast of Mexico. The duration of the Northern Monsoon is from the month of December to May. The currents of air are from the north and northwest, nearly parallel with the coast. They seek the heated waters of the Gulf and Bay of Panama. During its prevalence, fine weather is experienced; whence this season, although the winter of the northern hemisphere, has been denominated the summer of these regions. In the offing, they blow with more strength and steadiness than near the land.

When the sun advances to northern declination, heating the land of North America, from the month of May to September, the currents of air are from the south and southwest. These are the stormy months, attended with great explosions of electricity, and copious and constant precipitation, which is produced and evolved by evaporation and condensation. This causes great irregularity in these currents of air, from the colder temperature being in such close proximity to the heated waters of the ocean. Squalls and tempests prevail, which

come from the high land of the Isthmus, and rush with great violence over the sea, though they are of short duration.

Connected with this Monsoon, a southerly wind, an extension of the Southwest Monsoon, prevails from the Gallipagos Islands to the Bay of Panama. The cause here is also quite evident. The water of the ocean surrounding the Gallipagos Islands is some fifteen degrees colder than those of the Bay of Panama; consequently, the air in contact with it is cooler, and we should naturally expect, as we find to be the case, the air constantly seeking this rarefied area. The current of air, therefore, between these two points, prevails throughout the year; although it is a region subject to calms and very light airs; but when there is any wind, it is from the southwest.

I conceive that these are strong and sufficient proofs of the theory to which I wish to call attention.

There are also Monsoons on the west coast of South America, extending from Chili to Peru, which prevail from the northward from May to August, and from September to April, from the south. The former period is designated the rainy season. During the latter, the winds are considered to be allied to the Southeast Trade. No rain falls during this period.

The extent of this northerly Monsoon is through 23 degrees of latitude, from the 12th to the 35th degree south. This apparently is from a warmer to a colder latitude; but if we examine the temperature of the land, we shall find that it is warmer than the sea to the northward of it, and produces the same effect as in other cases. The northerly Monsoon takes place when the sun is in northern declination. It is characterized by being light and inconstant, and as it approaches the parts of Chili south of the rainless district which exists on this coast, the condensation and precipitation are immense, evolving heat and moderating the climate. The cold and dense atmosphere of the tropical parts of Peru, which comprises the rainless district before mentioned, is then induced towards the south; the resulting current of air is therefore from the northward, and nearly parallel to the coast.

This current of air is seldom experienced in the northern parts of Peru. When it does take place, the vapor which exists in the atmosphere is made evident in the form of mist, or the "garua" of Peru.

The heat engendered by the sun when in southern declination, causes the air to become rarefied on the coast of Peru; and the influx

of it from the south, to fill up and restore the equilibrium, produces the southerly Monsoon, which blows with great regularity.

The Monsoons of the West Coast of Africa prevail from the latitude of Madeira to the Cape de Verdes; thence south, extending into the Bight of Benin, and as far as the Cape of Good Hope, and are the next to claim attention.

They are divided into the northwesterly, westerly, southwesterly, and northeasterly Monsoons. The first three blow towards the land, whilst the last, called by the natives the "harmattan," blows from the land to the sea.

The duration of these Monsoons is very unequal; the former lasting some nine months, from March to December, while the latter rarely endures three months. Like the Monsoons of the coast of Brazil, the direction of these winds depends somewhat on the trend of the coast and the position of the sun in declination, by which the continent of Africa is heated and the rarefied areas maintained. The current of air rushes towards the heated areas which are nearest; and consequently, on different parts of the coast, the wind changes its direction, so that it is found to flow from the south to the northwest by the west.

The flow from the west under the equator extends nearly across the Atlantic Ocean, between the two continents, in a cuneiform shape, from the month of June to September; after which time it ceases, calms, and then the "harmattan" prevails from December till March, with occasional intermissions.

The character of these Monsoons is different;—that from the southward and westward is always attended with rain, while the northeast is a cold and very dry wind, flowing from the highlands of Africa. It seeks the heated areas of the ocean, but does not extend more than a hundred and fifty to two hundred miles from the coast.

There are other periodical winds, which have an extensive range, but of which our knowledge is as yet very limited. I have reference to the winds which sweep across the great deserts of Africa, Asia, and America. In order to trace these, we require many more observations than we have; but enough is known to establish the fact that the easterly and northerly winds in Africa and Asia prevail during nine months of the year, and are succeeded by those from an opposite direction. In the Mediterranean these winds which flow towards Africa have been long known by the name of the Ætesian winds.

A denser and colder aerial current also flows from the Caucasus, in

Southern Europe, towards the rarefied areas of the Great Desert, while the sun pours his vertical rays on it; but, on the sun's return to southern declination, the Desert becomes cooled, and light airs at times flow from it towards the heated waters of the Mediterranean. In Egypt, a cold current of air flows from the south during the winter months, towards that sea.

A peculiarity exists in the currents of air on the Red Sea. They flow in from the north and northwest; but their limits do not extend beyond half of the length of that sea, where they become neutralized by the high temperature; and, as has been observed, the currents from the Southwest Monsoon of the Indian Ocean prevail in the southern half.

Although we believe that the heated waters of the Tropics, which we have shown to exist, are sufficient to account for the flow of the aerial currents towards the Equatorial regions, we are far from denying the action and influence of the sun.

It will be seen by the map, that these heated waters occupy a much greater area in the northern than in the southern hemisphere, which we think is the cause of the unequal prevalence of the Trade Winds, as respects their extent in latitude. It is a well-established fact that the Northeasterly Trade Wind rarely if ever reaches the Equator; while the Southeast Trade, coming from the South Atlantic, passes at times several degrees to the north of that line. The anomalies and vibrations of the Trade Winds, we conceive, are caused by the sun's heat. These have been for a long time noticed by all navigators; and we think it quite clear that the diurnal increase and decrease of the Trade Winds which always follows or precedes the sun's course, renders these winds fitful and unsteady. The temporary heated belt and greater evaporation which is created by his rays, has an immediate influence, causing a rarefied area to follow, as it were, in his wake, into which the denser air rushes with velocity, giving rise to the extension of the Trade Winds in latitude by drawing the air from more remote parts, and sudden squalls, condensation, and consequent precipitation, and not unfrequently a change of wind through several points for a short time, occurs in what is supposed to be the very strength of the Trade Winds. When the sun is in the opposite hemisphere, the Trade Winds are more steady and regular, having less of a fitful character; and the squalls of wind and rain are rarely experienced.

The calm areas have been for a long time a terror to navigators, and

will continue to be until they are better understood. I have designated a calm as the result of an equilibrium of temperature, whether it be high or low. In the first case, it is more or less a rarefied and moist atmosphere: in the second, dense and dry.

All observations show that there are several areas of ocean where calms exist almost constantly. There are others which are periodical, and result from geographical position; while some have a daily recurrence, though well defined in limits. The areas of calms comprised within the Equatorial limit, and those on the outer borders of the Trade Winds, have also their periods of vibrations, caused by the influence of the sun's heat. The periodical calms are those consequent upon the change of the Monsoons, and the diurnal ones are the result of the land and sea breezes. Those resulting from geographical position, are the large areas of ocean where the heat has induced an almost constant high and equable temperature, to which the flow of the currents of air is sluggish, resulting from the velocity of the ascending current, and where large areas are reduced to a very low and equable temperature by the ice which exists in the Polar regions. All calms continue as long as the surrounding atmosphere remains undisturbed. Many instances of these will be brought to mind by the daily experience of every individual.

We thus perceive that calms are frequent both in high as well as low latitudes, and play an important and essential part in the circulation of the aerial currents. Were it not for calms, in order to secure the changes of atmosphere to insure a circulation, the heat and cold would be much greater, the changes more constant, whirlwinds and disastrous conflicts more frequent, and the shocks to our senses unbearable, or the atmosphere would be brought to a stand-still under one temperature, and we deprived of the blessings which a free circulation gives in the constant recurring cool and refreshing breezes, so essential to the health, welfare, and happiness of man. In the first case, neither man nor nature would know repose; in the second, there would be nothing to prevent that stagnation which would engender all kinds of disease, and both animal and vegetable life would suffer,—and that order of things which "tempers the wind to the shorn lamb," so beautiful, so simple, and so wisely ordained in the progressive movements of the winds in their retrograde action, would be destroyed, by which the temperature is made to increase and decrease gradually, its accumulation prevented, and not suffered to become stagnant, by the one great law under which it acts,—the denser and colder atmosphere

seeking the heated or rarefied areas. Knowing where the areas of the heated waters are, where calms usually take place, it will at once be perceived how these vexatious visitations to the navigator are to be avoided, and they will serve as a means by which he will be enabled to pursue his voyage and preserve his wind. All that is required of him is to regard those parts of the ocean where the high temperatures exist at certain seasons of the year, and so to navigate his vessel as to pass either on one side or the other, by which he may be assured that he will be able to take advantage of the current of air that may be flowing towards them.

It now remains to treat of the variable winds of the temperate zones, or those spaces which I have included between the latitudes of 30° and 60° north and south. It is well known in these northern and southern zones, in both hemispheres, that the winds prevail from the belt of calms on the borders of the Trades in the summer months, and towards them in the winter months. This is the general course of the variables. By the old theory as quoted, it will be recollected that these winds were assumed as the return current towards the Poles, and that their direction resulted from the action of the rotary motion of the earth, and the flow to the north and south was the return current to the Poles, which they had supplied to the Trades; and were it not for this interchange, the wind, it is argued, "would cease to blow for want of air to make wind of." The modification of this system, since adopted, I regard as equally inconsistent with what takes place, viz., that the heated air which rises from within the Tropics flows over towards the calm areas on the outer borders of the Trade Winds, there meets with another upper current from the Poles, descends to the surface, and reissues in two surface currents in opposite directions—the one to the south, the other to the north—the former to supply the Trades, the latter to restore to the Poles what had been taken from them for that purpose. This modification of the old theory removes one obstacle,—that of the winds coming in actual contact on every successive parallel; but it creates another, and, in my opinion, a greater one, viz.: a meeting and crossing at the area of calms of opposite currents of air of different temperatures without commingling. I can see no reason why the air should flow towards these belts by the upper current, descend, and reissue in different and opposite directions, affected, as it is represented to be, by the rotary motion of the earth, united with a flow to and from the Poles, whilst

the impulse of motion in either direction is changed or ceases, and the vis inertia of the body of air destroyed.

Now, in the region lying to the north and south of these areas of calm, it is found that the temperature of the ocean is higher in the summer months of the two hemispheres, and that there is in consequence a flow of air from it towards the parallels a few degrees to the north and south;—those in the northern hemisphere veering from the southwest to the southeast by the south, whilst those in the southern veer from the northwest to the northeast by the north. These currents of air frequently coincide with the general direction of the variable winds in higher latitudes, the flow of which is simply induced by the difference or variations of temperature, as shown by the isothermal lines of the oceans lying between the old and new continents in either hemisphere, combined with the heating of the surfaces of those continents during one portion of the year, which induces the flow towards them to be the greater. When they cool, the flow returns from them to the ocean, and this creates as well as gives direction to the alternate flow of currents of air familiarly called *the variables*, and with which the rotation of the earth can have nothing to do. The Polar winds, in like manner, circulate, caused by the unequal distribution of heat, and by the rays of the sun during his semi-annual sojourn, as well as the evolvement of heat in the condensation of vapors, and the changes of water into ice. The order of these movements is simple and effective in producing a thorough interchange and commingling of the atmosphere, and results wholly from the one great natural law which has been given to it by an All-wise Providence.

Having traced out the aerial currents on the surface, we will now take up those of the upper regions, which the theories quoted in the first part of this chapter represent as setting towards the Pole, "for the purpose of restoring the equilibrium, and drawing off the accumulation which would soon exist at the Equator, as well as to ameliorate the climate by diffusing heat around the Poles."

In confirmation of this upper-current theory, it is stated that the winds pass in a constant current from the southwest and northwest; but this, it appears, is only an inference from induction,—that there must be a return current to replace the air coming from the Poles, which otherwise would soon be without atmosphere. Where is the proof that these winds do prevail, and are constant?

The observations which have been made are too few to establish it, or that the air has any particular direction in the upper region. My stay of three weeks on the top of Mauna Loa, 14,000 feet above the level of the sea, did not show it. It is true the most stormy and violent winds came from the southwest, but a great part of the time the winds were light and variable, and from every point but southwest. The temperature of this wind was low, and doubtless induced to some warmer area.

Much stress has also been laid on the fact of the descent of ashes from the volcano of St. Vincent, in Barbadoes, in the year 1812, as proving that the upper current was from west to east in the upper regions. I think it by no means conclusive. The vast amount of heat evolved may have caused a change in the aerial currents of the upper atmosphere, or the ashes been attracted to Barbadoes by an electrical current; and full as plausible a solution may be advanced, that the ashes remained in the upper atmosphere till the earth had performed her revolution, during which period they may have imbibed sufficient moisture and loss of heat to become heavier, and descend over the region to the east, on the parallel with the two islands.

In recurring to the eruption of Cosiquina, in Nicaragua, in 1835, we find that the ashes were carried in all directions and to great distances.

It may indeed be doubted whether any continuous upper current does move from the Equator to the Poles. I have found no proof of it whatever. The upper clouds, which must move with the upper currents, have always the appearance of moving from east to west, within the Tropics. The opportunities for making these observations rarely occur. I speak, at least, from the experience I have had. I am not prepared to say that their absolute motion is such, but it is the most reasonable supposition; and if we admit that the air, in rising to the higher atmosphere, loses a part of the earth's velocity, it must fall behind, and have the appearance of moving in a contrary direction to the earth in her rotation.

Should this be the case, and all analogy would lead us to believe that it is so, yet, when we refer to the aerial voyages which have been made, we do not find anything that establishes the fact of the existence of an upper current in any particular direction.

In the celebrated voyage of Gay-Lussac and Biot, they rose to the height of 13,000 feet, and were up, in their ascension, three and a

half hours. The aerial current was found to prevail strong to the southeast. In the second voyage of Gay-Lussac, when he ascended to the extraordinary height of 23,940 feet, and continued up for six hours, the aerial current was then from the northwest, directly opposite to the former. On this voyage, Gay-Lussac, at the immense height he reached, had still the cirrous clouds above him, pointing in various directions. In both of these voyages, the most remarkable on record, we have a contradiction of the theory of the southwest upper current towards the Pole, as well as the slipping of the earth under its atmosphere. Had it been so, Gay-Lussac would have landed nearly one-quarter of the earth's circumference to the westward. He returned to mother earth a little over fifty miles from where he set out.

The voyages of Mr. Wise, the aeronaut, as well as others, do not prove that the aerial current is flowing from the west to the east. During the period of the year when his ascensions took place, there is generally a flow from the southwest and northwest to the eastward; that is, from the land towards the ocean; and although he states that there exists a westerly current within an elevation of 12,000 feet, I can find no proof in the publication of the voyages on which this bold and intrepid aeronaut bases his remark.

The cirrous clouds ought to afford us some indication of the course of the aerial currents in the upper atmosphere. The forms which these suspended vapors assume must be more or less shaped by the aerial currents in which they exist. Frequently they are seen to undergo rapid changes. Every one who has watched these clouds, knows that they tend in all directions. These facts go to prove that although upper currents prevail, they do not follow the theory, viz.: flow from the Equator towards the Poles, or in any particular direction.

It is impossible that the air of the Tropics should carry any heat to the Poles, to modify and lessen the rigor of the northern and southern climates, as held by the old theory;—for the air, on ascending, is reduced to the low temperature of the freezing-point, within the Tropics, at the height of 16,000 feet above the sea, at which altitude the snow-line is constant. It is therefore evident that there is nothing to support the theory that there are "return currents in the upper atmosphere flowing from the Equator to the poles;" and it is utterly impossible, if they did exist, that they could carry any of the heat

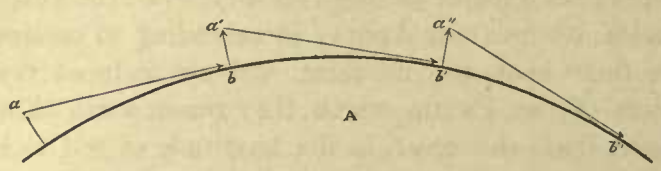
with them which they had acquired when within the lower Equatorial limits.

To return to the surface currents. Although the map which accompanies this chapter exhibits the flow of the aerial currents in the different seasons, it is necessary to state from whence these currents are supplied. In order to understand their action more fully, I shall endeavor to explain their flow.

Having satisfactorily proved that the Trade Winds do not receive their supply of air in a continuous current from the Poles, and that the return or upper current does not exist, it is incumbent to show whence they receive the vast supply and the circulation.

Lest I may not have made the interchange of the atmosphere fully understood by those who may not be familiar with the action of the currents of air, I shall now explain how great Equatorial currents are supplied and maintained. Prior to tracing them out, I will give what I conceive to be the progression of the atmosphere around the globe, from the cooler to the heated area, then ascending to the cooler upper strata, and onward to the heated area again. This may be better understood by the annexed diagram.

A represents a part of the earth's surface over which the great current is passing; a, a', a'' are the cold areas of the upper strata; b, b',



b'', the heated ones of the surface; the long arrow shows the direction of the cold or dense wind passing from a to b. It then rises in the direction of the short arrow to a', becomes cooled, and flows off to the warm area b'; thence it again rises to a'', and follows the same alternating course to b''; but always towards the direction where it is most strongly induced. Now, these lines are all tangents to the earth's surface, and the shortest distance between the two areas. The currents of air, in this way, pass over a mountain chain, rising up to its top, and leap over the lesser Monsoons, which flow underneath, parallel to the line of the coast or mountain range.

In examining the position of the heated areas of the ocean, we find that they generally lie, within the Tropics, to the westward of the

Trade Winds, with the exception of that towards which the Southeast Trade Wind of the South Atlantic blows.

Let us take, for instance, the Northeast Trade Wind.

The heated areas of the land (the Sahara) lie to the east of the Trade Winds. Vast currents of air are passing towards these, almost throughout the year. They come from the north and south as well as the east. On becoming heated over this area, they rise, lose their temperature, and are thence induced towards the nearest warmer area of the ocean lying to the west, on which they descend, some three hundred miles from the Coast of Africa, in about the longitude of 30° west, leaping, as it were, over the currents of air and calms which prevail between it and that coast. They thence pursue their course, rising and descending, to the warm regions of the Gulf of Mexico, are lost in calms, or intercepted by coming in contact with the highland of Mexico, rise again, become cold, and pass to the west, losing their moisture by condensation before reaching the elevated and dry plains of Mexico; thence, leaping the lesser Monsoons of the west coast, they flow towards the warm areas of the Pacific, constituting a part of the Northeast Trade Wind of that ocean.

The Northeast, as well as the Southeast Trade Winds of the Pacific derive their great supply from the currents of air which rush, in a constant stream, of greater or less velocity, over the vast plains of South America, towards the Andes; in ascending to escape, they are deprived of their heat and moisture, and are induced towards the heated waters of the Pacific, which they reach, some three to four hundred miles from the coast, in the longitude of 90° to 120°; and thence onwards to the heated areas on the western part of this ocean. The wide belt between these winds and the coast of South America is occupied by the lesser Monsoons of the west coast, over which they have passed. These winds in their onward progress, seek the area which is the nearest and most heated, and tend mostly towards the part of the Pacific which is affected by the direct rays of the sun, at the season.

As we have stated before, the Northeast Trade Winds are found, on the eastern side of the Atlantic Ocean, to be various in their directions. They are almost entirely different from the western portion; and this is considered to be a strong argument against the old theory of the Trade Winds, that they do not, where they begin, indicate by their direction the forces that are thought to produce them. In some

places we see the Trade Winds checked by the temperature of other winds, or lost in calms. In others, we find them merging in a periodical Monsoon, obeying other influences, and flowing towards other areas of higher temperature. In some cases, these are but temporary, while in others, they are permanent;—both the Northeast and Southeast Trade Winds of the Pacific are found to deviate towards the opposite Tropic when it is warmed by the sun's rays.

The Southeast Trade Wind of the Indian Ocean derives its great supply from the heated air which rises above New Holland, is cooled, and seeks in like manner the warmest area of the ocean to the west. It passes over, also, a wide tract of ocean, before it descends and becomes the surface Trade Wind.

As the sun reaches high northern and southern declination, the air is induced towards the great currents beyond their northern and southern edges; it is drawn in, as before mentioned in the explanation of the progression of wind, from beyond the belt of calms; but the supply is but temporary, and very small, compared to the vast volume that is required to keep up the circulation.

The Southeast Trade Wind of the South Atlantic derives its supply from the air which rises above and flows over the southern part of Africa, and then descends at some distance from its west coast, and pursues its route towards the Equator.

In regarding the movements of winds, we invariably find, where the greatest difference of temperature exists in close proximity, there its greatest violence is experienced. Perhaps the best known instances of this are found in countries where the mountains and plains lie in juxtaposition. If we take, for instance, the winds in the South of Europe, between the Alps and the Mediterranean Sea, these are, according to Dové, "celebrated for their violence and severity." We find that this extreme rapidity of the aerial current is due to the great difference of temperature. At the same time, the wind is known to blow very strong down the north side of the Alps, being induced towards the higher temperature of the plains. In New Holland, it not unfrequently occurs that the wind flows from the northwest and west, from the interior, towards the east coast. This, we suppose, to be owing to the cold and higher air being induced to flow towards the heated area of the east coast. These winds are dry and cold, the temperature often falling from 100° to 70° Fah.; yet they are felt to be almost suffocating to the feelings—and everything

within their range parts quickly with its moisture, leaving it entirely blighted.

Hot winds, so called, are liable to mislead us. If they could be traced, they would be found to be tending to areas of still higher temperature; and it is well known that they are comparatively local;—but many are so called from being dry and suffocating, rather than hot. We judge of them from our feelings, rather than test them by means of our instruments.

At other times, the Monsoons often unite with the Trades, and flow in a common direction, and, where the one wind is warmer than the other, they are found to commingle and produce precipitation.

On the ocean, where the areas of high temperature exist, the air generally flows towards them from all sides, though with greater or less velocity. In the Atlantic and Pacific Oceans, we have two very remarkable nuclei of heated water, where the temperature ranges nearly to 90°, and through which the Equator of heat passes. To these the air tends, although only a few degrees above the surrounding temperature; and the currents of air, after the equilibrium is restored, cease to move in any horizontal direction, when calms ensue. These areas of calms have various positions, but they always exist where the heat is equable, and generally hold a midway position between the Trade Winds, or between these and the variables. In both cases, they change to and fro, vibrating through a few degrees of latitude.

The calms, therefore, are the result of the restored equilibrium, and they endure as long as there is no disturbance produced by a change of temperature. These calms are another proof that the earth in her rotation produces no friction to affect motion on the air, and that the air moves with it. In the northern hemisphere, where they prevail during the summer months, the temperature is generally equable. In all places where they exist within the Equatorial belt, frequent local gusts of wind, of short duration, are experienced from every quarter. There the warm air ascends rapidly, evaporation and condensation take place, and explosions of electricity, with rain, are frequent. The period when these occur most frequently is during the season when the sun is vertical, and his action most powerful.

The intertropical seas being occupied by these large areas of heated water, light winds and calms must prevail, as the air can flow no faster towards them than it ascends to the upper atmosphere.

During the period when the lands adjacent to these areas become intensely heated, then the air of this Equatorial region is induced towards them in gentle breezes, in pursuance of what we believe to be the true theory.

On the land there is no difficulty in pointing out where the highest temperature exists. In some cases, however, this is more apparent than in others. In none more so than in New Holland, surrounded as it is by the ocean. During the period when the sun is in southern declination, imparting its heat to that sterile land, the air flows towards its centre from all sides.

Travellers in the interior of New Holland are overcome with the excessive heat, and make frequent mention of the long calms which prevail. The rainless districts offer several other instances in which the winds in like manner are concentrated; but as some of these occupy high table-lands instead of a depression, they change somewhat the character and direction of the air rushing towards them in the different seasons, and become quickly cooled in the absence of the sun

Wherever extended plains exist, and the surrounding country is high, the cold currents of air are drawn towards these areas,—and the greater the difference of temperature, the faster will be the flow. In all these localities calms and sudden squalls predominate, and the rain frequently falls in torrents, with great explosions of electricity.

If the theory I wish to establish, of the circulation of the atmosphere, be correct, we ought to find the winds pursuing their regular route towards the areas of ocean and land. This is the case. The ocean differs but a few degrees in temperature during the year;—the land often undergoes great changes within a day.

The great outlines of these currents on the ocean and land are given on the map; and it must be apparent to all that the circulation of the atmosphere cannot be reconciled with the old theory.

It is remarkable that the effects we witness in the northern hemisphere during the summer, do not take place in the Southern Pacific; the sun's action upon the Southeast Trade Winds contracts rather than expands their limits, and causes them to veer to the northward of east, even on what is supposed to be the parallel where they should blow strongest, and with the most regularity.

Instead of the summer being the fine season of the South Pacific, it is the most boisterous part of the year; violent gales come from the southwest and northwest.

The Southeast Trade Winds are interrupted by the Northwest Monsoon, and their limits encroached upon by the southwest winds; both denser winds. All these winds seek the areas which are most rarefied by the temperature of the ocean and the sun's heat, in order to restore the equilibrium of temperature.

In all countries there are local winds, but they are chiefly those which approximate to the general direction. For instance, in England, and perhaps throughout all Europe, the westerly winds are most common in the summer months. In the winter months, they have those from the north, northeast, and east; which prove, so far as Europe is concerned, that the great aerial currents flow from the colder to the warmer regions.

We now perceive that there can be no accumulation at the Equator, nor deficiency at the Poles; and consequently, that we need not recur to any hypothesis to supply the one or carry off the other, to maintain the equilibrium throughout the earth's surface, or secure the circulation and supply the great currents. Under the Equatorial limits the temperature is high;—under the areas on the outer border of the Trade Winds, the thermometer stands at temperate heat throughout the year; while within the Polar Circle, during the long nights, calms prevail: then the temperature is always low and generally equable. When the atmosphere is highly heated, the weight of its column is decreased;—hence the barometer stands low. Along the area of calms, between the Trades and Variables, it stands higher throughout the year, owing to the mean temperature being lower; but at the Poles there is less height of atmosphere;—consequently its standing is lower.

The supply for these great Equatorial currents comes from the north and south Variables and Polar regions, through the Monsoons, and alternately with greater or less force during the presence of the sun in either hemisphere. These currents of air do not flow towards the regions of the calm areas, or from them. The calm areas maintain nearly an equable temperature throughout the year. They confine the Equatorial currents to their bounds, and their limits only extend along the Trade Winds; they do not cross the Monsoons. These move freely to the north and south between them and the continents, and flow almost continuously. Short calms take place, but they are altogether transitory in their character, and confined to small spaces, where the temperature acquires a temporary equilibrium. But the

flow is not hindered; it is free from all barriers, and passes onward in a steady and sometimes strong gale towards the heated area, varying in duration, interchanging its particles, and ever acting under the simple but efficient law impressed upon it.

But to return to the circulation. Let us take an atom of the Southeast Monsoon of the Pacific, found in the southern hemisphere, southward of the Tropic of Capricorn, near the 180th degree of longitude, during the winter season (from May to October). It will flow to the northwest, west-northwest, or west, passing through Torres Straits, over part of New Holland on the south, or New Guinea on the north; thence over the Banda and Java Seas into the Indian Ocean, where it will pass to the Equator at the calm area; it has then become heated, is specifically lighter, and rises to the upper strata, where its temperature is lost; thence it is induced to the northeast towards the heated areas of Hindostan, China, or Arabia, in the Southwest Monsoon, and onward to the Himalaya Mountains, which intercept its course. Being unable to pass this high barrier, it must flow towards the east or the west; as it is induced, most probably in the latter direction, towards the heated deserts of Iran, Syria, or the great Sahara of Africa, it unites with the great current which passes over it, and flows onward to the west, to join the Northeast Trade Wind. But if this atom should have been induced, in the first part of its route, toward the central heated area of New Holland, to restore the equilibrium, it would then have flowed into the Southeast Trade Wind of the Indian Ocean, thence across the South of Africa have joined the Southeast Trade Wind of the South Atlantic, and with it passed to the Equatorial calms north of the Equator; thence westward over the continent of America, to join the flow over the ocean whence it set out,—having performed more than an entire revolution; and at the average rate of six miles per hour, it would have required just the half year to have completed this circulation. In the same way it may be shown that other atoms pass in various directions from the Variables, through the Monsoons, make the circuit without interfering with each other, flowing in the utmost order and harmony. These routes may be readily seen by an inspection of the map, and traced from the Polar Circle into the Variables, and through the Monsoons to the Equatorial currents,—and by noticing the mark on the arrow, it may be seen whether their flow is in the summer or winter season of the hemisphere. Thus the connection is formed and kept up between the Polar and Equatorial

regions—not through one great current, but innumerable ones, in all directions, serving to intermingle the whole as it approaches the Equatorial heats. The Variables flow toward the continents in summer, when they are heated by the sun, and from them towards the sea in the winter. The Polar winds are in like manner circulated during half the year; in the long period of night, they lie quiet in consequence of the equable temperature which prevails. Nor must we fail to give our attention to the areas of calm. They prevent the access between the Trade Winds and Variables except by the Monsoons. They constitute the barriers or walls which confine these currents of air to their proper limits, and prevent them flowing directly to the heated area: on examination, we shall readily see that, if they were permitted to do so, the circulation would soon cease, and everything become stagnant. How beautiful and how simple is the arrangement by which these barriers are maintained through an equable temperature, and the circulation kept within its proper limits!

The Monsoons form the great links of the circulation between the Trade Winds and Variables; and as each hemisphere in its turn becomes heated, the Variables alternate with each other, and with the atmosphere of the regions of the Polar Circles. All move in perfect harmony, exhibiting the wisdom and wonderful simplicity by which the whole is governed.

As the origin and cause of all winds is to be found at the area to which they blow, it follows that the indications in that quarter are to be regarded. The appearances to leeward, therefore, determine what the weather is to be,—the reverse of the practice of sailors, and all who claim to be weatherwise.

VAPORS.

Although I have contended that the rotary motion of the earth had no influence upon the surface currents of air in producing the direction of the Trade-Winds, I am not disposed to deny that the rotary motion has no effect upon the Vapor surrounding the globe.

Vapor, like other matter, obeys and is subject to the same laws of gravity, decreasing with the distance from the surface.

If we suppose the earth a sphere, surrounded by water of the same temperature, it would be enveloped in vapor, in equilibrium and at

rest, over the whole surface, and the pressure would be equal to the elastic force of vapor at its constant temperature. This pressure would prevent the formation or increase of vapor. No precipitation would take place, and the whole mass would be clear and transparent. If, however, the temperature should be changed, and become unequal, and the increase to take place at the Equator, the tension of vapor would be that of the minimum temperature; but as the evaporation would be in proportion, and go on continually, the condensation in like manner would be equally as rapid and as great, and the vapor would flow from the Equator towards the Poles, where the condensation would take place, the heat be given out, and the precipitation flow back to the Equator.

Now, this cannot take place so freely where the vapor is combined with the atmosphere, for it offers great resistance to the free passage of vapor, which is compelled, as it were, to filter through the air; but, notwithstanding it is retarded, the interchange takes place, and evaporation and condensation goes on.

The temperature of an aerial atmosphere diminishes much more rapidly with increasing elevation than one of vapor; as the relations of air to heat under different pressures varies from that of vapor in the higher regions, a new cause of precipitation and an increased evaporation beneath would be created. If the earth were covered with water, perpetual clouds would be experienced everywhere but on the Equator. The earth's surface, however, is divided into one-fourth land and three-fourths water; and as the land supplies but a small quantity of vapor, it produces a great change. Vapor tends to distribute itself according to temperature and tension over the whole surface. Vapor formed over the ocean will therefore press towards the land, and towards the colder parallels, in order to obtain an equilibrium. Now, if this vapor, in its progress, be influenced by the rotary motion of the earth, it must distribute itself more freely and in greater quantity to the west, in opposition to rotation; or it will flow, so to speak, to the west, without interruption; or, which is the same thing, the earth glides under it and leaves it behind. When it encounters the land, if the temperature is sufficiently low, it will be condensed; but if it should be higher, then it will be expanded and pass over the land until it meets with a change of temperature. It will then be condensed and precipitated. This generally occurs when it comes in contact with any high mountain range.

The natural course of vapor is then from the east to the west—consequently, the vapor from the oceans, seas, and lakes, which lie to the east, supply the vapor or moisture to the land on the west;—hence it follows that the continent of North and South America receives its great supplies of rain from the North and South Atlantic Ocean, while Asia, Europe, and Africa derive theirs from the Pacific and Indian Oceans, and inland seas.

The particles of vapor move over each other without friction, and vapor is impelled by the law of its distribution from the Equator towards the Poles. It meets with resistance in the atmosphere, whether the latter is at rest or in motion. If the course of the wind coincides with the direction of the vapor under its own pressure, it will be accelerated; but if adverse, it will be somewhat retarded. Nevertheless, it would seek to distribute itself agreeably to its own laws, from the Equator towards the Poles, for the purpose of maintaining the equilibrium.

The law by which vapor disseminates itself is in direct opposition to what the currents of air are known to follow, viz.: from the warmer areas to the colder ones, instead of the reverse. We are not aware of the great flow of vapor, as it passes almost in an invisible state, and is not developed until the temperature is so far decreased as to cause condensation, when it becomes evident in the form of clouds, fog, &c.

It has been shown satisfactorily that the atmosphere cannot carry any heat to the Poles, if the upper current did exist. Therefore, it can have no influence in ameliorating the climate there. But with vapor it is different. It carries its heat in a latent form, and retains it till it reaches the areas where it is required, and there it is given out by condensation. This, we think, moderates the cold of the northern and southern hemispheres.

It is almost impossible to obtain by experiment the height at which vapor exists. I have made many attempts to ascertain the height of the vapor plain by the vegetation, which varies in different latitudes from 1200 to 4000 feet. Whether it maintains a constant position, has not yet been determined; but that it does so, is very probable. In calms and during easterly winds, high peaks or mountains are seen capped with clouds, which mark the vapor plain. These are only observed in calms or easterly winds. With westerly winds, their outline is clear and well defined,—another proof, if it were wanting, of the flow of vapor from the east to the west.

As we ascend from the surface, as gravitation decreases, we believe that the atmosphere of vapor is retarded, or falls behind; or that the earth slips from under it, leaving it to the west. If this is so, the several meteorological phenomena connected with vapor can be readily, simply, and, we think, satisfactorily, explained.

The phenomenon of rain, it is well known, is produced by the commingling of two masses of atmosphere of different temperatures, when precipitation takes place. This is more or less copious, according to the quantity of moisture or vapor which is held in suspension by them. The question as to how this vapor is carried, and whence it is brought, and how so equally divided, has excited the curiosity and admiration of all.

It has been very naturally supposed that the clouds transport this moisture from one place to another; but, when we come to investigate, they are but the outward evidence that there is vapor in the atmosphere: the immense quantity of rain which falls, and the small amount which the clouds can hold suspended, satisfies us that but a part of the vapor can be borne by the clouds, and that the large supply must be held suspended in the atmosphere: though invisible, we know it exists there.

We do not entertain the opinion that the clouds, carried by the currents of air, can bear the moisture or rain from distant regions to fertilize a country; the local influences prevailing on the route would controvert, in our opinion, such a theory; it would be impossible for so large a quantity of water as frequently falls to remain so long suspended in the form of vapor through the various climates, without undergoing condensation and precipitation; and the time necessary to transport it, under the ordinary velocity of the winds, forbids it; besides, the supply would be at all times precarious, from the varying temperature of the climates which it would have to pass through on its transition from one parallel to another. On this account, and for other reasons, it seems impossible to subscribe to the theory of "rain-bearing winds." It must be distributed in other ways.

We have already referred to the distribution of vapor under its own law, and can readily account for the supply of rain; nor are we at a loss to point out the reservoir which affords such copious supplies.

The evaporation from the great oceans whence the supply of vapor comes, takes place at all seasons of the year, particularly when the sun is vertical. It flows to the west, under its law of distribution,

and may possibly be assisted by the rotation of the earth. This flow continues constant, though invisible, throughout the year, from the water to the land. The temperature of the ocean, we know, remains nearly the same, but the land is subject to great variations. So long as the temperature continues the same, the vapor is held suspended; consequently, we have but little rain on the ocean; but when it encounters the land, if the heat over it is greater, it is expanded and passes on; if less, condensation takes place, and precipitation ensues. Thus the supply is afforded in inexhaustible quantities in the most simple way,—one that is alone dependent upon a change of temperature. From these causes a greater quantity of rain falls near the coasts, decreasing towards the interior of continents, and rains of shorter or longer periods are produced. Local winds and even fresh gales are the result of the heat evolved by the condensation of the vapor, which forms large rarefied areas, into which the denser air flows with greater or less velocity.

According as the air is more or less surcharged with vapor, are we liable to have rain. The clouds are the evidence of the presence of vapor; they form and disappear at times rapidly. This is the result of the ascending and descending currents.

Within the tropics, when the sun is passing over the zenith of any parallel, it has been found that the rainy season prevails. It is explained by the fact that the evaporation at that time is greater, and the atmosphere more saturated; condensation takes place more easily, and the rain is more copious. It is remarkable, that when it is the rainy season in the Tropics, the rains occur only during certain hours of the day, and that the nights are cloudless. The part of the twenty-four hours in which the condensation and precipitation take place, is after the sun has passed the meridian. Now, under the hypothesis that the vapor is left behind by the rotary motion of the earth, we have a ready explanation of this phenomenon, and some idea may be had of the velocity of the retardation of vapor. Let us suppose the width of the ocean which lies to the eastward of the place where this phenomenon occurs, an arc of the earth's surface, from which the evaporation has arisen; and the time the rains fall, to represent the condensation of the same vapor—the difference between these will give the time of the retardation.

There are several localities within the Tropics where this phenomenon occurs, and where the rain falls for five hours. The width of the

ocean, or the distance to the coast of Africa, is 2000 miles;—a place on the coast of America would be two hours in passing through this arc. The difference is therefore three hours, and the retardation of the vapor to the west about 400 miles an hour.

As the effect of the sun decreases, these rains diminish, until they cease altogether, when the dry season ensues. The atmosphere being no longer surcharged with vapor, and the land more heated, precipitation does not take place. The vapor, then, which is held suspended, passes onward to the high mountain ranges of the western coast, where it is condensed, and supplies the extensive rivers of South America.

That the vapor is derived from the east, is well established, from the fact that condensation is more evident when the current of air flows from that direction; and it is shown by the prevalence of more copious rains, which take place on the eastern side of mountains and on the west side of seas and lakes. The Caspian Sea is a well-known instance of this. On the east side it is a barren, sandy waste, and rain rarely falls; while on the west it is fertile, with much rain. The rainless districts may also be cited as an evidence that vapor passes over a high plateau, such as the deserts of Gobi, Iran, and Syria, where the temperature is elevated, and the vapor cannot undergo condensation; and that it does not, is proved by the fact that metals of all kinds never oxidate when exposed to the atmosphere; that vast quantities of vapor pass over them, we know, for it is condensed on the Himalaya Mountains, and supplies the large rivers of Asia with their waters. The cause of the rainless and barren district, stretching entirely over the African Continent, 3000 miles from east to west, by 1000 miles wide, north to south, may also be readily accounted for. The Himalaya Mountains have condensed the vapor flowing over them from the east; the cold and dry air is thence induced onward to the heated areas of the Sahara, having its capacity for moisture greatly increased. On its route it takes up all the moisture which evaporation has left, leaving it perfectly dry and unsusceptible of cultivation. While this continues, it must ever remain a desert.

But it is not my intention to deny that vapor may permeate towards the east; its tendency, as before remarked, is to distribute itself towards the land, and its province is to restore the equilibrium in all directions. This tendency is increased by the wind, particularly when it prevails from the water to the land; its action, however, is very limited. The great precipitation which is observed on many

coasts is said to be owing to the moisture brought by the winds. We think this is produced by the descent of the cold currents of air flowing from the upper strata to the warmer surface areas, condensing the vapor which has arisen from evaporation over a small extent of ocean near to the coast. The action of the Southwest Monsoon, particularly, is often referred to, as transporting the vapors which cause the copious rains on the coast of India;—but according to the theory, the currents of air seeking this coast are cold, and comparatively dry; but descending into the vapor plain, to the warmer areas, they produce condensation, and great precipitation follows. The effect may be increased by the height of the Western Ghauts, which rise immediately above the line of coast, and act to retard and condense a portion of the vapor as it is left behind.

It has been thought that winds from certain directions always bring rain; but in places not far distant from each other, they are altogether from opposite quarters which produce this phenomenon. It often happens that the wind from the same direction at one season produces rain, while at another it is attended with fine weather. This is the case with the northeast winds of Europe, and also with the northeast winds on our own coasts. Every one is familiar with the name of *dry* northeaster. In Europe, at one season, the moisture is condensed on the Ural Mountains, lying perpendicular to the flow of vapor, by which the rivers flowing to the north and south from them are supplied;—consequently, none can flow onward to the west. At other times, the vapor passes onward, and is condensed farther to the west, in the centre of Europe. Many instances could be cited to show that this is the case in other places. In Germany, more rain falls than on the coast of France in the same latitude.

It has been often observed that the rains of one wind are different in character from another. This evidently depends upon the rapidity of the condensation: if the air which flows in be but a few degrees cooler, the condensation will be slower, and the precipitation more nearly allied to mist. As the difference in temperature is greater and more sudden, there will be violent rains, and often hail,—and this latter extends in narrow widths over areas; while beyond them, the temperature not falling so low, rain only will take place.

HURRICANE STORMS.

The fifth postulate which I have laid down, viz., that currents of air are influenced and disturbed by electricity, will, I think, be readily admitted.

The sudden changes in the atmospheric currents during thunder-storms, water-spouts, and whirlwinds, have been perceived by every one; and none fail to notice that they usually rise against opposing currents of air, which they overcome and entirely divert from their course.

The ordinary storms we consider as the result of the accumulation of heat and vapor over an extended area. The duration and violence depend upon the difference of temperature between the heated area and the denser air by which it is surrounded. They may have greater or less extent. Observation proves their route to be in the order of progression of the currents of air, as heretofore explained. The hurricane storm is similar, but with the addition of intense electrical action, which produces the local whirl. In other words, the true hurricane storm is to be regarded as an electrical meteor. These we intend to describe.

Although electricity has not been admitted as the great agent which causes the hurricane storms, that carry destruction and leave devastation in their track, yet it is well known to be one of the accompaniments, and its effect afterwards is always seen. It will be my endeavor to show that it is the cause of their origin, and, combined with heat and dynamical forces, sufficient to explain all the phenomena which are witnessed in their local as well as progressive motion.

My purpose is first to treat of the general character of these meteors, endeavor to explain the cause, give their direction, and the areas to which they are confined.

In the first place, these storms, in various parts of the earth's surface, arise from the same causes, and have the same signs and appearances. From the observations of navigators, as well as observers on land, we learn that their characteristics in both hemi-

spheres resemble each other. They are engendered on the sea in the heat of the Tropical regions. While confined to the ocean, they enlarge as they progress; but coming in contact with the land, they often divide, or contract to narrow limits, exhibiting all the marks of intense electrical action within short distances and confined spaces, as is often witnessed in our own country.

Their origin appears to be nearly on the same parallels, the 10th degree of latitude, in both hemispheres, and they have a whirling motion, but reversed. They are preceded by calms and shifting winds, or light and fitful breezes. Near the centre of action, or within their vortex, a high temperature always prevails. The atmospheric pressure is increased beyond their limits, but diminished within. Their approach is accompanied by a feeling of languor and exhaustion, apparently from a want of elasticity in the air. Their progress is from east to west. Their route forms a portion of an ellipse of greater or less diameter, recurving towards the pole of that hemisphere where they originate.

During their formation, the sky becomes overcast, of a deep leaden color—assumes a lowering aspect. The horizon is surrounded by a dense bank of clouds, from ten to fifteen degrees in altitude, with ragged edges, which tear off in vapors, moving rapidly, not as if borne by any wind, but attracted in various directions. The sun appears blood red—the clouds tinged with a lurid red, which gradually spreads itself over the whole sea; lightnings dart upwards from these clouds in columns, composed of separate rays, of a dull hue, and of long duration. The wind gradually freshens, blowing towards a central point or line. The clouds overhead decrease in height, as though a powerful attraction was operating to depress them, and to confine the approaching storm to the narrowest limits, causing a most appalling apprehension of danger to both man and beast.

The route of these meteors has been traced, from the minimum line of pressure, by very many observations; it is found that it coincides with the central line of maximum heat and vapor. It is known that between the first and last parts of a hurricane, a calm of longer or shorter duration takes place. At times it appears perfect, and often sudden; at others, more or less accompanied by fitful airs and light breezes from various quarters. The extent of these calms is also remarkable. They have been found to be equal in some cases to one-third the diameter of the storm. During the continuance of the

calms, various moanings, and loud roarings are heard from the front of the storm, which has passed, and from its rear, which is to come.

The last part of the storm, though not of so long duration as the first, is generally considered more violent, and vessels are reported as receiving more damage after the change of wind, which rushes in from an opposite quarter to restore the equilibrium.

The sudden change of wind from the opposite quarter which follows the calm, is preceded by sharp flashes of lightning; the temperature falls, the barometer rises, and fair weather ensues, with a pure and wholesome atmosphere. The utmost devastation is apparent on every side, and both animate and inanimate objects show the effect of the action of the electric fluid. During the whole period, the storm is accompanied by excessive and copious falls of rain; that which falls in the latter portion is very much reduced in temperature, and frequently hail is precipitated.

The effect of electricity is seen in the burnt appearance of vegetation,—and in some cases, the crews of vessels have found the effects of it upon their persons, although they had not been aware of having seen any.

The first part of the storm, which precedes the calm, is of much longer duration than the latter part. The rise of the barometer is more rapid than its fall. The change of temperature is equally great. Where these meteors have taken place, their approach, direction, and end, exhibit the above characteristics.

To explain these phenomena, it is requisite to have recourse to all the facts that have been established, and the localities where these hurricanes originate; comparing them with each other, to show the directions in which they move, and in what particulars they correspond. From them we derive what we believe to be the true explanation of the phenomena; and where these causes do not exist or prevail, there are no hurricanes, or even storms, to disturb the atmosphere; we may then be justified in ascribing to them the hurricanes. The great and predominating causes which we assign for these meteors, are therefore the accumulation of heat and electricity. They are engendered on the sea, where the temperature has attained its maximum. From evaporation, the atmosphere has become surcharged with vapor, and an accumulation of electricity has taken place. At these periods of the year, the winds have in a measure ceased over these areas, or become fickle and uncertain. There is no way in which these accu-

mulations can be carried off. The atmosphere over the sea has become, as it were, a vast reservoir or well-charged battery. The development of it in many places gives evidence of its existence in vast quantities, and is looked upon as a precursor of these storms. The temperature of the sea has reached its maximum, and the greatest heat of the atmosphere coincides with it, and prevails throughout the route these storms take. The appearances which we have given, as immediately preceding these tempests, also show very clearly powerful electrical action. On their development, a discharge, or successive discharges, either disruptive or convective, take place, and a great repulsion of the atmosphere, by electricity, causes the displacement of the atmosphere from the surface of the earth to take place, baring it or exposing its surface, creating a large rarefied area, into which the surrounding air rushes with great force, which, coming in contact with the earth's surface, moving from west to east, receives the impulse of its rotary motion, producing a horizontal whirl or volute from right to left in north, and from left to right in south latitude. This whirl continues until friction overcomes its velocity, when it dies away into calm. This is the local effect of the discharge.

The storm continues to advance along the line or route of highest temperature, coinciding with the line of minimum pressure, and progresses in the direction I have named as retrograde on our coast, from the southwest to the northeast, first having originated, as was observed by our celebrated countryman, Franklin, at the south.

As the electric fluid accumulates along the line of heat, it makes successive discharges, either disruptive or convective, producing the same effect as in the first instance, and the same results, more or less violent, according to the intensity of the action of the fluid. Thus the route of the storm follows the line of greatest heat. At each point of accumulation and discharge, the whirls form and continue until their action is exhausted by friction; or, when the equilibrium of temperature is restored, they cease.

Other causes, no doubt, tend to increase the effects which take place,—the expansion of vapor, its condensation, and the evolvement of large quantities of heat, and great precipitation, which always accompany these hurricanes.

The falling of the barometer at the central line is the result of its being the line of maximum heat; the expansion of the column and the upward tendency of the air may increase the effect. Too much

attention has been given to the barometrical pressure. This is an effect, not a cause, of the storm; and in future, I trust that the temperature, or thermometrical observations, may claim the attention of those who have the misfortune to encounter them. I am well satisfied that it is a far better guide than the barometer,—and by noting the standing, rising, or falling of the temperature of the air and water, ample time will be allowed to prepare for these hurricanes. In every case where I have found the observations of the thermometer recorded, they show the clearest indications of the approach of a tempest; and by avoiding the line of the greatest heat, you may escape the discharges of electricity and the whirlwinds caused by them.

The part of the great Ocean where these meteors occur, lies between the parallels of 10° and 30° north and south of the Equator. They only take place in the North Atlantic, between America, Europe, and Africa, and are first developed near to and about the longitude of 50° west, to the eastward of the Leeward Islands, whence they sweep along towards the coast of America, in a west and northwest direction, as far as the longitude of 75° west, recurving to the northeast in the latitude of 35°, and cease in about the longitude of 60° west, near the 45th parallel north.

In the North Pacific, they begin near the Marianne Islands, in the longitude of 140° east; from thence they extend to the coast of China, in 100° east, turning to the northeast along the east coast of Japan. In a few cases, they have been known to sweep across the Burmah peninsula to Hindostan, where they are dissipated; others are confined to the Bay of Bengal, from the Andaman Islands to the coast of Coromandel. None of these appear to recurve. Their course is probably short, and, coming in contact with the land, they are soon dispersed.

In the Indian Ocean, they originate near the 90th degree of east longitude; thence they pursue a course to the southwest to 40° east, in the latitude of 27° south, where they recurve to the southward and eastward.

In the South Pacific, their limits seem to be between 140° west and 165° east. Their extent in latitude is over 25 degrees. Those that have been experienced in the Southern Pacific recurve, but in what direction the observations have not yet been sufficiently numerous to establish.

In examining the route which these meteors take, it will be found

that they extend along the line of the highest temperature of both air and ocean, at the season when they take place. When they recurve, they follow the warm currents of the ocean, or the highest temperature of the atmosphere.

The action and effect of these storms are well understood by the inhabitants of the countries which are subject to them. They find it necessary to secure their doors and windows from being burst open by the expansion of the air within, and barricade them on the outside to prevent it. This tends to prove, that within the vortex a partial vacuum is produced. In some of the hurricanes which have taken place in our own country, we find every indication that the same effects take place. The falling of trees shows most conclusively intense electrical action, with which the wind has no connection.

TABLE II.

ENXADOS ISLAND, RIO DE JANEIRO.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	DORCHESTER INTS.	WASHINGTON INTS.
1838.			h. m. s.	h. m. s.	h. m. s.
Dec. 25,	H Arietis,	I	2 52 28·58	2 52 52·57	
" 26,	ε Arietis,	I	52 33·17		
" "	δ Arietis,	I		2 51 53·17	2 51 53·02
" 27,	δ Arietis,	I	52 22·16		52 47·60
" "	η Tauri,	I	52 24·15		52 32·40
" "	A′ Tauri,	I	52 29·15		
" 28,	η Tauri,	I	52 29·71		
" "	A′ Tauri,	I	52 20·31		
" "	ι Tauri,	I	52 29·31		
" 30,	K Aurigæ,	I	52 27·		
" "	μ Geminorum,	I	52 28·05		
" "	τ Geminorum,	II	52 19·40		
" 31,	δ Geminorum,	II	52 21·58	2 52 19·07	
1839.					
Jan. 3,	γ Leonis,	II	52 16·36		
" "	κ Leonis,	II	52 45 66		
			2 52 26·75	2 52 21·60	2 52 24·34

	h. m. s.		s.	
Greenwich Ints., 14 stars,	2 52 26·75	× 14 =	374·50,	10 sts. W., 4 sts. E.
Dorchester Ints., 3 stars,	2 52 21·60	× 3 =	64·80,	2 sts. W., 1 st. E.
Washington Ints., 3 stars,	2 52 24·34	× 3 =	73·02,	3 sts. W.
			512·32 ÷ 20	
			h. m. s.	° ′ ″
Mean longitude, ...			2 52 25·61 =	43 06 24·30.
Longitude by Chronometer, ...			2 52 20·10 =	43 05 01·50.

LATITUDE.

DATE.	NAME OF STAR.		OBS.	DATE.	NAME OF STAR.		OBS.
1838.		° ′ ″ ‴		1838.		° ′ ″ ‴	
Dec. 20,	α Tauri,	22 52 58·92	14	Dec. 22,	α Aurigæ,	22 53 01·20	14
" "	α Aurigæ,	53 02·80	20	" "	α Argus,	52 59·45	8
" "	α Argus,	52 59·60	14	" 23,	α Argus,	52 57·85	10
" "	α Canis Minoris,	52 56·25	10	" "	α^2 Geminorum,	53 04·22	10
" 22,	α Tauri,	52 57·06	18	" "	α Leonis,	53 05·43	18

TABLE II.—*Continued.*

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″ ‴	OBS.	DATE.	NAME OF STAR.	° ′ ″ ‴	OBS.
1838.				1838.			
Dec. 24,	*B* Tauri,	22 53 06·00	16	Dec. 25,	α Argus,	22 53 02·70	16
" "	α^2 Geminorum,	52 58·24	12	" 26,	α Tauri,	53 03·36	46
" "	α Hydra,	53 01·22	10	" "	α Argus,	53 05·33	40
" "	α Leonis,	53 03·68	22	" "	α^2 Geminorum,	53 03·17	48
" 25,	α Tauri,	53 04·90	24	" 27,	α Aurigæ,	53 07·12	38
" "	α Aurigæ,	53 09·90	36	" 30,	α Aurigæ,	53 01·67	36
					Mean Latitude,	22 53 02·27	

LEVUKA, ISLAND OF OVOLAU, FEEJEE GROUP.

LONGITUDE.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1840.			*h. m. s.*	*h. m. s.*	*h. m. s.*
May 17,	σ Scorpii,	II		11 55 45·2	11 55 47 9
" "	α Scorpii,	II	11 55 52·28		
" "	*A* Ophiuchi,	II		II 55 38·1	55 35·
" 18,	δ Sagittarii,	II	55 15·65		55 22·6
" "	λ Sagittarii,	II	55 11·28		55 12·3
" 23,	i Aquarii,	II	55 17·59		
June 9,	g Virginis,	I	55 35·29		
" 13,	σ Scorpii,	I	55 45·8	11 55 23·8	55 20·4
" "	α Scorpii,	I	55 28·68	11 55 31·8	55 28·5
" 14,	γ^2 Sagittarii,	I	55 32·77		
" "	δ Sagittarii,	I	55 32·74		
" 16,	σ Sagittarii,	II	55 44·21		
" "	τ Sagittarii,	II	55 11·25		
" "	h^2 Sagittarii,	II	55 08·61		55 17·3
" 17,	h^2 Sagittarii,	II	55 27 21		55 32·1
" "	c Sagittarii,	II	55 28·92		55 26·2
" 20,	θ Aquarii,	II			55 42·9
			11 55 28·02	11 55 34·72	11 55 28·52

TABLE I.

LONGITUDE OF CAMBRIDGE, DORCHESTER, AND WASHINGTON, DEDUCED FROM CORRESPONDING OBSERVATIONS OF MOON CULMINATING STARS IN CONNECTION WITH THE EXPLORING EXPEDITION,

DURING THE YEARS 1838, '39, '40, 41, AND '42.

DATE.	NAME OF STAR.	MOON'S LIMB.	CAMBRIDGE.	DORCHESTER.	WASHINGTON.
1838.			h. m. s. ″′	h. m. s. ″′	h. m. s. ″′
Dec. 25,	θ' Arietis,	I		4 43 56·82	
" 26,	δ Arietis,	I		4 43 35·29	5 07 53 18
" 27,	ε Arietis,	I			5 08 16·63
" "	δ Arietis,	I			5 07 54·63
" "	η Tauri,	I			5 07 47·63
" "	A' Tauri,	I			5 07 59·63
" 30,	K Aurigæ,	II			5 07 57·55
" "	τ Geminorum,	II		4 44 07·11	5 07 59·55
" 31,	δ Geminorum,	II		4 44 29·67	
" "	η Cancri,	II		4 44 40·67	5 07 46·86
1839.					
Dec. 17,	η Tauri,	I		4 43 48·09	
1840.					
May 17,	δ Scorpii,	II	4 44 34·99		5 07 46·99
" "	α Scorpii,	II	4 44 32·99		5 08 12·99
" "	A' Ophiuchi,	II	4 44 34·99		5 08 07·49
" "	θ Ophiuchi,	II	4 44 27·99		5 08 09 99
June 13,	δ Scorpii,	I	4 44 23·33		5 07 55·83
" "	α Scorpii,	I	4 44 14 83		5 07 54·33
" "	A Ophiuchi,	I	4 44 13·33		5 08 00·33
" "	θ Ophiuchi,	I			5 08 03·83
" 16,	h[a] Sagittarii,	II			5 08 05·91
" "	c Sagittarii,	II	4 44 15·10		5 08 04·41
Nov. 2,	υ Capricorni,	I			5 08 08·93
" "	γ Capricorni,	I	4 44 30·57		5 07 45 93
" "	δ Capricorni,	I	4 44 18·37		5 08 02·43
" 6,	n Piscium,	I	4 43 57·76		5 07 39·79
" "	ω Piscium,	I	4 44 07·76		5 07 55·29
" "	δ Piscium,	I			5 07 53·29
" "	ε Piscium,	I			5 07 59·79
" 13,	δ Geminorum,	II			5 07 55·94
" "	λ Cancri,	II			5 07 41·94
" "	θ Cancri,	II	4 44 17·03		5 07 56·14
" "	α Piscis Australis,	II	4 43 55·03		

TABLE I.—*Continued.*

DATE.	NAME OF STAR.	MOON'S LIMB.	CAMBRIDGE.	DORCHESTER.	WASHINGTON.
1841.			*h. m. s. ‴*		*h. m. s. ‴*
Feb. 7,	d Leonis,	II	4 44 18·19		5 07 55·19
" "	ν Leonis,	II	4 44 13·19		5 07 54·19
" "	β Virginis,	II	4 44 19·19		5 07 59·19
" 10,	θ Virginis,	II			5 07 28·28
" "	λ Virginis,	II	4 43 40·18		
June 28,	20 Libra,	I			5 08 07·50
" "	ι Libra,	I	4 44 11·85		
" 29,	20 Libra,	I			5 07 54·87
" "	ι Libra,	I			5 08 04·32
" "	δ Scorpii,	I	4 44 37·87		5 07 48·87
July 1,	τ Scorpii,	I	4 44 16·19		5 07 48·19
" "	D Ophiuchi,	I	4 44 27·19		5 07 57·19
" "	δ Ophiuchi,	I	4 44 12·19		
" 3,	h^2 Sagittarii,	II			5 08 20·02
" "	57 Sagittarii,	II			5 08 20·02
Aug. 29,	ε Aquarii,	I			5 08 17·35
" "	β Aquarii,	I			5 08 10·35
" "	θ Aquarii,	I			5 08 06·34
" "	ζ Aquarii,	I			5 08 00·00
" 31,	θ Aquarii,	I			5 08 00·63
" "	ζ Aquarii,	I			5 07 55·63
Sep. 25,	β^2 Capricorni,	I	4 44 02·85		
" 26,	λ Aquarii,	I			5 08 04·02
" "	ι Capricorni,	I	4 44 15·42		5 08 05·12
" "	μ Capricorni,	I			5 08 01·92
" "	ι Aquarii,	I	4 44 15·42		5 08 04·42
" 27,	u Capricorni,	I	4 44 26·59		5 07 57·59
" "	ι Aquarii,	I	4 44 22·09		5 08 00·09
" "	η Aquarii,	I			5 08 00·59
" "	λ Aquarii,	I	4 44 29·59		5 07 57·09
Oct. 6,	μ Geminorum,	I			5 07 41·52
" "	ε Geminorum,	I			5 07 52·52

	h. m. s. ‴	° ′ ″ ‴
6 Stars, 3 W. and 3 E. L., gives the long. of Dorchester,	4 44 06·27 =	71 01 34·05.
29 Stars, 19 W. and 10 E. L., gives the long. of Cambridge,	4 44 17·65 =	71 04 24·75.
56 Stars, 38 W. and 18 E. L., gives the long. of Washington,	5 07 58·76 =	76 59 41·40.

NOTE.—The predominance of the observations being of the I Limb in the two latter places, may account for the longitude being less than that assumed from more recent and larger series by the same observers.

TABLE II.

ENXADOS ISLAND, RIO DE JANEIRO.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	DORCHESTER INTS.	WASHINGTON INTS.
1838.			h. m. s.	h. m. s.	h. m. s.
Dec. 25,	H Arietis,	I	2 52 28·58	2 52 52·57	
" 26,	ε Arietis,	I	52 33·17		
" "	δ Arietis,	I		2 51 53·17	2 51 53·02
" 27,	δ Arictis,	I	52 22·16		52 47·60
" "	η Tauri,	I	52 24·15		52 32·40
" "	A′ Tauri,	I	52 29·15		
" 28,	η Tauri,	I	52 29·71		
" "	A′ Tauri,	I	52 20·31		
" "	ι Tauri,	I	52 29·31		
" 30,	K Aurigæ,	I	52 27·		
" "	μ Geminorum,	I	52 28·05		
" "	τ Geminorum,	II	52 19·40		
" 31,	δ Geminorum,	II	52 21·58	2 52 19·07	
1839.					
Jan. 3,	γ Leonis,	II	52 16·36		
" "	κ Leonis,	II	52 45 66		
			2 52 26·75	2 52 21·60	2 52 24·34

Greenwich Ints., 14 stars,	2 52 26·75 (h. m. s.) × 14 =	374·50 (s.),	10 sts. W., 4 sts. E.
Dorchester Ints., 3 stars,	2 52 21·60 × 3 =	64·80,	2 sts. W., 1 st. E.
Washington Ints., 3 stars,	2 52 24·34 × 3 =	73·02,	3 sts. W.
		512·32 ÷ 20	
Mean longitude, ...		2 52 25·61 (h. m. s.) =	43 06 24·30. (° ′ ″)
Longitude by Chronometer, ...		2 52 20·10 =	43 05 01·50.

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″ ‴	OBS.	DATE.	NAME OF STAR.	° ′ ″ ‴	OBS.
1838.				1838.			
Dec. 20,	α Tauri,	22 52 58·92	14	Dec. 22,	α Aurigæ,	22 53 01·20	14
" "	α Aurigæ,	53 02·80	20	" "	α Argus,	52 59·45	8
" "	α Argus,	52 59·60	14	" 23,	α Argus,	52 57·85	10
" "	α Canis Minoris,	52 56·25	10	" "	α^2 Geminorum,	53 04·22	10
" 22,	α Tauri,	52 57·06	18	" "	α Leonis,	53 05·43	18

TABLE II.—*Continued.*

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″ ‴	OBS.	DATE.	NAME OF STAR.	° ′ ″ ‴	OBS.
1838.				1838.			
Dec. 24,	*β* Tauri,	22 53 06·00	16	Dec. 25,	*α* Argus,	22 53 02·70	16
" "	α^2 Geminorum,	52 58·24	12	" 26,	*α* Tauri,	53 03·36	46
" "	*α* Hydra,	53 01·22	10	" "	*α* Argus,	53 05·33	40
" "	*α* Leonis,	53 03·68	22	" "	α^2 Geminorum,	53 03·17	48
" 25,	*α* Tauri,	53 04·90	24	" 27,	*α* Aurigæ,	53 07·12	38
" "	*α* Aurigæ,	53 09·90	36	" 30,	*α* Aurigæ,	53 01·67	36
					Mean Latitude,	22 53 02·27	

LEVUKA, ISLAND OF OVOLAU, FEEJEE GROUP.

LONGITUDE.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1840.			*h. m. s.*	*h. m. s.*	*h. m. s.*
May 17,	*σ* Scorpii,	II		11 55 45·2	11 55 47 9
" "	*α* Scorpii,	II	11 55 52·28		
" "	*A* Ophiuchi,	II		11 55 38·1	55 35·
" 18,	*δ* Sagittarii,	II	55 15·65		55 22·6
" "	*λ* Sagittarii,	II	55 11·28		55 12·3
" 23,	i Aquarii,	II	55 17·59		
June 9,	g Virginis,	I	55 35·29		
" 13,	*σ* Scorpii,	I	55 45·8	11 55 23·8	55 20·4
" "	*α* Scorpii,	I	55 28·68	11 55 31·8	55 28·5
" 14,	γ^2 Sagittarii,	I	55 32·77		
" "	*δ* Sagittarii,	I	55 32·74		
" 16,	*σ* Sagittarii,	II	55 44·21		
" "	*τ* Sagittarii,	II	55 11·25		
" "	h^2 Sagittarii,	II	55 08·61		55 17·3
" 17,	h^3 Sagittarii,	II	55 27 21		55 32·1
" "	c Sagittarii,	II	55 28·92		55 26·2
" 20,	*θ* Aquarii,	II			55 42·9
			11 55 28·02	11 55 34·72	11 55 28·52

TABLE II.—*Continued.*

		h. m. s.		s.	
Greenwich Ints.,	14 stars,	11 55 28·02	× 14 =	392·28,	5 W. sts., 9 East.
Cambridge Ints.,	4 stars,	11 55 34·72	× 4 =	138·9,	2 W. sts., 2 East.
Washington Ints.,	10 stars,	11 55 28·52	× 10 =	282·2,	3 W. sts., 7 East.
				816·38 ÷ 28	

		° ′ ″	
Mean Longitude,	. . . .	11 55 29·156	= 178 52 17·340.
Longitude by Chronometer,	. . .	11 55 30·71	= 178 52 40·78.

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″	OBS.	DATE.	NAME OF STAR.	° ′ ″	OBS.
1840.				1840.			
May 17,	α Centauri,	17 40 20·	10	June 24,	α Ophiuchi,	17 40 45·	20
" 18,	γ Draconis,	40 57·8	12	" "	α Cygni,	40 32·8	20
" "	α Lyræ,	40 50·74	14			17 40 43·88	196
" 21,	η Ursæ Majoris,	41 21·	18				
" "	η Bootes,	40 40·	6	May 18,	Sun,	17 41 09·3	20
" "	β Centauri,	41 10·3	10	" 19,	"	40 50·1	30
" "	α Bootes,	40 19·	10	June 18,	"	40 43·6	18
" "	α Centauri,	40 58·7	20	" 19,	"	40 46·	16
" "	α Coro. Borealis,	41 10·	4	" 20,	"	40 55·75	14
" 29,	η Ursæ Majoris,	40 15·5	4	" 21,	"	40 48·7	10
" "	η Bootes,	40 25·4	4	" 22,	"	40 28·3	25
" "	β Centauri,	40 24·6	6				
" "	A Bootes,	40 25·	10		By Sun,	17 40 48 82	134
" "	A Centauri,	41 05·8	8		" Stars,	17 40 43·88	196
June 24,	α Tri. Australis,	40 44·4	20				
					Mean Latitude by Sun and Stars,	17 40 46·35	330

HONOLULU, OAHU, HAWAIIAN GROUP.

LONGITUDE.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1840.			h. m. s.	h. m. s.	h. m. s.
Nov. 2,	γ Capricorni,	I		10 31 31·2	10 31 20·
" "	δ Capricorni,	I	10 31 08·13	31 24·8	31 36·
" 4,	θ Aquarii,	I	31 55·49		31 32·9
" "	σ Aquarii,	I	31 34·19		31 30·1
" "	x^2 Piscium,	I	31 28·		31 28·9

TABLE II.—*Continued.*

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1840.			*h. m. s.*	*h. m. s.*	*h. m. s.*
Nov. 6,	δ Piscium,	I	10 31 06·93		10 31 21·7
" "	ε Piscium,	I	31 31·93		31 35·4
" 7,	δ Piscium,	I	31 29·92		
" 10,	η Tauri,	II	31 13·04		31 41·8
" "	A′ Tauri,	II	31 26·04		31 42·
" "	β Tauri,	II	31 15 04		31 37·3
" 12,	κ Aurigæ,	II	31 13·14		31 36·4
" "	δ Geminorum,	II	31 48·14		
" "	α^2 Geminorum,	II	31 13·14		
" 13,	δ Geminorum,	II	31 25·87		31 44·
" "	α^2 Geminorum,	II	31 06·87		
			10 31 23·72	10 31 28·	10 31 33·87

Greenwich Ints., 15 stars, 10 h. 31 m. 23·72 s. × 15 = 355·80 s., 7 W. stars, 8 E. stars.
Cambridge Ints., 2 stars, 10 31 28· × 2 = 56· 2 W. stars.
Washington Ints., 12 stars, 10 31 33·87 × 12 = 406·44, 5 W. stars, 7 E. stars.

818·24 ÷ 29

Mean Longitude, ... 10 31 28·21 = 157° 52′ 03″·15.
Longitude by Chronometer, . . . 10 31 29·05 = 157 52 15·74.

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″	OBS.	DATE.	NAME OF STAR.	° ′ ″	OBS.
1840.				1840.			
Nov. 1,	⊙ Cir. Mer.,	21 18 55·67	15	Nov. 20,	γ Eridani,	21 18 26·20	4
" 2,	" "	18 58·72	20	" "	α Capella,	18 15·35	10
" 3,	" "	18 47 94	20	" "	α Canopus,	18 26·35	10
" 4,	" "	18 40·42	10	" "	α Canis Maj.,	18 40·57	10
" 5,	" "	18 35·92	15	" 28,	α " "	18 52·75	10
	By Sun,	21 18 47·73	80		By Stars,	21 18 32·24	44
					By Sun,	21 18 47·73	80
					Mean Latitude by Sun and Stars,	21 18 39·98	124

TABLE II.—*Continued.*

HILO, HAWAII, HAWAIIAN GROUP.

LONGITUDE.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1841.			*h. m. s.*	*h. m. s.*	*h. m. s.*
Feb. 7,	48 Leonis,	II	10 20 06·29		
" "	d Leonis,	II	20 08·49	10 20 18·6	10 20 20·8
" "	υ Leonis,	II	20 35·49	20 34·	20 31·5
" "	β Virginis,	II	20 03·49	20 14·3	20 12·8
" 10,	θ Virginis,	II	20 26·28		20 26·6
" "	α Virginis,	II	20 35·28		20 17·2
" "	λ Virginis,	II	20 09·28		20 30·7
" 11,	λ Virginis,	II	20 12·88		
Mar. 1,	α Canis Maj.,	I	20 31·52		
			10 20 18·8	10 20 14·1	10 20 23·266

		h. m. s.		*m. s.*	
Greenwich Ints.,	9 stars,	10 20 18·8	× 9 =	122 19·6,	1 W. 8 E. stars.
Cambridge Ints.,	4 stars,	10 20 14·1	× 4 =	80 56·4,	4 E. stars.
Washington Ints.,	6 stars,	10 20 23·266	× 6 =	182 49·2,	6 E. stars.
				386 05·2 ÷ 19	
				° ′ ″	
Mean Longitude, ...				10 20 19·22	= 155 04 48·3.
Longitude by Chronometer, . . .				10 20 17·	= 155 04 15·

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″	OBS.	DATE.	NAME OF STAR.	° ′ ″	OBS.
1841.				1841.			
Feb. 7,	α Orionis,	19 43 48·88	4	Feb. 8,	α Spica,	19 43 58·33	12
" "	Polaris,	43 45·86	6	" "	α Orionis,	43 45·26	8
" "	α Canopus,	43 41 62	20	" "	α Canopus,	43 35·26	20
" "	α Canis Maj.,	44 20·	8	" 9,	α Canis Maj.,	43 45·30	18
" 8,	α′ Crucis,	43 55·90	14				
" "	Polaris,	43 42·92	6		Mean Latitude,	19 43 49·9	116

TABLE II.—*Continued.*

NISQUALLY, OREGON TERRITORY.

LONGITUDE.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1841.			*h. m. s.*	*h. m. s.*	*h. m. s.*
May 30,	α Virginis,	I	8 10 16·28		
" "	x Virginis,	I	10 11·28		
" 31,	α Virginis,	I	10 46·83		
" "	x Virginis,	I	10 35·83		
" "	λ Virginis,	I	10 52·83		
June 1,	λ Virginis,	I	10 29·7		
" "	γ^1 Libræ,	I	10 29·7		
" 4,	η Ophiuchi,	II	10 25·73		8 10 37·6
" "	θ Ophiuchi,	II	11 28·26		10 49·1
" "	γ^2 Sagittarii,	II	11 20·26		10 51·
" "	μ^1 Sagittarii,	II	11 15·26		
" 26,	β Libræ,	I	10 06·14		
" "	α Scorpii,	I	09 48·14		
" 28,	β Libræ,	I	09 54·14		
" "	20 Libræ,	I	10 10·95		
" "	ι^1 Libræ,	I	10 29·95	8 10 20·9	10 31·
" 29,	ι^1 Libræ,	I			10 31·3
" "	b Scorpii,	I			10 12·4
" "	δ Scorpii,	I	10 38·95		
" 30,	b Scorpii,	I	10 26·41		10 15·7
" "	δ Scorpii,	I	10 11·41		10 24·6
July 1,	τ Scorpii,	I		10 47·	10 37·9
" "	D Ophiuchi,	I	10 30·78	10 31·8	10 40·6
" "	γ^2 Sagittarii,	I	10 35·78		
" "	δ Ophiuchi,	I	10 03·78		
" 2,	D Ophiuchi,	I	10 23·84	10 37·5	
" "	γ^2 Sagittarii,	I	10 20·84		
" "	θ Sagittarii,	II	10 25·84	10 28·4	
" "	δ Sagittarii,	II	10 28·84	10 43·2	
" 3,	φ Sagittarii,	II	10 17·9		
" "	δ Sagittarii,	II	10 15·9		
" "	h^2 Sagittarii,	II	10 23·45		10 30·2
" "	57 Sagittarii,	II	10 29·		10 28·5
			8 10 28·46	8 10 34·8	8 10 33·87

TABLE II.—*Continued.*

			s.	
Greenwich Ints.,	30 stars,	8 10 28·46 × 30 =	853·8,	20 sts. W., 10 E.
Cambridge Ints.,	6 stars,	8 10 34·8 × 6 =	208·8,	4 " W., 2 E.
Washington Ints.,	13 stars,	8 10 33·87 × 13 =	440·31,	7 " W., 6 E.
			1502·91 ÷ 49	

	h. m. s.	° ′ ″
Mean Longitude, ...	8 10 30·67 =	122 37 40·05.
Longitude by Chronometer, . . .	8 10 31·74 =	122 37 56·15.

LATITUDE.

DATE.	NAME OF STAR.		OBS.	DATE.	NAME OF STAR.		OBS.
1841.		° ′ ″		1841.		° ′ ″	
June 27,	Polaris,	47 07 20·	8	June 28,	Polaris,	47 08 00·74	8
" "	α Scorpii,	06 57·51	14	" "	α Aquilla,	06 55·88	20
" "	Jupiter,	07 25·85	12	July 2,	α Scorpii,	07 45·17	20
" "	α Aquilla,	07 11·64	12	" "	Jupiter,	07 22·38	20
" 28,	α Scorpii,	07 25 92	10	" "	Polaris,	07 30·	8
" "	Jupiter,	07 53·53	22	" "	Saturn,	08 05·47	16
" "	α Lyræ,	07 10·28	4	" 8,	α Aquilla,	07 05·20	16
					Mean Latitude,	47 07 26·35	190

SAUSALITO, SAN FRANCISCO BAY, CALIFORNIA.

LONGITUDE.

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1841.			h. m. s.	h. m. s.	h. m. s.
Aug. 26,	γ^2 Sagittarii,	I	8 09 41·75		
" "	δ Sagittarii,	I	09 25·76		
" "	π Sagittarii,	I	09 16·76		
" 27,	δ Sagittarii,	I	10 40·		
" 28,	α^2 Capricorni,	I	09 53·45		
" "	α Cephei,	I	10 44·45		
" 29,	ν Capricorni,	I	10 16·50		
" "	ε Aquarii,	I	09 59·5		8 09 51·7
" "	ι Capricorni,	I	10 01·5		09 57·1
" 30,	ι Capricorni,	I	10 06·34		10 09·8

TABLE II.—*Continued.*

DATE.	NAME OF STAR.	MOON'S LIMB.	GREENWICH INTS.	CAMBRIDGE INTS.	WASHINGTON INTS.
1841.			*h. m. s.*	*h. m. s.*	*h. m. s.*
Aug. 30,	β Aquarii,	I	8 09 54·34		8 09 52·
" "	θ Aquarii,	I	09 42·34		09 49·5
" "	ζ Aquarii,	I	09 37·34		09 52·
" 31,	θ Aquarii,	II	09 19·8		09 30·9
" "	ζ Aquarii,	II			09 40·8
Sept. 6,	ε Arietes,	II	09 36·12		
" "	δ Arietes,	II	09 40·12		
" "	A′ Tauri,	II	09 40·12		
" 23,	ρ^1 Sagittarii,	I	09 15·70		
" "	h^2 Sagittarii,	I	09 37·70		
" 24,	ρ^1 Sagittarii,	I	09 48·		
" "	h^2 Sagittarii,	I	09 56·		
" "	β^2 Capricorni,	I	10 01·		
" "	υ Capricorni,	I	09 45·		
" 25,	υ Aquarii,	I	09 03·76		09 18·3
" "	ι Capricorni,	I	09 20·76		09 33·8
" 26,	μ Capricorni,	I	09 58 64		10 04·7
" "	ι Aquarii,	I	10 23·64		10 07·6
" 27,	μ Capricorni,	I	09 28·5	8 09 35·2	09 42·7
" "	ι Aquarii,	I	09 44·	09 48·2	09 48·2
" "	η Aquarii,	I	09 14·5		
" "	λ Aquarii,	I	09 26·	09 30·	09 38·1
" 28,	η Aquarii,	I	09 31·65		
" "	λ Aquarii,	I	09 38·65		
" "	ι Piscium,	I	09 33·65		
Oct. 3,	η Tauri,	II	09 20 65		10 01·3
" "	A′ Tauri,	II	09 36 65		09 58·1
" 6,	μ Geminorum,	II	09 48·52		10 07.3
" "	ε Geminorum,	II	09 54·52		10 10·6
			8 09 44·31	8 09 37·8	8 09 55·5

		h. m. s.	*s.*	
Greenwich Ints.,	38 stars,	8 09 44·31 × 38 =	1683·78,	30 sts. W., 8 E.
Cambridge Ints.,	3 stars,	8 09 37·8 × 3 =	113·4,	3 " W.
Washington Ints.,	19 stars,	8 09 55·5 × 19 =	1054·5,	13 " W., 6 E.
			2851·78 ÷ 60	
			h. m. s.	° ′ ″
Mean Longitude,	. . . . .		8 09 47·52 =	122 26 52·8.
Longitude by Chronometer,	. . .		8 09 47·34 =	122 26 50·15.

TABLE II.—*Continued.*

LATITUDE.

DATE.	NAME OF STAR.	° ′ ″	OBS.	DATE.	NAME OF STAR.	° ′ ″	OBS.
1841.				1841.			
Aug. 21,	⊙ Cir. Mer.,	37 50 48·	10	Oct. 28,	α Pisc. Aust.	37 51 06·	14
" 24,	" "	50 43·	10	" "	ξ Pegasi,	50 42·	8
" 28,	" "	50 55·	10	" "	α Aquarii,	50 48·	20
Sept. 11,	" "	51 12·	10	" "	ε Pegasi,	50 40·5	12
Oct. 21,	" "	50 49·	10	" "	β Aquarii,	51 09·	16
" 22,	" "	51 14·	10	" "	α^2 Capricorni,	51 04·	10
" 23,	" "	50 44·	10	" "	α Andromedæ,	50 58·	12
" 28,	α Pegasi,	51 12·9	12	" "	α Cassiopeæ,	50 47·	14
		Mean Latitude by Sun and Stars,				37 50 52·1	188

The following stations have been determined through Meridian distances, several times repeated. The unpropitious state of the weather, and the limited time of our stay, did not permit us to obtain a full series of astronomical observations to give them an independent determination. But through the combined observations, I feel every confidence in the accuracy of the positions assigned them, and have adopted them as initial points.

	Latitude. ° ′ ″ ‴		Longitude. ° ′ ″ ‴	
Orange Harbor, Terra del Fuego,*	55 31 25.	S.,	68 02 40·	W.
Valparaiso, fort,†	33 01 35·	"	71 39 20·	"
Callao, wharf, ...	12 03 40·	"	77 11 10·	"
Tahiti, Point Venus, ...	17 29 30·	"	149 31 13·05	"
Pago Pago, Tutuila Island, Samoan Group, . .	14 18 06·	"	170 38 18·	"
Sydney, Fort Macquarie,‡	33 51 30·	"	151 12 00·	E.
Bay of Islands, Clendon's wharf, N. Zealand, .	35 16 10·	"	174 04 17·	"
Manilla, end of quay, ...	14 35 34·41	N.,	120 54 19·39	"
Soung Roads, Observatory Point, Sooloo Island, .	6 01 00·	"	120 55 51·	"
Singapore, quay, ...	1 17 37·	"	103 54 30·	"
Cape of Good Hope, Observatory, ...	33 56 03·	S.	18 28 45·	"

	° ′ ″ ‴
* Longitude of Orange Harbor, by moon culminations, ...	67 39 09 30 S.
† " Valparaiso, fort, " "	71 40 25·65 W.
‡ " Fort Macquarie, " "	151 16 26·25 E.

Should any of these points at a future time receive more accurate determinations, the differences may be applied to the points determined by the Expedition.

SIGNS

TO DENOTE HOW THE

LATITUDES, LONGITUDES, AND HEIGHTS

HAVE BEEN DETERMINED.

☉ Meridian altitude, or circummeridian observation of sun.
✳ " " " " stars.
♋ Observation on the parallel.
♒ " " meridian.
△ Triangulation.
♃ Equal or double altitude of sun.
♈ " " stars.
♉ Altitude and azimuth of sun and stars.
♊ Azimuthal bearing.
♓ Meridian distance by chronometers.
● Eclipses or occultations.
☾✳ Moon-culminating stars.
☽✳ Lunar observations.
† Barometer.
‡ Sympiesometer.
♁ Altitude and base.
♀ Dip.
§ Determination on shore.

The Capital Letters are used to denote the name of the observer, where other authority than our own has been adopted for positions. D.R., where there has been no observation but the ship's reckoning.

TABLE III.

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
PAUMOTU GROUP.	S. ° ′ ″		W. ° ′ ″			
Adventure or Motutunga.	17 04 00	⊙	144 17 00	♓	Low coral.	Centre.
Ahii or Peacock.	14 27 20	△	146 13 24	△	" "	East End.
" "	14 34 00	⊙♒	146 25 00	●♓	" "	West End.
" "	14 28 16	△	146 21 20	△	" "	Ent. to Lag.
Ahangatou or Arackcheeff.	15 52 00	♉	140 52 00	♓	Low, inhabited.	Centre.
Akiaki or Queen Charlotte.	19 17 40	B	138 42 00	♒	" "	Centre.
Akahaina or Predpriatie.	15 58 00	K	140 11 38	♓	" "	Centre.
Amanu or Moller.	17 43 00	♃	140 39 00	♒	Low.	N. E. Pt.
" "	17 54 00	△	140 50 00	△	"	S. W. Pt.
Anaa or Chain.	17 23 00	♋	145 38 30	♓	Low, with trees, inhab.	N. W. Ex.
" "	17 32 00	♊	145 28 00	♓	" "	S. E. Ex.
Apataki.	15 14 00	♋	146 32 00	♒	Inhabited, low.	N. W. Pt.
"	15 18 10	△	146 12 00	△	" "	N. E. Pt.
"	15 35 00	♊	146 13 00	♊	" "	S. E. Ex.
Aratica or Carlshoff.	15 28 20	♃	145 20 05	♓	Low, with trees 50 to 60	N. E. Pt.
" "	15 26 17	△	145 28 00	△	feet high, inhabited.	N. Pt.
" "	15 33 25	△	145 39 00	△	" "	West End.
" "	15 40 40	⊙	145 29 30	♓	" "	S. Pt.
Archangel or Heretua.	20 24 40	⊙	143 30 00	♓	Low.	E. End.
" "	20 25 20	♊	143 32 25	♓	Inhabited.	W. End.
" "	20 24 57	♊	143 31 12	♓	"	Centre.
Arackcheeff or Ahangatou.	15 52 00	♉	140 52 00	♓	Low, inhabited.	Centre.
Arutua or Rurick.	15 29 30	⊙	146 47 30	♓	Low, lagoon island, with	S. Pt.
" "	15 16 00	△	146 51 50	♊	trees, inhabited, 20	W. End.
" "	15 10 00	△	146 49 20	△	feet in height.	N. W. Ex.
Aurora or Metia Island.	15 49 35	⊙♃	148 13 15	♓	200 feet, inhabited.	N. Ex.
" "	15 53 15	△	148 10 11	♊△	50 feet.	S. E. Ex.
" "	15 51 15	⊙	148 12 42	△	"	Village.
Batist St. Juan.	24 00 00	B	139 00 00	B	Low.	Centre.
Barrow or Teku.	20 45 00	B	139 03 00	♓	"	Centre.
Barclay de Tolly or Raroia.	16 13 00	♃	142 29 00	♓	Low.	S. W. Pt.
" "	15 56 00	△	142 22 00	△	"	N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Bacon or Tipotu.	16 43 45	⊙	144 03 20	B	Reef low, inhabited.	S. E. Pt.
" "	16 41 40	△	144 05 48	△	Wooded.	N. W. Pt.
Betero or Ebrilles Reef.	22 28 00	E	133 30 00	E	Awash.	Centre.
Bird or Hekuera.	17 48 00	♋	143 04 52	♓	Low, inhabited.	S. E. Ex.
Bligh's or Hereheretna.	21 40 00	B	140 38 00	♓	" "	Centre.
Bow or Hau.	18 06 18	⊙ B	140 51 15	♒	" "	N. Ex.
" "	18 26 00	⊙	140 40 00	♓	" "	S. E. Ex.
Buyer's or Reitoue.	18 18 00	♋	143 05 00	♓	" "	Centre.
Byam Martin or Nganaiti.	19 40 22	B	140 22 28	♓	" "	N. W. Ex.
Crescent or Temoe.	23 20 00	B	134 34 10	B	6 feet, trees, inhabited.	S. Ex.
" "	23 17 00	B	134 34 10	B	" "	N. E. Ex.
Cadmus.	23 08 00	A	137 20 00	A	Low.	Centre.
Carlshoff or Aratica.	15 28 20	♌	145 20 05	♓	Low coral.	N. E. Pt.
" "	15 26 17	△	145 28 00	△	Trees 50 to 60 feet high.	N. Pt.
" "	15 33 25	△	145 39 00	△	Inhabited.	West End.
" "	15 40 40	⊙	145 29 30	♓	" "	S. Pt.
Carysfort or Tureie.	20 44 00	B	138 19 30	B	Low.	E. Ex.
" "	20 44 00	B	138 26 30	B	Wooded.	W. Ex.
Chain or Anaa.	17 23 00	♉	145 38 30	♓	Low, trees 35 feet,	N. W. Ex.
" "	17 32 00	♋	145 28 00	♊	inhabited.	S. E. Ex.
Clermont de Tonnerre.	18 32 49	⊙	136 21 12	♓	12 feet, trees, inhabited.	S. E. End.
" "	18 27 42	△	136 29 08	△	" "	N. W. End.
Clerke or Pukapuka.	17 23 00	M	138 35 00	♒	Low, wooded, S. part bare reef.	W. End.
" "	17 23 00	△	138 25 00	△		E. End.
Clute or Ohiti.	16 49 52	♋	144 16 18	♒	Low, inhabited.	S. W. Pt.
" "	16 48 33	⊙	144 14 45	♓	" "	N. E. Pt.
Cockburn.	22 17 00	B	138 39 53	B	Low.	S. W. Ex.
"	22 14 00	B	138 35 10	B	"	N. E. Ex.
Croker or Heraiki.	17 28 00	W	143 23 42	W	"	Centre.
Cumberland or Manuwangi.	19 11 00	♋	141 10 00	♓	Low, inhabited.	East End.
" "	19 12 00	♊	141 19 06	♒	"	West End.
Dawhaida.	17 55 00	♋	142 17 00	♓	Low.	N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Heights.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Dawhaida.	18 02 40	⊙	142 12 20	)(	Low.	S. Pt.
Dean's or Nairsa.	15 16 30	♊	147 13 40	)(	Low, inhabited.	East End.
" "	15 05 15	♊	147 58 28	)(	South side bare reef.	W. Ex.
" "	14 56 00	♊	147 53 00	)(	Clump of trees.	N. W. Ex.
Disappointment, Wytoohee.	14 10 40	⊙	141 12 50	)(	Wooded, inhabited.	East End.
" "	14 09 30	△	141 17 48	△	12 feet.	West End.
" Otooho.	14 05 00	⊙	141 30 00	)(	Wooded, inhabited.	Centre.
Doubtful or Tekareka.	17 19 46	B	142 22 10	)(	Very low.	Centre.
Ebrilles or Bertero Reef.	22 28 00	E	133 30 00	)(	Awash.	Centre.
Egmont or Tatukoto.	19 24 26	M	139 34 14	)(	Large clump of trees on N. W. End, inhab.	S. W. Ex.
" "	19 22 30	△	139 28 00	△		N. E. Ex.
Elizabeth or Toau.	15 58 00	B	145 49 30	)(	Low, inhabited.	S. E. Pt.
" "	15 43 30	B	146 08 00	≋	Low.	N. W. Pt.
" "	15 43 30	△	146 00 00	△	"	N. E. Pt.
Encarnacion.	24 45 00	?	137 42 00	?	"	Centre.
Faith.	21 10 00	⊙	138 55 00	)(	"	Centre.
Fakarawa or Wittgenstein.	16 05 00	K	145 33 00	≋	"	N. E. Pt.
" "	16 33 00	K	145 22 00	)(	"	S. Pt.
" "	16 07 00	K	145 38 00	△	"	N. End.
Faaite or Myloradowitch.	16 43 00	⊙	145 19 30	)(	"	W. End.
" "	16 48 00	♊	145 06 00	)(	"	E. End.
Four Crowns or Tekn.	20 27 39	⊙	143 18 17	)(	Low, wooded.	Centre.
Furneaux or Marutea.	17 05 00	⊙	142 44 00	)(	Low, inhabited.	East End.
" "	17 05 00	♊	143 05 00	≋	" "	West End.
Gambier's or Mangareva.	23 08 00	B	134 55 30	B	Mt. Duff, 1248 ft. inhab.	Pk.
Gambier's Reef.	23 02 00	B	134 55 00	B		N. E. Ex.
Gloucester or Hariri.	19 08 00	B	140 40 00	B	Inhabited.	Centre.
Good Hope.	16 48 00	♊	141 35 00	)(	Low, coral.	Centre.
Greig or Niau.	16 11 00	⊙	146 22 00	)(	Low, wooded.	Centre.
Hau or Bow.	18 06 18	B⊙	140 51 15	B)(	Low, inhabited.	N. Ex.
" "	18 26 00	△	140 40 00	△	" "	S. E. Ex.
Hairiri or Gloncester.	19 08 00	B	140 40 00	B	" "	S. W. Ex.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Hereheretua or Bligh's.	21 40 00	B	140 38 00	B	Low, inhabited.	Centre.
Heraika or Croker.	17 28 30	W	143 23 42	W	" "	Centre.
Hekuera or Bird.	17 48 00	B	143 04 52	♓	" "	S. E. Ex.
Heretua or Archangel.	20 24 40	☉	143 30 00	♓	Low.	E. End.
" "	20 25 20	♊	143 32 25	♓	Inhabited.	W. End.
" "	20 24 57	♊	143 31 12	♒	"	Centre.
Henuake or Honden or Dog.	14 54 55	△	138 49 15	△	Low.	W. End.
" "	14 55 54	☉	138 45 48	♓	Wooded.	E. End.
" "	14 56 55	△	138 46 33	△	"	S. End.
Honden or Henuake or Dog.	14 55 54	△	138 45 48	△	No inhabitants.	E. End.
" "	14 54 55	☉	138 49 15	♓	" "	W. End.
Holt or Taenga.	16 18 00	☉	143 17 00	♓	Low, inhabited.	N. W. Pt.
" "	16 20 00	△	143 03 00	△	" "	E. Pt.
Katiu or Saken.	16 31 00	☉	144 12 10	♓	Low.	S. E. Pt.
" "	16 25 00	△	144 20 00	♊	Inhabited.	N. W. Pt.
" "	16 27 00	△	144 14 00	△	"	Entrance.
Kawahe or Vincennes.	15 59 48	☉	145 09 30	♓	Clump of trees, E. side.	S. Pt.
" "	15 46 50	♃☉	145 11 50	♓♃	Low, inhabited.	N. Pt.
" "	15 06 30	△	145 12 43	△	" "	Entrance.
Kaukura.	15 50 00	♋	146 27 00	♒	" "	E. End.
"	15 43 00	♊	146 49 00	♒	" "	N. W. Ex.
King's or Taiara.	15 42 30	♃♃	144 37 30	♓♃	Low, wooded.	E. End.
" "	15 41 05	△	144 39 38	△	" "	N. W. End.
King George's Group.	14 22 10	☉	144 58 30	✳	Trend S.S.W. & N.N.E.	N. End.
" "	14 44 20		145 20 00		Low, wooded.	S. End.
Koutousoff, Makemu, or Phillips.	16 26 00	K	143 56 00	K	" "	W. End.
" "	16 36 00	♊	143 24 00	♓	Inhabited.	E. End.
Krusenstern's or Tikehau.	15 00 00	☉♃	148 20 30	♓	Low, wooded.	W. End.
" "	14 52 00	♋	148 15 15	△	" "	N. Pt.
" "	14 56 00	△	148 08 30	♒	" "	E. Ex.
" "	15 06 30	△	148 17 45	△	" "	S. End.
Lagoon or Nukutawake.	18 43 19	D	138 47 13	D	" "	Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Lazareff or Mataiwa.	14 53 30	☉	148 43 30	♓	Low, wooded.	W. Side.
" "	14 51 40	△	148 41 40	△	" "	N. Ex.
" "	14 55 00	♊	148 38 00	♒	" "	E. End.
Lord Hood's or Marutea.	21 30 00	B	135 32 00	♓	Low, wooded.	W. Pt.
" "	21 30 00	B	135 20 00	♓	Inhabited.	E. End.
Mangareva or Gambier's.	23 08 00	B	134 55 30	B	Mt. Duff, 1248 feet.	Pk.
Maria Reef.	21 53 00	A	135 57 00	A		Centre.
Marutea or Lord Hood's.	21 30 00	B	135 32 00	♓	Low, wooded.	W. Pt.
" "	21 30 00	B	135 20 00	♓	Inhabited.	E. End.
Manuwangi or Cumberland.	19 11 00	♋	141 10 00	♓	Low.	E. End.
" "	19 12 00	♊	141 19 06	♓	Inhabited.	W. End.
Marutea or Furneaux.	17 05 00	☉	142 44 00	♓	Low, inhabited.	E. End.
" "	17 05 00	♊	143 05 00	♒	" "	W. End.
Manaka. Two Groups.	18 13 28	☉	142 10 00	♓	" "	S. Pt.
" "	18 03 00	♊	142 11 15	♓	" "	N. Pt.
Matilda or Osnaburgh.	21 50 00	B	138 45 00	♓	East side wooded, west reef awash.	E. End.
" "	21 51 00	B	139 00 00	♓		W. End.
Makemu, Pheilips, or Koutousoff.	16 26 00	K	143 56 00	K	Low, N. wooded, S. chain of reefs, inhab.	W. End.
" "	16 36 00	♊	143 24 00	♓		E. End.
Margaret's or Nukutipipi.	20 42 21	☉	143 03 48	♓	Low, wooded.	Centre.
Mauhii or Wilson.	14 24 00	☉	145 52 00	♒	" "	E. Ex.
" "	14 26 25	♉	146 04 20	♊	Inhabited.	W. Ex.
" "	14 27 15	△	146 03 12	△	"	Ent. to Lag.
Mataiwa or Lazareff.	14 53 30	☉	148 43 30	♓	Low.	W. Side.
" "	14 51 40	△	148 41 40	△	Wooded.	N. Ex.
" "	14 55 00	♊	148 38 00	♒	"	E. End.
Matia or Osnaburgh.	17 55 00	B	148 02 00	♓	Inhabited, 1500 feet.	Centre.
Metia or Aurora.	15 49 35	☉♃	148 13 15	♓	♁ 200 feet, wooded.	N. End.
" "	15 53 15	△	148 10 11	♊△	♁ Inhabited, 50 feet.	S. E. Ex.
" "	15 51 15	△	148 12 42	△	" "	Village.
Melville or Tekukota.	17 35 00	B	142 39 00	♓	Low, wooded.	N. W. Ex.
" "	17 41 00	△	142 35 00	△	" "	S. E. Ex.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Moller or Amanu.	17 43 00	♃	140 39 00	♒	Low.	N. E. Pt.
" "	17 54 00	△	140 50 00	△	"	S. W. Pt.
Motutunga or Adventure.	17 04 00	⊙	144 17 00	♓	Low, coral.	Centre.
Myloradowitch or Faaite.	16 43 00	⊙	145 19 30	♓	Low, wooded.	W. End.
" "	16 48 00	♊	145 06 00	♓	" "	E. End.
Nairsa or Dean's.	15 16 30	⊙	147 30 40	♓	" "	E. End.
" "	15 05 15	♊	147 58 28	♓	Inhabited.	W. Ex.
" "	14 56 00	♊	147 53 00	♓	Clump of trees.	N. W. Ex.
Nengo Nengo or Prince William Henry.	18 43 00	Dup.	141 40 00	♓	Low.	N. Ex.
" " "	18 49 00	⊙	141 40 00	♓	"	S. Pt.
Niau or Greig.	16 11 00	⊙	146 22 00	♓	Low, wooded.	Centre.
Niheri or Negeri.	16 42 00	B	142 48 00	♓	" "	N. Pt.
" "	16 45 00	△	142 48 00	△	" "	S. Ex.
Nganaiti or Byam Martin.	19 40 22	B	140 22 28	♓	" "	N. W. Ex.
Nukutipipi or Margaret's.	20 42 21	⊙	143 03 48	♓	" "	Centre.
Nukutawake or Lagoon.	18 43 19	D.	138 47 13	D	" "	Centre.
Ohiti or Clute.	16 49 52	⊙	144 16 18	♓	Low, inhabited.	S. W. Pt.
" "	16 48 33	⊙	144 14 45	♓	" "	N. E. Pt.
Oura.	14 32 08	⊙	145 14 30	♓	Low, wooded.	N. Pt.
"	14 44 20	△	145 20 00	△	Inhabited.	S. Pt.
Osnaburgh or Matia.	17 55 00	B	148 02 00	♓	1500 feet.	Centre.
Osnaburgh or Matilda.	21 50 00	B	138 45 00	♓	East side wooded.	E. End.
" "	21 51 00	B	139 00 00	♓	West reef, awash.	W. End.
Otooho.	14 05 00	⊙	141 30 00	♓	Low, wooded, inhab.	Centre.
Pablo, St.	19 51 20	⊙	144 58 25	♓	Low, inhabited.	N. Ex.
"	19 53 20	⊙	145 00 00	♓	" "	W. Islet.
"	19 55 22	△	144 58 00	△	" "	S. End.
Peacock's or Ahii.	14 27 20	△	146 13 24	△	Low.	E. End.
" "	14 34 00	⊙ ♍	146 25 00	● ♓ ♍	Wooded.	W. End.
Phillips, Makemu, or Kontousoff.	16 26 00	M	143 56 00	♓	Low, wooded.	W. End.
" "	16 36 00	M	143 24 00	♓	" "	E. End.
Predpriatie or Akahaina.	15 58 00	K	140 11 30	♓	Low, inhabited.	Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c., &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Prince William Henry or Nengo Nengo.	18 43 00	Dup.	141 40 00	⁑	Low.	N. Ex.
" "	18 49 00	Dup.	141 40 00	⁑	"	S. Pt.
Pukerua or Thrum Cap.	18 30 00	B	139 08 00	B	"	N. W. Ex.
Pukapuka or Clerke.	17 23 00	⊙	138 35 00	⁘	Low, inhabited.	W. End.
" "	17 33 00	△	138 25 00	△	" "	E. End.
Queen Charlotte or Akiaki.	19 17 40	B	138 42 00	⁘	Low.	Centre.
Raraka.	16 06 25	⊙ ⁘	144 57 40	⁑ ⁘	North side wooded.	En. to Lag.
"	16 15 45	△	144 52 50	△	Bare reef.	Apex S. pt. of reef.
"	16 10 00	△	144 46 50	△	Inhabited.	A'x S. E. pt
"	16 08 00	△	145 00 40	△	"	Apex W. pt.
Raroia or Barclay de Tolly.	16 13 00	Bel.	142 29 00	⁑	Low, inhabited.	S. W. Pt.
" " "	15 56 00	Bel.	142 22 00	Bel.	" "	N. Pt.
Resolution or St. Simeon, or Taweree.	17 22 21	⊙	141 29 39	⁑	Low.	Near Sand Spit
" " "	17 23 35	⊙	141 26 05	⁑	Inhabited.	S. E. pt.
" " "	17 24 00	△	141 28 45	△	"	S. W. clump.
Reitoue or Buyer's.	18 18 00	⊙	143 05 00	⁑	Low.	Centre.
Ried or Tninaka.	16 40 00	⊙	144 10 28	⁑	"	S. Pt.
" "	16 37 17	△	144 13 00	△	"	N. W. Pt.
" "	16 37 00	⊙	144 09 30	⁑	"	N. E. Pt.
Romantzoff or Tike.	14 57 00	Koz.	144 35 30	K	Low, wooded.	Centre.
Rurick or Arutua.	15 29 30	⊙	146 47 30	⁑	" "	S. Pt.
" "	15 16 00	△	146 51 50	⁑	Inhabited.	W. End.
" "	15 10 00	△	146 49 20	△	"	N. W. Ex.
Saken or Katiu.	16 31 00	⊙	144 12 10	⁑	"	S. E. Pt.
" "	16 25 00	△	144 20 00	⁑	Low.	N. W. Pt.
" "	16 27 00	△	144 14 00	△	"	Entrance.
Serle.	18 21 10	⊙	137 04 20	⁑	Inhabited.	S. E. Pt.
"	18 16 50	△	137 09 06	△	Low.	N. W. End.
St. Juan Baptist.	24 00 00		139 00 00			Centre.
St. Simeon, Taweree, or Resolution,	17 22 21	⊙	141 29 39	⁑	Low.	Near Sand Spit
" "	17 23 35	⊙	141 26 05	⁑	Low, inhabited.	S. E. Pt.
" "	17 24 00	△	141 28 45	△	Low.	S. W. clump.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
St. Pablo.	19 51 20	⊙	144 58 00	⚹	Low, inhabited.	N. Ex.
"	19 53 20	⊙	145 00 00	⚹	" "	W. Islet.
"	19 55 22	△	144 58 00	△	" "	S. End.
Tatukoto or Egmont.	19 24 26	M	139 34 14	⚹	Large clump of trees on N. W. end, inhab.	S. W. Ex.
" "	19 22 30	△	139 28 00	△	" "	N. E. Ex.
Tawerce, St. Simeon or Resolution.	17 22 21	⊙	141 29 39	⚹	Low, inhabited.	Sand Spit.
" "	17 23 35	⊙	141 26 05	⚹	" "	S. E. Pt.
" "	17 24 00	△	141 28 45	△	" "	S.W. clump.
Takurea or Wolconsky.	15 48 00	⊙	142 15 30	⚹	Inhabited, low.	S. End.
" "	15 39 30	△	142 06 15	⚹	East side wooded, west side bare.	N. E. End.
Taenga or Holt.	16 18 00	⊙	143 17 00	⚹	Low, inhabited.	N. W. Pt.
" "	16 20 00	△	143 03 00	△	" "	E. Pt.
Tahanea or Tchitshagoff.	16 52 00	K	144 58 00	⚹	Low.	W. End.
" "	16 57 00	K	144 48 00	⚹	"	E. End.
Taiara or King's.	15 42 30	⊙ ☾	144 37 30	⚹ ☾	"	E. End.
" "	15 41 05	△	144 39 38	△	Wooded.	N. W. End.
Teku or Barrow.	20 45 00	B	139 03 00	⚹	Low.	Centre.
Tematu-Leiwnwau or Whitsunday.	19 23 38	Bel.	138 36 48	⚹	6 ft. above sea, wooded.	Centre.
Tekareka or Doubtful.	17 19 46	B	142 22 10	⚹	Very low.	Centre.
Tekukota or Melville.	17 35 00	B	142 39 00	⚹	Low, wooded.	N. W. Ex.
" "	17 41 00	B	142 35 00	⚹	" "	S. E. Ex.
Temoe or Crescent.	23 20 00	B	134 34 10	B	6 feet, trees, inhabited.	S. Ex.
" "	23 17 00	B	134 34 10	B	" "	N. E. Ex.
Teku or Four Crowns.	20 27 39	⊙	143 18 17	⚹	Low, wooded.	Centre.
Thrum Cap or Pukerau.	18 30 00	B	139 08 00	B	Low, inhabited.	N. W. Ex.
Tike or Romantzoff.	14 57 00	K	144 35 30	K	Low, wooded.	Centre.
Tiokea.	14 22 10	⊙	144 58 30	⚹	" "	N. Pt.
"	14 31 12	♊	145 09 30	⚹	" "	S. W. Pt.
"	14 29 00	△	145 06 00	△	" "	Ent. to Lag.
Tipotu or Bacon.	16 43 45	⊙	144 03 20	B	Reef, low, inhabited.	S. E. Pt.
" "	16 41 40	△	144 05 48	△	Wooded.	N. W. Pt.
Tikehau or Krusenstern's.	15 00 00	⊙♃	148 20 30	⚹	Low, wooded.	W. End.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Heights.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Tikehau or Krusenstern's.	14 52 00	♋	148 15 15	△	Low, wooded.	N. Pt.
" "	14 56 00	△	148 08 30	≋	" "	E. Ex.
Toau or Elizabeth.	15 58 00	B	145 49 30	♓	Low, inhabited.	S. E. Pt.
" "	15 43 30	B	146 08 00	≋	" "	N. W. Pt.
Tuinaka or Reid.	16 40 00	⊙	144 10 28	♓	Low.	S. Pt.
" "	16 37 17	△	144 13 00	△	"	N. W. Pt.
" "	16 37 00	⊙	144 09 30	♓	"	N. E. Pt.
Turcei or Carysfort.	20 44 00	B	138 19 30	B	Low, wooded.	E. End.
" "	20 44 00	B	138 26 30	B	" "	W. Ex.
Vincennes or Kawahe.	15 59 48	⊙	145 09 30	♓	Clump of trees, E. side.	S. Pt.
" "	15 46 50	♃⊙	145 11 50	♓♒	Low, inhabited.	N. Pt.
" "	15 06 30	△	145 12 43	△	" "	Entrance.
Wilson's or Manhii.	14 24 00	⊙	145 52 00	≋	Low, wooded.	E. Ex.
" "	14 26 22	△	146 04 20	△♒	Inhabited.	W. Ex.
" "	14 27 15	△	146 03 12	△	" "	Ent. to Lag.
Wittgenstein or Fakarawa.	16 05 00	K	145 33 00	≋	" "	N. E. Pt.
" "	16 33 00	K	145 22 00	♓	" "	S. Pt.
" "	16 07 00	K	145 38 00	△	" "	N. End.
Whitsunday or Tematu.	19 23 38	Bel.	138 36 48	♓	6 ft. above sea, wooded.	Centre.
Wolcousky or Takurea.	15 48 00	⊙	142 15 30	♓	Inhabited, low, E. side wooded, W. side bare.	S. End.
" "	15 39 30	△	142 06 15	♓		N. E. End.
Wytoohee.	14 10 40	⊙	141 12 50	♓	Low, wooded, inhab.	E. End.
"	14 09 30	△	141 17 48	△	Low, reef.	W. End.
SOCIETY GROUP.						
Aorai. Tahiti.	17 38 00	△	149 33 00	△	6979 feet.	Peak.
Borabora.	16 22 00	♊	151 40 00	♊	High.	N. End.
Eimeo.	17 29 30	♋	149 55 00	♓	2500 feet.	N. E. End.
"	17 34 15	♊	150 00 30	♓		S. End.
Eimeo, Oroo Peak.	17 30 00	△	149 49 00	△	4045 feet. ♁	Peak.
Huahine.	16 42 10	⊙	151 11 00	♊	High.	N. End.
"	16 54 20	♋	151 08 00	♊	"	S. End.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Matavi Bay, Tahiti.	17 29 30	⊙	149 31 13	△ ♒	Low.	Pt. Venus
Maurua.	16 27 00	⊙	152 14 00	♓	800 feet.	Centre.
Matia or Osnaburgh.	17 55 00	B	148 02 00	B	1500 feet.	Highest Pt.
Motuutu Islet, Papieti Har.	17 32 05	⊙ ♒	149 35 46	♓ ♒		Fort.
Otaha, or Tahaa.	16 35 00	C	151 35 00	C	Surrounded by Ulitea R.	Centre.
Papoa Harbor, Eimeo.	17 30 00	⊙ ♒	149 58 10	♓ ♒		W. Side.
Papieti Harbor, Tahiti.	17 32 05	⊙ ♒	149 35 46	♓ ♒		Fort.
Papaoa Harbor, "	17 31 26	⊙ ♒	149 33 22	♓ ♒		Watering Place.
Raiatea or Ulieta.	16 40 00	♊	151 40 00	♓	High.	N. Pt.
Tahaa or Otaha.	16 35 00	C	151 35 00	C	In same reef as Ulitea.	N. End.
Taiarabu.	17 52 30	B	149 10 30	♓	High.	S. E. Pt.
"	17 42 00	B	149 07 00	♓		N. E. Pt.
Tahiti.	17 38 30	△	149 30 00	△	8250 feet.	Centre.
"			149 32 00	△	Morai Oamo.	S. Side.
"	17 33 30	♋	149 39 15	♒	Motuahou-na.	W. Side.
"	17 28 20	△	149 31 15	△	Reef.	N. Ex.
Taloo Harbor, Eimeo.	17 29 23	⊙ ♒	149 51 22	♓ ♒		Vinu. Pt.
Tapamanoa, or Sir Charles Saunders.	17 29 00	W	150 24 30	♓	High.	E. Pt.
" "	17 30 30	⊙	150 32 30	♓		S. W. Pt.
Tetuaroa.	17 07 15	⊙	149 29 30	♒	Low.	E. End.
"	17 06 45	♊	149 34 00	♓	"	W. End.
Toanoa Harbor, Tahiti.	17 31 26	⊙ ♒	149 34 22	♓ ♒		Watering Place.
Tubai or Motu-iti.	16 11 00	Bel.	151 48 00	♓	Low.	N. Pt.
Ulieta or Raiatea.	16 40 00	♊	151 40 00	♓	High.	N. Pt.
Pt. Venus, Tahiti.	17 29 30	⊙ ♒	149 31 13	♓ ⊙	Low.	Obs.
SAMOAN GROUP.						
Alao Town, Tutuila.	14 17 30	⊙ ♒	170 31 30	♓ ♒		E. End.
Aluan Bay, "	14 18 00	⊙	170 44 15	♓		N. Side.
Amoa, Savaii.	13 38 40	△	172 07 00	△		E. End.
Alofa Town, Opolu.	13 47 00	△	171 46 00	△		N. Side.
Anfanga, "	14 00 00	△	171 26 20	△		S. Side.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Apolima, Upolu.	13 49 30	♉♊	172 03 00	♓	♁ 547 feet.	Centre.
Apia, "	13 48 56	♉♊	171 41 09	♓♊		Obs.
Apia Peak, "	13 51 00	△	171 41 00	△	♁ 960 feet.	Centre.
Asua Town, N. side Savaii Island.	13 31 45	△	172 35 40	△	Rocky.	
Anuu, Id., S. E. side Tutuila.		△	170 30 15	♒	"	E. Pt.
"	14 18 40	♋	170 30 40	△	230 feet.	Centre.
"	14 19 10	☉	170 30 40		Rocky.	S. Pt.
Atoa Town, Fangaloa Har.	13 56 00		170 29 00			½ mile s. w. Musumusu
Aua Harbor, Tutuila.	14 17 00	♉♊	170 33 00	♓♊		West Pt.
Bat Point, "	14 17 00	△	170 34 45	△	Rocky bluff.	N. side.
Bartlett's Point, "	14 16 35	△	170 35 00	♒	" "	"
Bird Point, "	14 17 40	△	170 42 45	♓	Rocky.	"
Black Rock, "	14 17 05	△	170 31 10	♓	85 feet.	East End.
Black's Bay, "	14 20 30	△	170 39 00	♓		S. Side.
Cockscomb Pt., "	14 15 20	△	170 38 20	△	Rocky.	N. Side.
" Islet.	13 49 50	△	172 02 00	△	In the Upolu Reef.	E. End.
Cone Hill, Savaii.	13 47 00	♋	172 10 00	△	♁ 530 feet.	S. E. Pt.
Cocoanut Point, Tutuila.	14 20 00	♊	170 39 00	△	Low, sandy.	S. side.
Cocoanut Islet, Falealili Har.	14 00 13	♉♊	171 35 38	♓♊		S. Side of Upolu.
Craggy Point, Tutuila.	14 16 30	△	170 37 40	△	Rocky bluff.	N. Side.
Devil's Own Point, "	14 18 45	△	170 37 25	△	" "	S. Side.
Deceit " "	14 21 10	△	170 40 10	△	Low, sandy coral extends ¾ mile beyond.	S. Side.
Double " "	14 19 25	△	170 38 00	△	Rocky.	S. Side.
Elliott " "	14 17 25	△	170 42 15	△	Rocky Point.	N. Side.
Eld's " Upolu.	13 53 30	△	171 28 10	△	Rocky.	N. Side.
Emmons Point, "	13 54 00	△	171 27 10	△	"	N. Side.
Faluasófia, Town, "	13 51 10	☉	171 58 50	△		West End.
Falilati, " "	13 53 00	♉♊	171 55 00	♓♊		S. Side.
Falealili " "	13 59 00	☉	171 36 00	△		"
Fanganga Peak, "	13 59 25	△	171 23 30	△	1750 feet. ♁	S. E. End.
Fanuatapu Id., "	13 58 20	△	171 20 25	△	In the Upolu Reef, East end.	Centre.
Fangaloa Bay, "	13 55 00	♉♊	171 28 00	♓♊		Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Fao Peak, . Upolu.	13 54 45	△	171 29 25	△	2900 feet. ♁	
Falifa Harbor, "	13 52 33	⊙ ⁘	171 31 46	⚳ ⁘		Centre.
Falifa Town, "	13 53 00	△	171 32 20	△		
Falooloo Pt. and Town, "	13 47 00	△	171 44 45	△		N. Side.
Fasetootai, Town, . "	13 48 30	△	171 52 25	△		N. Side.
Faleatii, "	13 48 30	⊙	171 53 45	△		N. Side.
Fagaitua Bay, Tutuila.	14 18 00	⊙	170 33 42	⚳		S. Side.
Felialupo Point, Savaii.	13 30 40	△⊙	172 44 50	△ ⁞⁞	Rocky.	W. Pt.
Fouei Town, Upolu.	13 51 45	△	171 34 15	△		N. Side.
Fungasa Harbor, Tutuila.	14 18 00	⊙ ⁘	170 42 30	⚳ ⁘		Centre.
Faleapuna, Upolu.	13 51 05	△	171 33 21	△		N. Side.
Greyhound Point, Tutuila.	14 18 00	△	170 44 15	△	Rocky.	N. Side
Hardie Point, . Savaii.	13 28 45	♋△	172 13 45	△		N. E. Pt.
Kidd's Point, Tutuila.	14 16 35	△	170 32 20	△		N. Side.
Lauto Pk. or Crater, Upolu.	13 54 30	△	171 41 30	△	2570 feet. ‡	Centre of I.
Lauli Point, Savaii.	13 28 00	△	172 20 00	△	Rocky.	N. Side.
Laulii Harbor, Upolu.	13 49 42	⊙	171 38 25	⚳		Anchorage.
Laulii Town, "	13 50 50	△	171 38 00	△		N. Side.
Latonga, "	13 50 30	⊙	171 39 00	△		"
Lepa, "	14 00 00	△	171 23 30	△		S. Side.
Lafanga, Boat Har. Upolu.	13 55 00	△	171 53 00	△		"
Leopard Point, . Tutuila.	14 19 00	△	170 47 15	△	Rocky.	N. W. Part.
Lena, Upolu.	13 55 30	△	171 27 30	△		N. Side.
Lion's Head, Tutuila.	14 18 25	△	170 34 30	△	Rocky.	S. Side.
Leone Point, "	14 22 20	⊙	170 43 15	⚳		"
Lotofanga, Upolu.	14 00 00	△	171 29 40	△		S. Side.
Luatuanua Town, "	13 51 00	△	171 37 15	△		N. Side.
Manono Id. "	13 50 00	△	172 01 00	△	In Upolu Reef.	Centre.
Masina Town, "	13 56 30	△	171 28 15	△		N. Side.
Malata Peak, . "	13 57 00	△	171 30 00	△	2631 feet. ♁	East End.
Matafongatele Point, "	13 48 30	△⊙	171 40 30	△⚳	Low.	N. Side.
Mataatu Har. Savaii.	13 28 00	⊙ ⁘	172 18 00	⚳ ⁘		Obs.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.		Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
		S. ° ′ ″		W. ° ′ ″			
Maletun Point,	Savaii.	13 28 30	△	172 23 00	△	Rocky.	N. Side.
Maury's Point,	"	13 40 40	△	172 06 00	△	"	E. End.
Massacre Bay,	Tutuila.	14 18 10	☉ ♒	170 43 20	♓ ♒		N. Side.
Massefao Bay,	"	14 16 35	☉ ♒	170 35 00	♓		"
Matutula Cape,	"	14 16 25	△	170 31 15	♓	Rocky.	N. E. Pt.
Matafao Peak,	"	14 19 30	△	170 40 00	△	2327 feet. ‡	
Manua Id.		14 15 00	♋ ☉	169 26 30	♒	2500 feet. ♁	Centre.
"				169 24 00	♒	Bluff.	E. Pt.
"		14 17 20	♋ ☉			Rocky Bluff.	S. Pt.
"		14 13 15	♃	169 28 40	♓	300 feet. ♁ Rocky Bluff.	N. W. Pt.
Missionary Point,	Savaii.	13 43 15	♃	172 33 25	△		S. W. Side.
Mole Point,	"	13 29 40	△	172 44 00	△	Rocky Bluff.	W. End.
Mosquito Point,	Tutuila.	14 16 45	△	170 33 00	△	Rocky.	N. Side.
Mutiatele Town,	Upolu.	13 58 25	☉	171 21 50	♓		E. End.
Musumusu,	"	13 55 30	☉	171 28 50	♓	Fangaloa Harbor.	W. Side.
Murray's Point,	Tutuila.	14 21 20	△	170 44 40	△	Rocky.	S. Side.
Nafavalii Point,	Upolu.	13 47 50	△	171 50 30	△		N. Side.
Namua Islet,	"	13 58 40	△	171 21 20	△	In Upolu Reef.	Centre.
Nelson's Point,	Tutuila.	14 16 30	△	170 39 40	△	Rocky.	N. Side.
Nuutele Islet,	Upolu.	14 01 00	♋	171 21 40	♒	Off S. E. End.	Centre.
Nuulua "	"	14 01 30	♃	171 20 50	♒	" "	"
Naneivi Point,	"	13 52 20	△	171 31 15	△	Rocky.	Falifa Har.
Observatory Point,	Tutuila.	14 18 06	☉ ♒	170 38 18	♓ ♒		Harbor of Pago Pago.
Ofoo Id.		14 11 00	♃ ♒	169 36 00	♓ ♒		W. Pt.
"		14 11 35	△	169 33 20	△	1020 feet. ♁	E. Pt.
"		14 12 15	♊				S. Side.
Oafuno Harbor,	Tutuila.	14 16 48	☉ △	170 37 15	♓ △		Centre.
Oluna,	Upolu.	13 55 15	△	171 28 40	△		Fangaloa Bay.
Olemanga Crater,	"	13 58 00	△	171 24 40	△	2720 feet. ♁	E. End.
Oloosinga Id.		14 11 00	☉	169 32 00	△	1220 feet. ♁	N. Pt.
" "		14 12 20	△	169 32 00	♓	Rocky.	S. Pt.
Paluale Point,	Savaii.	13 47 40	♋	172 11 40	△		E. Pt. Bay.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.		Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
		S. ° ′ ″		W. ° ′ ″			
Paluale Point,	Savaii.	13 46 50	⊙	172 15 15	△		W. Pt.
Pago Pago Harbor,	Tutuila.	14 18 06	⊙✳	178 38 18	☽✳		Obs. Pt.
Pickering Peak,	Savaii.	13 40 00	△	172 11 20	△	1120 feet. ♁	Crater.
Pyramid Rock,	Tutuila.	14 18 40	△	170 35 15	△		S. Side.
Red Point,	"	14 18 00	△	170 31 25	△	Rocky.	S. E. End.
Rocky Point,	"	14 21 10	△	170 47 00	△	"	S. W. Side.
Rose Island.		14 31 30	⊙ ♒	168 08 30	♓ ♒	Clump of trees, 60 feet, low coral.	
Round Bluff,	Tutuila.	14 18 30	△	170 33 20	△	Rocky.	S. Side.
Round Point,	Upolu.	13 57 30	△	171 48 40	△ ♒	"	S. Side.
Samatou Point,	"	13 52 30	△	171 58 30	△		S. E. Pt.
Sanaapu Town,	"	13 56 40	⊙ ♒	171 43 40	♓ ♒		S. Side.
" Harbor,	"	13 57 47	⊙	171 44 27	♓	Entrance.	S. Side.
Salany,	"	13 59 30	△	171 32 20	△		S. Side.
Salamanu Peak,	"	13 56 10	△	171 25 30	△	2570 feet. ♁	E. End.
Satitoa,	"	13 59 00	△	171 22 00	△		E. End.
Saleaaumua,	"	13 57 50	△	171 22 00	△		E. End.
Samusu Town,	"	13 56 40	⊙	171 22 40	△		E. End.
Samamea Town,	"	13 54 30	△	171 27 20	△		Fangaloa Bay.
Sauano Town,	"	13 54 00	△	171 29 30	△		N. Side.
Saluafata Harbor,	"	13 51 24	⊙	171 34 18	♓		Centre of Har.
Saluafata Town,	"	13 51 55	△	171 33 40	△		E. Side.
Salclese,	"	13 51 40	△	171 34 30	△		Saliafatu Harbor.
Sangana or Alofa,	"	13 47 00	△	171 46 00	△		N. Side.
Salamoa Church,	"	13 47 10	△	171 47 45	△		N. Side.
Sasava,	"	13 49 00	△	171 55 21	△		N. Side.
Salafuata Point,	"	13 48 25	⊙ △	171 56 30	♓ △		N. Side.
Savaii.		13 30 35		172 44 50	♒ ♓	Inhabited.	W. End.
"		13 40 45		172 06 00	♒		E. End.
"		13 48 40	⊙ ♃	172 28 40	△	Rocky iron bound coast.	S. Pt.
"		13 27 30	⊙	172 17 30	△	Low.	N. Ex.
"		13 48 30		172 08 30	△	Rocky.	S. E. Pt.
Sapapale,	Savaii.	13 42 00	⊙	172 06 25	♓		E. End.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.		Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
		S. ° ′ ″		W. ° ′ ″			
Salealoua Bay,	Savaii.	13 43 25	☉	172 33 20	♓		W. Pt.
Sandy Point,	Tutuila.	14 17 25	△	170 31 10	△		E. End.
Sail Rock Point,	Tutuila.	14 22 35	☉△	170 41 00	△	♀ 160 ft., rocky bluff.	S. Side.
Suovidi Point,	Savaii.	13 29 00	△	172 30 45	△		N. Side.
Southworth Point,	Tutuila.	14 17 00	△	170 40 30	△	Rocky bluff.	N. Side.
Soto Point,	Savaii.	18 39 10	△	172 37 30	△	Rocky.	S. W. Side.
South Point,	"	13 48 40	△	171 28 40	△	"	S. Ex.
Square Head,	Tutuila.	14 18 00	♋	170 45 00	△	Rocky bluff.	N. Side.
Step's Point,	"	14 22 35	☉	170 42 25	△		S. Side.
Susigna Peak,	Upolu.	13 53 00	△	171 44 40	△	2750 feet. †	
Swain's Point,	Savaii.	13 30 30	△	172 35 40	△	Rocky.	E. Pt.
Tapanga Point,	Upolu.	14 00 10	☉	171 22 20	♒		S. E. Pt.
Tiavea Point,	"	13 55 40	☉△	171 23 00	♓△		N. Side.
Tiavea Town,	"	13 56 10	△	171 24 25	△		N. Side.
Tofua Peak,	"	13 51 20	△	171 52 00	△	1510 feet. ♁	Crater.
Toapii,	"	14 00 00	△	171 30 40	△		S. Side.
Tooanea,	"	13 47 10	☉	171 48 10	♓		N. Side.
Tonga Point,	Savaii.	13 29 30	△	172 42 40	△	Volcanic.	N. Pt.
Tower Rock,	Tutuila.	14 19 15	△	170 38 00	△	60 feet.	Pago Pago.
Tula Town,	"	14 17 00	△	170 31 30	△		E. End.
Tutuila.		14 20 40	☉♋	170 48 15	♓	Inhabited.	W. Cape.
"				170 31 15	♒		E. Ex.
"		14 22 40	♋				S. Ex.
"		14 15 30	☉△				N. Ex.
Tutoiva,	Upolu.	13 55 25	△	171 24 10	△		N. Side.
Tupu Point,	Savaii.	13 32 45	△	172 43 50	△	Rocky.	S. Side.
Tumo Point,	Upolu.	13 50 30	△	171 36 30	△	"	N. Side.
Uafato Town,	"	13 55 15	☉♒	171 26 25	♓♒		N. Side.
" Harbor,	"	13 54 35	△	171 26 25	△	Rocky.	W. Pt.
Ulutongia,	"	13 59 20	△	171 22 20	△		E. End.
Upolu.				171 20 00	♓	Inhabited.	E. End.
"				172 02 30	△		W. End.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Upolu.	13 46 00	⊙			Reef.	N. Side.
Upolu Bluff.	14 00 30	⊙ ♓			Rocky.	S. Side.
Vailoa, Upolu.	13 59 35	△	171 22 20	△		E. End.
Vailele Town, "	13 49 15	△	171 40 00	△		N. Side.
Vaialasa, "	13 48 40	△	171 43 00	△		"
Vatia Town, Tutuila.	14 16 40	△	170 38 30	△		"
Whitstone Point, Asau Bay.	13 30 20	△ ⊙	172 37 00	△	Rocky.	N. Side Savaii.
FEEJEE GROUP.	S.		E.			
Abootolema.	18 53 30	△	181 24 00	△	60 feet. In Angasa Reef.	Centre.
Abuda.	18 56 00	△	181 26 30	△	In Angasa Reef.	"
Adolphus Reef.	16 19 30	△	179 18 30	△	1½ mile long E. and W.	"
Aiva-thaki Reef.	18 21 50	△	181 21 00	△	Awash.	S. E. Pt.
" " Island.	18 21 00	△	181 17 00	△	30 feet.	Centre.
" " Reef.	18 19 30	△	181 12 00	△	Awash.	N. W. Pt.
Agate Id., Asaua Group.	17 11 30	△	177 08 10	△	High, rocky.	Centre.
Alden, Hudson's Isles.	17 37 20	△	177 00 00	△	" "	"
Ambau.	17 59 16	⊙ ♒	178 39 20	♓ ♒		Centre.
Ambatiki.	17 47 00	⊙	179 10 30	△	750 feet. ♂	"
Anganga.	16 34 30	△	178 38 20	△	Rocky Point.	E. End.
"	16 36 00	⊙	178 33 20	♓		W. Pt.
Anutunga.	16 37 00	△	178 40 00	△	Low.	Centre.
Andulong Peak, Ovolau.	17 40 00	⊙ △	178 51 10	♓	♀ 2070 feet. ♂	
Angasa.	18 55 00	△	181 28 00	△	150 feet. ♀	Centre.
Anutha Levu.	17 45 26	△	178 49 30	△	Low.	"
" Lailai.	17 46 06	△	178 49 10	△	"	"
Anufe Point, Vitilevu.	17 21 00	△	177 58 00	△		N. Side.
Annan Islands.	17 16 30	⊙	178 13 00	♓	Off. N. Ex. of Vitilevu.	S. Ex.
" "	17 13 40	△	178 12 00	△		N. Pt.
Androna, Asaua Gr.	16 57 00	⊙	177 21 40	♓	900 feet. ♂	S. Pt.
" "	16 52 00	△	177 24 30	△		N. Pt.
" "	16 54 00	△	177 26 30	△		E. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Heights.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Angasau Tombu.	17 50 06	△	178 47 40	△	Sandy.	Centre.
Angau.	18 06 00	⊙	179 22 00	♓	S. E. Point.	Pt. Lobo.
"	17 55 30	♉	179 19 30	♊		Uthivione Point.
"	18 01 00	♊	179 16 20	♓		Via-Via Pt.
"	17 58 30		179 19 00		1560 feet. ♁	Dilathoa Peak.
Argo Reef or Bocatatanoa.	18 18 00	⊙	181 38 30	△	Awash.	S. E. Pt.
" "	17 58 30	♉	181 33 30	△	"	N. Pt.
" "	18 11 00	△	181 22 20	△	Broken reef, Awash.	W. Pt.
Aro.	17 42 30	⊙	181 22 00	♓	Reef ½ a mile wide.	Centre.
Aramula Passage.	16 09 00	△	179 46 00	△	N. Side Vanualevu.	"
Asaua.	16 42 20	△	177 29 40	△		"
Astrolabe Reef.	18 42 00	⊙	178 27 00	♓		N. Pt.
Ato, Asaua Group.	16 59 30	⊙△	177 18 25	△		Centre.
Awakalo or Round.	16 40 30	⊙	177 43 00	♓	515 feet. ♁	"
Avia, Exploring Isles.	17 10 30	△	181 06 00	△	200 feet. ♁	"
Batia.	17 22 10	△	177 45 20	△		"
Batia Point, Vitilevu.	17 22 20	△	177 45 10	△		N. Side.
Baino Harbor, Vanualevu.	16 44 00	⊙⁈	179 51 00	♓		Sharp Pt.
Baldwin, Asaua Group.	17 26 50	△	177 00 45	△		N. Pt.
Batatho Point, Vitilevu.	17 38 15	△	178 36 30	△		N. E. End.
Bateman's.	17 40 30	△	177 14 20	△	Low.	Centre.
Ba Point, Vitilevu.	17 26 20	⊙	177 36 00	△	"	W. End.
Bacon's Isles, Argo Reef.	18 02 00	⊙	181 28 30	♓		Centre.
Bell's Reef.	17 02 30	△	181 03 00	△	1½ mile in diameter.	"
Biva.	17 08 30	△	176 52 30	△	Low.	"
Biva Reef.	17 12 00	△	176 51 40	△	Awash.	S. W. Pt.
Bird.	18 19 20	△	177 58 15	△	Low.	Centre.
Blair.	18 30 10	△	177 36 00	△		"
Blunt.	18 52 00	△	178 24 40	△		"
Blunt's Point, Vanualevu.	16 13 30	△	179 33 00	△	High.	N. Side.
Black Rock.	18 43 00	⊙⁈	178 27 00	♓⁈	Astrolabe Reef.	
Bocatatanoa or Argo Reef.	18 18 00	⊙	181 38 30	△	Awash.	S. E. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Bocatatanoa or Argo Reef.	17 58 30	♉	181 33 30	△	Awash.	N. Pt.
" "	18 11 00	△	181 22 20	△	Broken reef. Awash.	W. Pt.
Bolin Point, Vanualevu.	16 12 54	△	179 38 10	△	High.	N. Side.
Brown's Reef, Ringgold's Is.	16 16 00	△	180 34 30	△	2 miles in diameter.	Centre.
Brackenridge.	16 33 00	△	178 47 20	△	Low.	S. E. End.
Budd's, Ringgold's Isles,	17 26 30	☉♒	180 23 00	♓♒	800 feet. ♁‡	Centre.
" Farthest, Vitilevu.	17 48 00	△	178 15 00	△		Peale's R'r.
Buia, Town, Vuna.	16 57 30	☉	179 55 40	△		S. W. End.
Buia Point, Vanualevu.	17 01 30	☉♊	178 46 00	♓♒	High.	S. End.
Bukalau.	16 12 20	△	179 45 50	△	Low.	E. Pt.
Bush Peak, Vanualevn.	16 15 05	△	179 44 45	△		N. Side.
Case.	17 37 30	△	177 03 30	△	High.	Centre.
Cabeva.	16 11 20	△	179 34 45	△		S. Pt.
Carr, Hudson's Isles.	17 36 25	△	177 02 00	△	High.	E. Pt.
"	17 36 00	△	177 00 25	△		W. Pt.
"	17 35 00	△	177 01 30	△		N. Pt.
Carr's Harbor, Matuku.	19 11 00	☉	179 43 40	♓		Centre.
Casangha Town, Vitilevu.	18 01 50	△	178 34 00	△		
Chichia.	17 44 30	☉	180 42 00	♓♁	300 feet.	N. W. Pt.
"	17 48 30	△	180 44 00	△		S. E. Pt.
Chicobea.	15 49 30	♊△	180 11 30	♊△		S. Knoll.
"	15 47 40	△	180 09 00	△		N. Knoll.
Charlie's Har., Moala I.	18 37 30	☉♒	179 54 00	♓♒		Centre.
Chicondua Reef.	18 54 30	△	181 29 30	△		"
Chick's Reef.	18 38 30	△	181 14 20	△	2 miles long E. and W.	"
Clark's.	16 22 24	△	179 11 32	△	Low.	"
Corolib or Goat, Somu Somu Straits.	16 46 20	☉♃	180 01 40	♓♒	High.	"
Cocoanut.	16 29 54	☉	178 51 42	♓	Low.	"
Cocoanut Point, Vanualevu.	16 59 00	△	178 43 30	△	"	S. W. End.
Colvocoressis.	18 49 30	△	178 25 40	△	High.	Centre.
Cobu Rock.	17 51 30	☉♒	179 29 00	△	♁ 500 feet.	Mothea R.
Craven.	17 39 00	△	177 01 30	△	High.	Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Cumming's.	16 21 40	△	179 08 47	△	Low.	Centre.
Davis, Asaua Group.	17 27 40	△	177 00 30	△	High.	"
Dana's Peak, Vanualevu.	16 45 10	△	178 49 20	△	1765 feet.	W. End.
Day's.	16 24 24	△	179 09 20	△	Low.	N. E. Pt.
De Haven, Ringgold's Isles.	16 30 20	△	180 21 30	△	High.	N. End.
Dibble's Reef.	16 59 00	△	181 02 00	△		"
Dimba-dimba Pt., Vanualevu.	16 48 18	△	178 30 30	△		West End.
Direction or Nemena.	17 06 00	⊙♃	179 06 00	♓♒	310 feet. Obs. Bluff.	N. End.
Dille-ovolau Pk., Ovolau.	17 40 30	△	178 50 00	△	2300 feet. ♁	
Dongaloa.	17 24 00	△	177 39 30	△	Low.	Centre.
Doughty's Reef.	16 20 00	△	180 40 00	△	1 mile long.	"
Drnan or Ndrundrua.	16 11 24	⊙♒	179 35 37	♓	156 feet.	N. E. Pt.
" "	16 12 24	△	179 35 20	△		Centre.
Drayton's Peak, Vanualevu.	16 33 00	△	179 24 00	△	1575 feet.	E. End.
Duff's Reef.	16 48 00	△	180 58 00	△		N. W. Pt.
"	16 52 40	△	181 02 00	△		S. E. Pt.
Dye's Reef.	16 23 00	△	180 34 00	△		Centre.
Eagleston's House, Vitilevu.	17 25 00	⊙♒	177 40 30	♓♒		W. Side.
Eld.	17 09 40	⊙♒	177 10 10	♓♒	High.	N. Pt.
"	17 10 40	△	177 10 30	△		S. E. Pt.
Elliot.	18 51 00	△	178 24 00	△		Centre.
Elliot Harbor, M'Benga.	18 23 20	⊙♒	178 06 15	♓♒		Pt. Robinson.
Emmons, Hudson's Isles.	17 38 20	△	177 06 00	△	High.	Centre.
Emmons Bay, Ya Asaua.	16 44 00	⊙♒	177 30 00	♓♒		Anchorage.
Enkaba.	18 50 00	⊙	181 06 30	♊	Surrounded by a reef.	N. End.
"	18 52 00	△	181 05 40	△		S. End.
Exploring Isles Reef.	17 04 00	△	181 15 00	△		N. E. Pt.
" "	17 08 30	△	180 57 00	△		N. W. Pt.
" "	17 24 40	△	181 09 00	△		S. Pt.
Faliki Harbor, Androna.	16 55 18	⊙	177 24 30	♓		Ita I.
Fawn Harbor, Vanualevu.	16 43 42	△	179 47 11	♓		Tukonreva.
Fenno Point, "	16 15 24	△	179 39 22	△	High.	N. Side.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Flying-Fish Shoal.	18 37 00	☉ ♒	177 45 30	♓ ♒		Centre.
Fox, Asaua Group.	17 11 00	△	177 09 30	△		"
" " "	17 11 40	△	177 10 20	△	363 feet. ♁	East End.
Forefinger Peak, Ovolau.	17 43 16	△	178 52 10	△	627 feet. ♁	
Freeman's Reef,	17 45 30	△	181 23 00	△	Awash.	S. W. Pt.
" "	17 43 30	△	181 24 00	△	"	N. E. Pt.
Frost's Reef.	17 23 00	△	180 48 30	△	"	Centre.
Fulanga.	19 04 30	☉	181 19 40	♓	150 feet. ♁	East End.
"	19 03 35	△	181 15 40	△		West End.
Gibson's.	16 22 34	△	179 11 20	△	Low islet.	Centre.
Gordon Reef.	17 40 00	△	181 25 30	♓	Awash.	"
Goro.	17 16 00	☉	179 21 00	♓	High, with no peaks.	N. W. Pt.
"	17 13 30	△	179 26 30	△	" " "	N. Pt.
"	17 23 00	△	179 25 50	△	" " "	S. Pt.
Goat or Corolib.	16 46 20	☉♌	180 01 40	♓ ♒	214 feet. ♁	Centre.
Granby Harbor, Vitilevu.	18 13 50	☉	177 50 55	♓	South Side.	Beacon I.
Green's.	16 24 24	△	179 05 27	△	Low islet.	Centre.
Graves Point, Vanualevu.	16 14 24	△	179 31 30	△	Rocky.	N. Side.
Hanbury.	16 13 24	△	179 35 00	△	87 feet.	Centre.
Harrison.	18 51 00	△	178 24 20	△		"
Hamersley.	18 30 15	△	177 36 20	△		"
Hawkins Reef.	17 47 30	△	181 20 40	△	Awash.	S. End.
" "	17 45 30	♊	181 20 40	♊	"	N. End.
Hale's Peak, Vanualevu.	16 22 30	△	179 34 00	△	1783 feet. ♁	East End.
Henry's, Underwood's Group.	17 41 30	☉	177 17 30	♓	Low islet.	Centre.
Henderson's.	16 13 30	△	179 32 00	△	" "	"
Howison.	18 51 00	△	178 25 30	△	36 feet. ♁	"
Horse-Shoe Reef.	17 37 15	△	179 20 15	△	Awash.	Crust Pt.
Hot Springs, Vanualevu.	16 45 20	☉ ♒	178 19 20	♓ ♒		S. Side.
Hope.	16 48 00	△	179 34 10	△	Low islet.	Centre.
Hudson.	18 52 00	△	178 26 00	△	75 feet.	"
Hupo Point, Vanualevu.	16 45 50	☉	179 15 00	♓	20 feet.	S. Side.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Ielalu Point, Vitilevu.	17 22 00	△	178 18 00	△	30 feet.	N. E. Side.
Indimbi Town, "	18 09 00	△	178 10 00	△		S. Side.
Inamara Bay, "	17 29 30	△	178 23 30	△		N. Side.
Ivaca Peak, Vanualevu.	16 36 00	△	178 33 30	△	1160 feet. ♁	W. End.
Johnson, Hudson's Isles.	17 36 30	△	177 00 20	△	70 feet.	Centre.
Kambara.	18 58 30	⊙	181 03 00	♓	350 feet. ♁	S. End.
"	18 55 00	△	181 03 00	♓	" " "	N. End.
Karoni.	18 39 00	△	181 27 00	△	Reef extends S. 1½ mile.	Centre.
Katafanga.	17 30 30	△	181 19 30	△	150 feet. ♁	E. Pt.
"	17 31 00	⊙	181 18 00	♓		W. Pt.
Kanathia.	17 14 30	⊙	180 51 30	♓		N. W. Pt.
"	17 17 30	♊	180 52 30	♊		S. W. Pt.
" Peak.	17 16 30	△	180 53 00	△	330 feet. ♁	
" Reef.	17 12 00	△	180 58 00	△		N. E. Pt.
Kamia.	16 45 00	△	180 17 00	△		N. W. Pt.
"	16 48 00	⊙	180 15 30	♓		W. Pt.
"	16 47 00	△	180 18 00	△	1875 feet.	Highest Pt.
Kamba Point. Vitilevu.	18 01 16	⊙ ♒	178 45 00	♓ ♒	Low.	E. End.
Kantavu.	19 00 00	♊	178 24 00	♒		E. Pt.
"	19 05 00	♊	177 57 00	♊		W. Pt.
" Peak.	19 05 00	△	177 58 00	△	2879 feet. ♁	W. End.
Kanusi Point, Vitilevu.	17 41 30	△	177 22 00	△	Low.	"
Karoni.	18 40 00	△	181 28 40	△	High.	Centre.
Kasonoola Peak, "	17 32 30	△	177 39 00	△	1320 feet. ♁	W. End.
Kea.	16 39 00	△	179 57 20	△	570 feet. ♁	Holmes' Pk
Kendi-Kendi Mtn., Lakemba.	18 14 00	△	181 10 30	△	900 feet. †	
Kie.	16 13 54	△	179 05 00	△	760 feet. ♁	Centre.
Kiusick, Asaua Group.	16 41 00	△	177 33 00	△	40 feet.	"
Kneass Reef.	17 48 00	△	180 39 10	△	Awash.	"
Knox.	17 26 00	△	177 02 00	△	47 feet.	Centre.
Korotuna.	16 04 00	△	180 37 30	△	Inhabited.	Centre.
Korotuna Reef.	16 04 00	△	180 29 30	♒		W. End.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Korotuna Reef.	16 03 00	⊙	180 39 30	♓	Awash.	E. Ex.
" "	16 05 30	♊			"	S. Ex.
" "	16 01 00	♊			"	N. Ex.
Kombelau Harb., Vanualevu.	16 55 10	⊙	179 02 30	♓		Mbure I.
Konaivo Reef.	18 56 00	△	181 33 30	△		Sand Spit.
Konapatu Reef.	18 42 00	△	181 29 30	△	2 miles in diameter.	Centre.
Komo.	18 37 30	⊙	181 20 00	♓	270 feet.	E. Pt.
"	18 38 30	△	181 18 40	△	Surrounded by a reef.	S. W. Pt.
Komo Riki.	18 38 00	△	181 18 30	△		Centre.
Korai Harbor, Androna.	16 56 00	⊙	177 23 15	♓		S. E. Side.
Kotuho.	16 48 50	△	179 25 30	△		Centre.
Kuva Point, Vitilevu.	18 04 40	△	178 43 40	△	Low.	E. End.
Kuku.	17 47 00	△	177 07 00	△	87 feet. ♁	Centre.
Lakemba.	18 13 00	△	181 12 00	△	435 feet.	N. E. Pt.
"	18 16 30	△	181 11 30	△		S. Pt.
"	18 14 00	△	181 08 30	♓ ☄		W. Pt.
Lakemba Reef.	18 13 00	△	181 18 30	△		E. Pt.
Lauthala.	16 44 00	♊	180 23 00	♊	4 miles long.	N. Pt.
"	16 47 00	⊙	180 23 00	♊	1740 ft. Highest Pt.	
"	16 45 30	△	180 24 00	♊		E. Side.
Lada Reef.	17 32 30	⊙ ☄	178 53 20	△	Awash.	N. Pt.
Lekoo I., Sunday Harbor.	18 04 00	⊙ ☄	177 16 00	♓ ☄	Low.	Centre.
Leluvia.	17 48 30	△	178 46 00	△	Low islet.	"
Levu Reef.	18 53 00	△	181 32 30	△	Awash.	E. End.
"	18 53 00	△	181 30 00	△	"	W. End.
Lewis Reef.	16 55 30	△	181 09 30	△	"	Centre.
Lewis.	17 28 40	△	177 00 10	△	Islet.	"
Leeumba Point, Vannalevu.	16 51 38	⊙ ☄	178 35 06	♓ ☄	Low, sandy.	
Levuka, Ovolau.	17 40 46	△	178 52 40	△		Observat'y.
Lewa Peak, Vitilevu.	17 37 00	△	177 29 00	△	987 feet. ♁	W. End.
Lewa Islet.	17 09 00	△	176 52 00	△	Low.	Centre.
Leonidas.	16 39 24	△	178 36 50	△	"	"

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Linthicum, Underwood's Gr.	17 44 00	♋♃	177 15 10	♓♆	Low.	Centre.
Like-Like Reef.	18 30 40	△	181 27 00	△	1¼ mile in diameter.	"
Lloyd Point, Vanualevu.	16 16 54	△	179 26 20	△	Bluff.	N. Side.
Lookout Reef.	16 54 00	△	181 17 30	△	Awash.	E. Pt.
" "	16 55 00	⊙	181 12 00	♓	"	W. Pt.
" "	16 52 30	△			"	N. Ex.
" "	16 56 00	△			"	S. Ex.
Lotu, Vanualevu.	16 48 00	△	179 25 30	△		S. Side.
Lokomi Peak, Vitilevu.	17 35 30	△	177 32 00	△	1127 feet. ♁	W. End.
Lukimoa Peak, "	17 30 00	△	177 44 30	△	1240 feet. ♁	N. Side.
Mango.	17 28 30	⊙	180 55 00	♓		S. E. Pt.
"	17 26 30	♊	180 52 00	♊	300 feet. ♁	N. W. Pt.
"	17 27 30	△	180 53 30	△		Centre.
Malatta, Exploring Isles.	17 20 30	△	181 01 00	△	270 feet. ♁	"
Malevuvu Reef.	17 22 30	♊	181 18 00	♊	Awash.	N. Pt.
" "	17 25 00	⊙	181 18 00	♓	"	S. Pt.
Malina.	17 08 30	△	180 50 00	△		Centre.
" Reef.	17 11 00	△	180 51 30	△	Awash.	S. E. Pt.
Mali Peak, Vanualevu.	16 24 24	△	179 24 30	△	1672 feet. ♁	N. Side.
Mali.	16 20 54	⊙♆	179 19 42	♓♆	350 feet. ♁	Highest Pt.
"	16 21 00	△	179 18 00	△		W. End.
" Passage.	16 19 14	⊙	179 16 00	♓		Entrance.
Malitu Bay, Mali.	16 20 14	△	179 21 00			Anchorage.
Maury.	16 28 30	△	180 21 30	△	60 feet.	Centre.
Mambualau.	17 57 10	△	178 48 15	△	Low.	"
Malatta Bay, Kantavu.	18 58 00	⊙	178 05 48	♓		Anchorage.
May.	18 51 45	△	178 27 00	△	60 feet.	Centre.
Malolo Passage..	77 52 30	△	177 09 30	♓♆		"
Malolo Island.	17 46 10	△	177 08 40	♒	400 feet. ♁	"
" "	17 44 20	△	177 09 00	△	Bluff, 50 feet.	N. Pt.
" "	17 46 30	△	177 07 20	△		S. W. Pt.
Malolo Lailai.	17 46 30	△	177 10 30	△	30 feet.	N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Malolo Lailai.	17 49 20	△	177 08 20	△	Bluff, 50 feet.	S. W. Pt.
Malaki, Vitilevu.	17 16 10	△☉	178 08 40	△♓	150 feet.	N. E. Pt.
" "	17 17 20	♋	178 07 30	♒	Bluff.	W. Pt.
Malaki Passage.	17 15 00	△	178 06 00	△	2 miles N. W. of Island.	Centre.
Matathoni Levu, Asaua Gr.	16 57 00	△	178 18 45	△	Bluff.	N. Pt.
" " "	16 59 30	△	178 18 45	△	"	S. W. Pt.
Matuku.	19 09 00	☉	179 44 00	♓	Highest Point.	N. W. Pt.
"	19 13 30	△	179 44 00	△	1179 feet. ♁	S. Pt.
Mamoa Reef.	17 16 00	△	178 39 30	△		Centre.
Matagora Town, Vanualevu.	17 37 00	☉	178 34 40	♓		N. E. End.
Mangrove.	17 50 30	△	177 21 00	△	Low.	Centre.
Mayula Peak, Vitilevu.	17 56 30	△	177 25 20	△	987 feet. ♁	W. End.
Maawa, or Vitiraurau Peak, Vitilevu.	17 47 30	△	177 32 00	△	1540 feet. ♀	"
Mbua Point, Vanualevu.	16 39 24	△	178 31 30	♒	470 feet high. ♁	"
Mbenga.	18 22 45	♋	178 11 00	♒	1289 feet. ♁ Bluff.	E. Pt.
"	18 24 00	☉	178 06 00	♓		W. Pt.
Mbenga Peak.	18 22 15	△	178 07 30	△	1400 feet. ♁	
" Reef.	18 30 00	△	178 05 30	△		S. Pt.
Melamela Point, Vanualevu.	16 39 00	△	179 53 00	△		E. End.
Mitre Peak, "	16 39 20	△	178 53 30	△	2300 feet high. ♁	N. Side.
Middle Point, "	16 24 14	△	179 11 20	△		"
Morse's Reef.	17 19 00	△	180 52 00	△	Awash.	Centre.
Monk Rock.	16 10 24	△	179 35 20	△	80 feet high. ♁	"
Monkey-Face Passage, Vanualevu.	16 37 50	△	178 33 00	△		"
Mokungai.	17 27 16	△	179 00 30	△	High.	S. Pt.
"	17 24 16	△	179 01 00	△	"	N. Pt.
Mokundranga.	17 24 16	△	178 58 50	△	"	Centre.
Moturiki.	17 42 46	☉♒	178 46 00	♓♒		N. W. End.
Moturiki Peak.	17 47 06	△	178 48 25	△	450 feet.	S. E. Pt.
Moturiki Passage.	17 48 16	☉	178 46 44	♓		Centre.
Moala.	18 34 30	☉	179 56 00	♓	High.	N. E. Pt.
"	18 41 00	△	179 53 00	△	"	S. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Moala.	18 37 30	△	179 49 30	△	High.	W. Pt.
Mothea Reef, Nairai.	17 55 30	⊙	179 30 00	⚹	Awash.	S. Pt.
Moramba.	18 56 30	△	181 09 00	△	Surrounded by a reef.	Centre.
Motha.	18 36 30	△	181 26 00	△	2 miles in diameter, inclosed in a reef.	"
Monersab Point, Vitilevu.	17 16 20	△	178 10 50	△		N. End.
Munia, Exploring Isles.	17 22 00	△	181 07 30	△	Telanicolo, 1054 ft. ♁	Centre.
Mukalau.	18 11 00	△⊙	178 30 10	△	Low.	"
Mumbolithe Reef.	18 12 30	⊙	179 21 30	⚹		"
Muthuata.	16 25 54	⊙	179 03 02	⚹		Cemetery.
"	16 25 00	△	179 03 54	△	1005 feet. ♁	E. End.
" Peak.	16 25 34	△	179 03 09	△		
Muthuata Town, Vanualevu.	16 27 20	△	179 03 20	△		
Naiau.	17 57 30	△	180 58 00	△	High.	N. W. Pt.
"	18 01 20	⊙	180 59 30	⚹	"	S. E. Pt.
Naitamba.	17 04 30	△	180 47 20	△	"	S. E. Pt.
"	17 02 00	⊙	180 45 30	⚹	"	N. W. Pt.
"	17 03 30	△	180 46 00	△	"	Centre.
Namuka.	18 47 00	△	181 21 30	△	165 feet. ♁	E. Pt.
"	18 46 30	♊	181 18 00	♊		W. Pt.
Navutu Harbor, Vanualevu.	16 28 54	⊙	178 56 20	⚹		N. Side.
Naloa.	16 37 24	△	178 41 32	△	High.	Centre.
Narangi.	16 48 30	△	179 29 20	△		"
Nanuia, Asaua Group.	16 58 30	△	177 19 50	△	High.	"
Naviti, " "	17 04 00	⊙	177 16 40	⚹	Tapau Point.	N. E. Pt.
" " "	17 09 00	♊	177 09 30	♊	Baruma Point.	S. W. Pt.
" " "	17 05 00	⊙	177 14 00	△	Vaka Bay.	Centre.
Navula Point, Vitilevu.	17 58 30	⊙⁞	177 13 00	⁞	Low.	S. W. Pt.
Nanggara Point, "	18 15 30	△	177 59 00	△	"	S. Side.
Naisilai Point, "	18 06 00	△	178 42 00	△	"	S. E. End.
Nasilai, Town, "	18 01 00	△	178 33 00	△		Peale's Rr.
Navumbalavu Islets.	17 37 30	⊙	178 37 00	⚹	122 feet. ♁	Centre.
Naingani.	17 33 40	⊙	178 43 00	⚹	420 feet. ♁	N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Naingani.	17 35 00	△	178 43 00	△		S. Pt.
Naingani Reef.	17 36 00	△	178 44 00	△	Awash.	S. E. Pt.
Nairai.	17 51 00	⊙	179 28 30	♓	730 feet. ♁	S. Pt.
"	17 45 00	⊙	179 28 30	♓		N. Pt.
Nanuku.	16 42 30	△	180 36 00	△	Surrounded by Reef, situated in S. E. cor.	Centre.
Nanuku Reef.	16 31 00	△	180 40 30	△		N. E. Pt.
" "	16 44 30	⊙	180 29 00	♓		S. W. Pt.
Namuka.	18 21 50	△	177 58 50	△	Inclosed in Mbenga Rf.	Centre.
Nandi Bay, Vanualevu.	16 53 30	⊙	178 57 00	♓		S. Side.
Nangati, Asaua Group.	16 57 30	△	177 19 40	△	930 feet. ♁	Centre.
Nakumbutha.	16 35 30	△	178 36 30	△		"
Nambite.	16 29 00	♊	178 50 10	♊	Low.	S. Pt.
"	16 27 54	△	178 50 00	△	"	N. Pt.
Natava Peak, Vanualevu.	16 33 30	△	179 42 00	△	1350 feet. ♁	
Navendara Town, "	16 31 54	△	178 53 30	△		N. Side.
Ndronga Harbor, Vitilevu.	18 06 30	⊙	177 23 00	♓		S. Side.
Ndrundruau or Druau.	16 11 24	⊙♒	179 35 37	♓♒	156 feet. ♁	N. E. Pt.
" "	16 12 24	△	179 35 20	△		Centre.
Nemena or Direction.	17 06 36	⊙♃	179 07 21	♓♒	310 feet. ♁ Obs. bluff.	W. End.
Nemena Reef.	17 12 36	△	179 11 30	△	Awash.	S. E. Pt.
Needle Peak, Vanualevu.	16 39 00	△	179 06 30	△	1747 feet. ♁	Centre.
Nisukisuki Reef.	18 59 30	△	181 31 00	△		"
Nifo.	16 59 30	△	177 19 10	△		"
North.	16 28 30	△	180 20 30	△	High.	"
Nuku Ticumbia Reef.	17 09 00	△	181 20 00	△		N. Pt.
" "	17 13 30	△	181 19 00	△		S. Pt.
Nukumanu, Id. and Reef.	16 20 30	△	180 36 40	△		Centre.
Nukumbasanga Islets, 2 in number.	16 19 00	⊙	180 45 20	♊	Inclosed in same reef.	Eastern I.
Nuku Levu Islets.	16 08 30	△	180 46 00	△		Centre.
Nuku Levu Reef.	16 08 30	⊙	180 38 30	♓		W. Ex.
" " "	16 08 50	△	180 47 30		2½ miles wide.	E. Ex.
Nneumbati.	16 27 54	△	179 00 45	△		Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Heights.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Nuthila Point, Vanualevu.	16 33 14	△	178 50 00	△	Rocky Point.	N. Side.
Nuvera.	16 32 10	⊙	178 46 40	⋈	Low.	S. W. Pt.
"	16 28 50	△	178 48 30	△	"	N. Pt.
Nugu-ongea Reef.	19 09 25	⊙	181 32 50	⋈		Sand Spit.
Nukulevu.	17 41 16	⊙ ⁈	178 39 10	⋈ ⁈		Centre.
Nukatimba Bay, Vitilevu.	17 26 00	⊙	178 21 00	△		"
Nunga.	16 55 00	△	177 20 30	△	Rock.	"
Nukumurry Har., Vanualevu.	16 42 40	⊙ △	178 32 00	⋈ ⁈		Island.
Nugutobe Islets, 3 in number.	17 18 00	⊙	180 29 00	△	Trend E. N. E. and W. S. W.	Centre.
Nukalau.	18 10 23	⊙ ♃	178 30 30	⋈ ⁈	Low.	"
Oandrou.	16 34 30	△	178 47 09	△	"	"
Observatory Islet.	18 24 40	⊙	181 28 00	⋈	250 feet high. ♁	"
Ogle, Underwood's Group.	17 40 00	△	177 14 30	△	Low islet.	"
Okimbo, 3 islets.	17 03 00	△	180 59 00	△	Low.	"
" Reef.	17 03 00	⊙	181 02 00	⋈		E. Pt.
"	17 00 30	△	180 59 00	△	Awash.	N. Pt.
"			180 58 25	△	"	W. Side.
"	17 04 30	△	181 00 00	△	"	S. Ex.
Olenea or Ularua.	18 33 30	⊙	181 14 00	⋈	Surrounded by a reef.	N. End.
Ombo.	17 30 30	△	177 04 00	△		Centre.
Omene.	17 45 16	△	178 38 00	△	Low.	"
Ono.	18 55 30	△	178 24 00	△	High.	"
Oneata.	18 24 30	⊙	181 27 30	⋈	Highest.	E. Pt.
"	18 24 30	△	181 25 00	△	330 feet. ♁	W. Pt.
Oneata Reef.	18 24 10	△	181 32 30	△		E. End.
Ongea Levu.	19 03 00	△	181 30 00	△	High.	N. End.
Ongea Reef.	19 02 30	△	181 31 00	△		N. E. Pt.
Ongea, Port Refuge,	19 05 50	△	181 28 50	△	Inside of Reef.	
Ongea riki.	19 07 00	△	181 29 00	△	178 feet. ♁	Centre.
One Tree Islet, Ya Asaua I.	16 47 09	⊙ ⁈	177 26 08	⋈ ⁈	Low.	"
Orana Pt., Vanualevu.	16 39 14	△	178 42 30	△	"	N. Side.
Osubu I., Exploring Isles,	17 10 00	△	181 10 00	△		Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Otovawa I. Asaua Group.	16 55 30	⊙	177 19 20	♓		N. W. Pt.
" "	16 56 40	△	177 19 20	△		S. Pt.
Ovolau.	17 45 16	△	178 49 00	△		"
"	17 39 00	△	178 47 10	△		W. Pt.
" Observatory.	17 40 46	⊙✳	178 52 40	☾✳		E. Side.
"	17 37 16	⊙	178 50 20	△		N. Pt.
Ovalu, or Passage I.	17 22 30	⊙♃	178 48 00	♓♃	High.	Centre.
Ovawa.	16 47 30	△	177 25 00	△	"	"
Passage, or Ovalu I.	17 22 30	⊙♃	178 48 00	△	"	"
Palmer's.	17 45 00	△	177 07 00	△		"
Papa Pt., Ya Asaua.	16 48 20	△	177 25 00	△	High.	
Perry's.	17 41 30	△	177 05 00	△	"	Centre.
Peka.	16 52 54	△	177 26 06	△	"	"
Piner's.	16 23 54	△	179 08 25	△	Low.	"
Pickering's Pk., Vitilevu.	17 57 00	△	177 36 30	△	1240 feet.	
Poukeepsie Reef.	16 27 30	△	180 33 10	△		Centre.
Porpoise Reef.	16 28 30	△	180 34 30	△		"
" Shoal.	17 01 00	⊙♊	176 57 00	♓♊		"
Poto Bay. Waia I.	17 18 40	△	177 05 30	△		"
Polotu Harbor, Peka I. Asaua Group.	16 52 54	⊙	177 26 06	♓		
Pully's I.	16 25 24	△	179 07 00	△	Low.	Centre.
Rambe.	16 24 40	△	180 08 00	△	High.	N. Pt.
"	16 30 30	△	180 01 00	△	"	S. W. Pt.
"	16 30 30	⊙	180 07 30	♓	"	S. E. Pt.
Rativa.	16 44 20	⊙	179 40 30	♓		Centre.
Rabi-Rabi.	16 57 25	⊙	178 43 20	♓	Low.	"
Raki-Raki.	17 20 20	⊙	177 59 30	♓	High.	"
Raritona Har. Ya-Asaua.	16 47 09	⊙	177 26 08	♓		One Tree Islet.
Ravu Ravu.	16 27 24	△	178 56 10	△		Centre.
Revareva Reef.	18 58 00	△	181 32 30	△	Awash.	"
Reynold's.	18 48 00	△	178 25 10	△	High.	"
Red Bluff. Vitilevu.	18 16 00	△	177 44 00	△	52,500 feet.	S. Side.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Rewa Roads, Vitilevu.	18 10 23	☉ ♒	178 30 30	♓ ♒		Nukalau I
" Town, Vitilevu.	18 05 00	☉	178 32 30	△		Peale's R.
Reynold's, Underwood's Gr.	17 43 10	△	177 12 10	△	Low.	Centre.
Reid's, Largest.	17 57 20	△	181 38 30	△	High.	"
" Reef.	17 57 30	△	181 42 10	△		E. Pt.
"	17 59 00	♋	181 37 00			S. Ex.
"	17 56 30	△	181 33 20	△		W. Pt.
"	17 54 00	☉	181 37 00			N. Ex.
Ridgely Port, Vanua Valavo.	17 13 30	☉ ♒	181 02 20	♓ ♒		Tip I.
Rich's Peak, Vitilevu.	17 43 30	△	178 26 00	△	1715 feet.	East End.
Richmond's.	16 25 24	△	179 07 50	△	Low.	Centre.
Robert's Point, Vanualevu.	16 19 54	△	179 23 00	△	High.	N. Side.
Rock.	16 39 24	△	178 39 00	△		Centre.
Round Point, Vitilevu.	18 13 45	☉	177 54 00	♓		Whippy Harbor.
Round, or Awakalo.	16 40 30	☉ ♒	177 43 00	♓ ♒	515 feet. ♁	Centre.
Robinson's Reef.	16 25 30	△	180 32 30	△		"
Ruke Ruke Bay, Vanualevu.	16 40 18	☉	178 32 36	△		Sleepy Pt.
Saddle Peak, "	16 39 00	△	179 20 00	△	1140 feet.	S. Side.
" "	16 15 54	△	179 35 00	△		N. Side.
Safety Port, Kea I.	16 37 30	☉	179 58 30	♓		Anchorage
Sae's Point, Vanualevu.	16 24 34	△	179 14 00	△	High.	N. Side.
Sarapeu Peak, Vitilevu.	17 41 10	△	177 29 00	△		W. Side.
Sam.	17 35 30	☉	177 25 20	♓	Low.	Centre.
Sakau Point, Vitilevu.	17 24 00	△	177 55 40	△	"	N. Side.
Sandford.	18 50 00	☉	178 24 00	△	High.	Centre.
Sail Rock, Largest.	16 10 54	△	179 33 00	△	"	
" "	16 38 00	△	178 16 10	△		
Savu Savu Pt., Vanualevu.	16 49 30	☉ ♒	179 16 00	♓ ♒		S. Side.
Sawau Harbor, M'benga,	18 22 00	☉ ♒	178 09 30	♓ ♒		Pt. Leavett.
Sau-Sau.	16 16 24	☉	179 25 20	♓		Centre.
Sau-Sau Passage.	16 10 54	☉	179 28 45	♓		"
Shylock Reef.	19 53 30	△	178 21 48	△		Opening N.W. Side

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Sinclair, Asaua Gr.	17 12 30	△	177 08 30	△	High.	Centre.
Sleepy Point, Vanualevu.	16 40 18	△	178 32 36	△		Ruke-Ruke B.
Smith, or Mamonku Reef.	17 43 30	△	181 09 30	△		Centre.
" Island, Underwood's Gr.	17 43 00	△	177 16 20	△	Low.	"
" " " "	17 40 00	△	177 14 00	△	"	"
Soangi.	16 32 54	△	178 46 00	△	"	"
Southworth Pt., Vanualevu.	16 42 48	△	178 32 06	△	High.	W. End.
Soni.	17 44 00	△	177 07 40	△	"	Centre.
Somu-Somu Town, Vuna.	16 46 40	♓	180 04 00	♓		W. Side.
Speiden's.	17 52 00	△	177 10 30	△	Low.	Centre.
Stuart's.	18 24 20	♓	178 05 25	♓	High.	"
Storm.	18 20 20	♓	178 10 15	♓	"	"
Susui.	17 21 00	△	181 03 00	△	74 feet. ♁	"
Suva Harbor, Vitilevu.	18 06 40	♓	178 23 30	♓		Anchorage.
" Point, "	18 09 00	△	178 27 00	△	Low.	S. Side.
Sualib Bay, "	17 00 08	♓	178 48 00	♓		Centre.
Sunday Harbor, "	18 04 00	♓	177 16 00	♓		Lekoo I.
Tauthake Peak, Ya Asaua.	16 50 40	⊙	177 24 30	♓	581 feet. ♁†	S. End.
Taki.	17 07 00	△	176 52 50	△	Low.	Centre.
Tambaukan Pk, Vitilevu.	17 39 40	△	177 32 50	△		W. Side.
Tabea Town, "	17 25 00	⊙	177 54 50	♓		N. Side.
Talatala Point, "	17 45 40	△	177 21 00	△	Low.	W. Side.
Tavunuku Reef.	18 36 30	△	181 15 10	△	1 mile in diameter.	Centre.
Talouno Reef.	18 43 30	△	181 42 00	△		"
Tabutha.	17 40 00	⊙	181 12 00	♓	♁ 350 feet, the cap.	"
"	17 41 30	△	181 13 00	△		S. E. Pt.
"	17 39 00	△	181 11 00	△		N. W. Pt.
Tabuca Bay, Kantavu I.	19 02 06	⊙	178 05 00	♓		Anchorage.
Tabooa Point, Vitilevu.	17 30 00	△	177 30 10	△	High.	W. Side.
Taunava.	17 47 16	△	178 39 10	△		Centre.
Tavea.	16 38 24	⊙	178 43 30	♓		"
Tasman's Straits.	16 48 00	⊙	180 14 30	♓		"

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Teilau, Bay of Ambau.	17 55 16	△	178 39 40	△		Centre.
Teteka Reef.	19 01 50	△	181 32 10	△		"
Thompson's.	18 30 45	△	177 36 45	△		"
Thangala.	17 47 46	△	178 46 40	△	Low.	"
Tieumbia, Exploring Isles.	17 16 30	△	181 12 30	△	High.	"
Tibethe Point, Vanualevu.	16 11 25	⊙	179 44 00	△	Low.	N. Side.
Tilingitha.	16 10 50	⊙ ♒	179 47 00	⁜ ♒	"	Centre.
Timboor, Asaua Gr.	16 40 00	⊙	177 30 30	⁜	High.	"
Tokonova Point, Vanualevu.	16 46 30	△	179 54 40	△	"	S. E. End.
Totten.	17 29 30	△	177 01 15	⁜	"	Centre.
Tombarua.	17 59 46	△	178 45 10	△	Low.	"
Toba Peak. Vitilevu.	17 34 00	△	178 29 40	△	756 feet.	E. End.
" Point, "	17 33 25	⊙	178 31 00	⁜	High.	"
Totoia.	18 54 00	⊙	180 04 30	⁜		N. W. Pt.
"	18 57 00	△	180 07 30	△		S. E. Pt.
"	18 55 30	△	180 05 30	△	1148 feet.	Noteh Pk.
Tova Reef.	18 38 00	⊙	180 24 00	⁜		Entrance.
Tokotusi Peak, Vitilevu.	17 24 00	△	177 43 00	△		N. W. Side.
Toki Point, "	17 29 40	△	178 25 00	△		N. E. Side.
Tua " "	17 36 15	△	178 34 00	△		"
Tub.	17 19 00	⊙	178 03 30	⁜		Centre.
Tuki.	17 19 40	△	178 02 00	△		"
Tubanaielli.	18 42 30	△	180 56 00	△	150 feet. ♁ Reef surrounded.	"
Turtle, or Vatoa Id.	19 47 00	△	181 43 42	△		Pt. Porpoise
Tye, Town, Vanualevu.	16 59 40	⊙	178 47 21	⁜		Snalib Bay.
Ularua, or Olenea.	18 33 30	⊙	181 13 00	⁜	Surrounded by a Reef.	N. End.
Ulunikora Mountains. Vitilevu	17 55 30	△	177 56 00	△	4126 feet.	Centre Pk.
Umea Point, "	17 24 10	△	177 46 00	△		N. W. Side.
Unda Point. Vanualevu.	16 06 30	⊙	180 07 00	⁜		N. E. Pt.
Underwood's Tower, Ovolau.	17 37 36	⊙	178 51 40	⁜		N. E. Pt.
Vanua Vatu.	18 21 38	⊙	180 38 45	⁜	Surrounded by a Reef.	N. Pt., reef
"	18 22 50	△	180 38 45	△		S. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Vanua Vatu.	18 22 00	△	180 39 00	△	500 feet. ♁	Mt. Otty, Centre.
Vatu Rera.	17 26 10	△	180 31 30	△	230 feet. ♁	N. Pt.
"	17 29 00	△	180 31 30	△		S. Pt.
"	17 27 30	△	180 31 30	△		Centre.
Vanua Valavo, Exploring I.	17 10 00	⊙	180 58 00	♓		N. W. Pt.
"	17 12 40	△	181 04 30	△	750 feet.	M. Totten E. Pt.
"	17 19 30	△	180 09 30	△		S. Pt.
Vanualevu.	16 06 30	⊙	180 07 00	♓		Unda, N. E. Pt.
"	16 44 45	⊙	179 58 00	△		Long, S E Pt
"	16 46 08	⊙	178 30 46	♓		W. Pt.
"	17 01 08	⊙	178 45 51	♓		Buie, S. Pt.
Vatou.	16 33 24	△	178 44 30	△		N. Pt.
"	16 34 39	△	178 42 47	△		S. W. Pt.
Vatoa, or Turtle.	19 47 00	△	181 43 42	△		Pt. Porpoise
Va-va Point, Vanualevu.	16 27 15	△	179 58 30	△		E. End.
Vavula " Vitilevu.	17 53 30	△	177 14 20	△	Low.	S. W. End.
Vuso " Vanualevu.	16 48 30	△	179 20 40	△	High.	S. Side.
Vatungili.	16 34 54	⊙	178 42 00	△		Centre.
Vao Reef.	18 34 00	△	181 36 20	△		"
Vatu-Lele.	18 31 30	⊙	177 34 30	♓	70 feet. ♁	Remo-remo Pt.
"	18 37 30	△	177 38 30	△		Tokelau Pt.
Vatu.	17 16 00	△	177 07 00	△	High.	Centre.
Vanderford, Underwood's Gr.	17 38 00	△	177 21 30	△	Low.	"
Vekai.	17 33 00	△	181 11 00	△	Reef extends 1 mile to the South.	"
Veleraria.	16 52 00	△	181 00 45	△	Low sandy.	"
Vendrala.	16 36 54	△	178 42 45	△	High.	"
Veraki Point, Vanualevu.	16 36 34	⊙	178 45 30	♓	Low.	N. Side.
Vela Bay, Vitilevu.	17 28 00	⊙	178 22 00	♓		Centre.
Verata Point, "	17 50 16	△	178 39 40	△	Low.	E. End.
Vitonga " "	17 34 40	⊙ ♍	177 26 30	♓ ♍	High.	W. End.
Viti-rau-rau Peak, "	17 47 30	△	177 32 00	△		"
Vitilevu Bay, "	17 21 00	△	178 15 00	△		Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Viwa I., Bay of Ambau.	17 56 56	⊙	178 39 25	☋	Low.	Centre.
Vicuna.	16 11 35	△	179 50 25	△	"	"
" Harb., Haycock Islet.	16 11 20	⊙	179 52 10	☋		
" Passage.	16 09 20	⊙	179 50 00	☋		Entrance.
Votia.	17 33 30	△	177 26 20	△	Low.	Centre.
Vomo.	17 30 00	⊙	177 15 00	☋	♁ 250 feet.	S. Pt.
" Lailai.	17 29 00	△	177 13 00	△	♁ 60 feet.	Centre.
Vuna Point, Vuna I.	17 01 50	△	179 57 50	△	High.	S. End.
" Island.	16 41 30	⊙	180 11 00	☋	2050 feet. ♁	N. Pt.
"	16 48 30	△	180 14 00	△		E. Pt.
"	16 57 00	△	179 56 00	△		W. Pt.
Vunda Point, Vitilevu.	17 38 30	△	177 22 40	△	Low.	W. End.
Wailea Bay.	16 38 25	△	178 36 50	△		Leonidas I.
Waia I., Asaua Gr.	17 16 00	⊙	177 05 00	☋	High.	N. Ex.
"	17 19 20	△	177 04 00	△		BompotePt.
"	17 16 00	△	177 03 30	△		Sifo Pt.
"	17 17 30	△	177 07 10	△		Ilata Pt.
" Peak.					664 feet. ♁	
" Lailai.	17 19 40	⊙	177 06 00	△		N. Pt.
" "	17 22 10	△	177 07 30	△		S. Pt.
Waia Lailaithake.	17 22 20	⊙ ⁘	177 06 10	☋ ⁘	555 feet. †	Observatory Hill
Walker, Hudson's Isles.	17 34 30	△	177 03 10	△		Centre.
Waldron.	17 51 00	△	177 09 30	△	Low.	"
Wakaia.	17 35 16	⊙ ⁘	179 02 00	☋ ⁘		N. Pt.
"	17 42 16	△	179 02 50	△		S. Pt.
" Flying-Fish Har.	17 35 25	△	179 02 30	△		Centre.
" Reef.	17 41 30	⊙	179 05 30	☋		S. Pt., reef.
Watmough.	17 45 50	⊙	177 20 40	☋	Low.	Centre.
White Rock.	17 22 20	△	177 12 50	△		"
Whippy Har., Vitilevu.	18 13 45	⊙ ⁘	177 54 00	☋ ⁘		Round Pt.
Whittle.	18 50 30	△	178 25 30	△		Centre.
Winns's Point, Vanualevu.	16 30 54	△	178 53 30	△	High.	N. Side.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		E. ° ′ ″			
Williams.	16 24 45	△	179 06 22	△	Low.	Centre.
Williamson's Reef.	16 59 20		180 57 20			"
Ya-Asaua, Ilau.	16 51 40	△	177 26 40	△♁	437 feet. High Bluffs.	"
Yalangalala.	16 49 30	△	180 57 20	△		"
" Reef.	16 46 30	△	180 55 40	△		N. Ex. of Reef.
" "	16 48 30	△	180 52 00	△		W. Ex.
Ya Asaua.	16 43 00	⊙	177 30 05	△	High.	N. Ex.
"	16 51 40	△	177 24 10	△		S. Pt.
"	16 50 10	△	177 28 30	△		Sari Pt.
"	16 44 50	♊	177 33 00	♊		E. Ex. Ovioui Pt.
Yangati.	16 59 40	△	177 18 00	△	High.	N. Pt.
"	17 03 00	△	177 17 30	△		S. Pt.
Ythata.	17 17 00	⊙	179 34 30	♓	High.	E. Pt.
"	17 17 00	△	180 31 30	△		W. Pt.
Yendua.	16 47 43	△	178 14 20	△	Madonovi.	N. Pt.
"	16 49 00	△	178 16 00	△♁	875 feet. Loto Peak.	Highest Peak.
"	16 49 40	△	178 17 00	△		E. Pt.
"	16 50 00	⊙ ♒	178 14 41	♓ ♒		Observat'y.
" Strahan's Har.	16 49 10	△	178 15 00	△		Centre.
" Porpoise Har.	16 50 15	△	178 15 10	△		"
TARAWAN, OR KINGSMILL GROUP.	N.		E.			
Apamama, or Hopper.	0 20 00	⊙	174 01 00	♓	Low.	S. E. Pt.
"	0 30 20	♊	173 54 00	♊	"	N. Pt.
"	0 25 40	△	173 51 00	△	"	W. Pt.
Apia, or Charlotte.	1 44 10	△	173 07 00		"	S. E. Pt.
" "	1 53 40	⊙	172 55 10	♓	"	W. Pt.
" "	1 58 00	△	172 58 50	△	"	N. Pt.
" " Passage.	1 48 40	△	173 01 30	△	"	S. W. Side.
Kuria or Woodle,	0 14 50	⊙△	173 27 00	△♓	"	S. Pt.
" Reef.	0 19 30	△	173 25 00	△		N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Maina, or Hall's.	00 51 20	⊙	173 03 30	♓	Low.	S. Pt.
" "	00 58 00	△	173 08 30	△	"	E. Pt.
" "	01 02 00	△	173 04 00	△	"	N. Pt.
" " Reef.	00 55 40	△	172 59 10	△	Awash.	W. Pt.
Maraki, or Matthews.	1 58 00	⊙	173 24 40	♓	Low.	S. W. Pt.
" "	2 03 00	△	173 25 30	♊	"	N. Pt.
Makin, or Pitt's I. Tari-Tari.	3 01 30	⊙	172 45 35	♓	"	S. Pt.
" "	3 09 30	△	172 55 50	△	"	E. Pt.
" "	3 14 00	△	172 40 25	△	"	N. W. Pt.
" " Makin.	3 15 45	♊	172 55 00	♊	"	S. Pt.
" "	3 21 00	△	172 58 00	△	"	N. Pt.
	S.					
Nanouti, or Sydenham I.	0 45 30	⊙	174 32 30	♓	Low.	S. E. Pt.
" "	0 29 50	△	174 20 00	△	"	N. W. Pt.
" Reef.	0 45 00	♊	174 15 45	♊	Awash.	W. Ex.
	N.					
Nanouki, or Henderville I.	0 08 25	⊙	173 40 30	♓	Low.	S. Pt.
" "	0 13 30	△	173 41 25	△	"	N. Pt.
" "	0 11 50	♊	173 35 40	♒	"	W. Pt.
Tarawa, or Knox I.	1 22 00	⊙	173 12 30	△	"	S. E. Pt.
" "	1 21 30	△	173 00 30	△	"	S. W. Pt.
" "	1 38 40	△	173 02 30	△	"	N. Pt.
	S.					
Taputeouea, or Drummond I.	1 28 00	△	175 13 00	△	Low.	S. E. Pt.
" "	1 08 00	△	174 50 50	△	"	N. W. Pt.
Uteroa Town.	1 12 30	△♊	174 54 15	△	"	Taputeouea I.
" "	1 13 38	⊙	174 51 34	♓	"	Anchorage.
PHŒNIX GROUP.	S.		W.			
Birnie's I.	3 35 15	⊙	171 39 00	♓	Low.	Centre.
Enderbury I.	3 06 35	⊙♒	171 14 25	♓♒	"	N. Pt.
"	3 09 20	△	171 14 20	△	"	S. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	S. ° ′ ″		W. ° ′ ″			
Gardner's or Kemiss I.	4 37 30	⊙	174 39 00	♓	Low.	Centre.
Hull's I.	4 30 00	⊙	172 15 30	♓	"	E. Pt.
"	4 30 00	⊙	172 20 10	♓	"	W. Pt.
"	4 31 25	△	172 18 15	△	"	S. Pt.
"	4 28 30	△	172 17 00	♊	"	N. Pt.
Mary Balcout I.	3 05 20		171 44 00		Low Sandy.	S. End.
" "	2 51 10		171 46 30		Low.	N. Pt.
McKean's I.	3 36 00	⊙	174 16 00	♓	"	Centre.
Sydney I.	4 25 30	T	171 21 40	T	"	"
UNION GROUP.						
Bowditch or Fakaafo.	9 26 40	⊙	171 03 15	♓	Low.	S. Pt.
" "	9 23 10	⊙♊	171 07 10	♓♒	"	W. Pt.
" "	9 20 00	△	171 03 50	△	"	N. Pt.
Nuku-Nono, or Duke of Clarence.	9 12 45	⊙	171 38 55	♓	Awash.	S. Pt.
" "	9 09 50	♊	171 42 50	♊	Low.	W. Pt.
" "	9 05 20	△	171 38 15	△	"	N. Pt.
Oatafu, or Duke of York.	8 39 30	⊙	172 22 10	♓	"	S. Pt.
" " "	8 36 00	△	172 23 50	△	"	N. Pt.
" " "	8 38 00	♊	172 21 15	♒♒		E. Pt.
ELLICE'S GROUP.			E.			
Ellice's, or Funafuti I.	8 38 50	⊙	179 14 35	♓	Low.	S. Pt.
" "	8 31 30	△	179 21 00	△	"	E. Pt.
" "	8 26 30	♊	179 13 30	♊	Awash.	N. W. Pt.
Nukufetau, or DePeyster's I.	7 59 10	S ⊙	178 31 20	E ♊	Low.	E. Pt.
" "	8 01 00	△	178 24 00	△	"	W. Pt.
" "	7 56 00	△	178 27 00	♊	"	N. Pt.
" "	8 04 00	♊	178 28 40	♊	"	S. Pt.
Oaitupu, or Tracy I.	7 29 00	⊙	178 46 30	♓	"	Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
ISLANDS IN THE SOUTH PACIFIC.	S. ° ′ ″		E. ° ′ ″			
Auckland.	50 38 00	⊙ ♒	166 28 00	⁜ ♒	High.	Sarah's Bosom.
			W.			
Bellinghausen.	15 48 00	⊙ ♒	154 30 00	⁜ ♒	Low.	Centre.
Curtis.	30 36 00		179 14 00		"	"
Esperance Rocks.	31 27 00		178 54 30			"
Flint's.	11 25 43	⊙	151 48 00	⁜	Low.	"
Gardner's, or Kemiss.	4 37 30	⊙	174 39 00	⁜	"	"
Wollaston I., Tierra del Fuego.	55 37 00	⊙	67 32 00	⁜	Anchorage.	Seagull Har.
Hoorn.	14 14 20	⊙	178 10 30	⁜	High.	W. End.
Jarvis.	00 22 30	⊙	159 51 20	⁜	Low.	Centre.
Kemiss, or Gardner's.	4 37 30	⊙	174 39 00	⁜	"	"
			E.			
Matthew's Rock.	22 27 00	⊙	172 10 33	⁜	High.	Centre.
Macquarie.	54 44 00	⊙	159 49 00	⁜	1370 feet.	S. End.
			W.			
Macauley.	30 16 00	♊	178 32 00	♊	750 feet.	Centre.
McKean's.	3 36 00	⊙	174 16 00	⁜	Low.	"
Minerva Reef.	23 55 00	K	178 28 00	K		S. W. Ex.
" "	23 30 00		178 00 00			N. E. Ex.
Tierra del Fuego.	55 31 25	⊙	68 02 40	⁜	Observatory.	Orange Har.
Penrhyn's.	8 55 35	⊙	158 07 00	⁜	Low.	N. W. Pt.
"	9 06 25	⊙	158 02 10	△	"	S. W. Pt.
Pylstart.	22 35 00	⊙	176 04 00	⁜	"	Centre.
Raoul.	29 20 00	⊙	178 10 00	⁜	"	"
Rosarette Rock.	30 20 00		179 20 00		"	"
Siminoff.	21 03 00	⊙	178 50 00	⁜	Low.	"
Staver's, or Wostock.	10 05 50	⊙	152 20 00	⁜	"	"
Swain's.	11 10 20	⊙	170 52 30	⁜	"	"
			E.			
Tongataboo.	21 07 00	⊙	175 11 00	⁜	"	Pangaimotu I.
			W.			
Uea, or Wallis.	13 24 00	⊙	176 09 22	⁜	High.	Elan Islet.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
ISLANDS IN THE NORTH PACIFIC.						
Abajos.	19 45 00	?	128 50 00	?	Not seen.	Position passed over.
Arrowsmith.	7 05 00	⊙	171 23 54	♓	Low.	S. E. End.
Assumption.	19 43 30	♊	144 48 00	♓	2090 feet. ♁	Centre.
			W.			
Avon.	13 05 00	⊙	168 30 00	♓	Low.	Centre.
			E.			
Baring, or Ebou.	5 34 42	⊙	168 26 24	♓	No Lagoon.	Centre.
Batan, Straits of Balintang.	20 30 00	♓	122 10 00	♊	Inhabited.	
Bigini, or Pescadores.	11 25 20	⊙	167 28 10	♓	Awash.	N. End.
" "	11 14 40	△	167 30 15	△	"	S. End.
" "	11 23 20	△	167 36 30	△	Low.	E. End.
Bird.	23 02 00	△	168 10 00	△	"	Centre.
Bonham, or Namurik,	5 53 45	⊙	169 36 16	♓	Low. Inhabited.	"
			W.			
Brothers (Two), or Reef Shoal.	24 14 00	⊙	168 30 00	♓		Centre.
			E.			
Byer's.	28 32 00	⊙	177 04 00	♓	Low.	Centre.
			W.			
Christmas Island.	1 59 00		157 32 00		Low.	N. End.
Cooper "	25 24 00	♓	131 26 00	♓		Position passed over.
Copper "	20 06 00	⊙?	131 54 00	♓?		
			E.			
" "	20 05 00	⊙?	131 50 00	♓?	Low.	
Cornwallis "	16 50 00		169 30 00	?		
			W.			
Cure "	28 27 00	⊙	178 23 30	♓	Low.	Centre.
Daniel "	7 27 00	⊙	172 07 00	♓	"	"
Fanning's "	3 53 00	⊙	158 23 00	♓	"	W. Side.
			E.			
Faroilep "	8 36 00	⊙	144 36 00	♓	Low.	Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Cepes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Feis Island.	9 47 00	△	140 38 00	♊	Low.	Centre.
Folger's ".	18 21 00	⊙?	155 19 00	♓?		Position passed over.
			W.			
French Frigate Shoal.	23 45 00	⊙				N. Pt.
" " "	23 34 00	△				S. Pt.
" " "			165 59 15	♓		E. Side.
Gardner's or Man of War Shoal.	25 03 00	⊙	167 52 45		Bare Rock.	Centre.
Gaspar Rico.	14 30 00	⊙	175 30 00	♓		Does not exist within this space.
			E.			
" "	15 10 00	⊙	174 00 00	♓		
Grigan Island.	18 48 00	⊙	145 50 00	♓	2,500 feet high.	N. End.
Halcyon "	19 13 00	⊙	163 30 00	♓		Does not exist.
Hunter "	5 42 00	⊙	169 05 46	♓	Low.	Centre.
			W.			
Jane's "	16 34 00	⊙	173 20 00	♓		Does not exist.
			E.			
Korsakoff. Knox Islet.	11 05 00	⊙	166 36 00	♓	Low.	At E. End.
" Sifo "	11 08 00		166 22 00			W. End.
			W.			
Layson Island.	25 46 00	K	171 49 00	♓	Low.	Centre.
Lisiansky "	26 00 00	K	173 45 00		"	"
Maro Reef.	25 21 00	⊙		♓		S. Pt.
" "			170 37 36	♓		W. Pt.
Malloon's I.	19 26 00		165 15 00			Does not exist.
			E.			
Mille Group.	6 12 00	⊙	172 22 00	♓?		Position passed over.
Morell I.	29 57 00	⊙	174 31 00	♓	Low.	Centre.
McKenzie's, or Oulouthy I.	10 07 53	⊙	139 54 58	♓	Inhabited.	E. Ex.
" " "	9 46 00	♊	139 44 00	♊	Lagoon and passages.	S. Ex.
Mulgrave I.	5 59 00	⊙	172 02 33	♓	Low.	Centre.
			W.			
Neckar "	23 34 40	⊙	164 42 40	♓	Low.	

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
New Nantucket Island.	1 00 00		174 34 00	?	Low.	The positions examined.
Oulouthy, or McKenzie's I.	10 07 53	⊙	139 54 58	♓	Two islands 8 miles asunder.	E. Ex.
" " "	9 46 00	♊	139 44 00	♊		S. Ex.
Palmyra.	5 50 00	⊙	162 23 00	♓		N. W. Side.
Pearl and Hermes Reef.	28 22 00	⊙	177 32 00	♓		N. W. Ex.
" " "	27 31 00	△	176 28 00	♓		S. E. Ex.
			E.			
Pescadores I.	11 25 20	△	167 28 30	△	Low.	N. End.
"	11 14 40	⊙	167 30 15	♓	"	S. End.
"	11 23 20	△	167 36 30	△	"	E. End.
Rodogala I.	11 11 00	⊙	166 58 00	♓	"	S. Pt.
"	11 22 30	△	167 10 20	△	"	E. Pt.
"	11 33 00		166 54 00		"	N. Pt.
" Tufa Islet.	11 14 30		166 47 00			Centre.
Sabtang I.	20 18 00	⊙	121 50 11	♊ E		W. End.
			W.			
San Pablo I.	16 07 00		179 00 00	? W		Position examined
Smyth's Island.	16 48 00	⊙	169 45 36	♓ W		Centre.
			E.			
Wake's "	19 15 00	⊙ ♍	166 30 00	♓ ♍	Low.	Centre.
" Reef.	17 40 00	K	172 40 00	K		Doubtful.
			W.			
Washington's I.	4 41 35	⊙	160 15 37	♓	Low.	E. End.
Walker's I.	3 54 00	K	149 25 00	K	"	Centre.
HAWAIIAN GROUP.						
Alena Point, Maui I.	20 32 00	♊	156 21 00	♊		
Anahula Point, Kaiau I.	22 10 30	△	159 20 00	△		
Diamond, or Leahi Pt. Oahu I.	21 15 00	♋	157 49 00	♓		S. Pt.
Ewa, or Pearl River.	21 20 00	⊙	157 59 33	♓		Hammer Point.
Halealala, Crater, Maui I.	20 43 00	⊙	156 18 00	♓	10,200 feet. †	
Haucoo Point, "	20 44 00	△	156 03 00	△		

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.		Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
		N. ° ′ ″		W. ° ′ ″			
Haiku Point,	Maui.	20 56 00	△	156 19 00	△		N. Side.
Haalua,	Oahu I.	21 39 00	⊙	157 56 00	⁒		
Haleaha,	" "	21 36 00	△	157 54 00	△		N. E. Side.
Hanapapea Har.	Kauai I.	21 49 00	⊙	159 36 00	⁒		
Haalea Point,	" "	22 12 00	△	159 42 00	△		
Halelea Harbor,	" "	22 13 00	B	159 34 00	△		
Halaua Point,	Molokai.	21 09 00	△	156 45 00	△		E. Pt.
Hilo Bay,	Hawaii.	19 43 51	⊙✳	155 03 06	☾✳		Observatory.
Honokohau,	Maui I.	21 03 00	♊	156 39 00	♊		N. W. End.
Honolulu,	Oahu.	21 18 40	⊙✳	157 52 15	☾✳		Observatory.
Huilua Point,	Maui I.	20 34 00	△	156 14 00	△		
Hubaia Harbor,	Kauai I.	21 56 54	⊙	159 21 15	⁒		
Kalae Point,	Hawaii I.	18 53 30	△	156 45 00	△		S. Pt.
Kalaua Point,	Molokai.	21 06 00	⊙	157 18 00	⁒		W. Pt.
Kailua Bay,	Hawaii I.	19 39 00	⊙	156 04 30	⁒		
Kawili Point,	" "	19 11 30	△	156 05 00	△		
Kawaihae,	" "	20 03 00	♊	155 56 30	♊		
Kaholalele,	" "	20 05 30	♊	155 13 30	♊		
Kapaho,	" "	19 34 00	⊙	154 54 00	⁒		E. Pt.
Kaaha,	" "	19 13 00	△	155 16 00	△		
Kaena Point,	Oahu.	21 35 00	⊙	158 15 00	⁒△		S. W. Pt.
Kahikinui,	Maui I.	20 31 00	⊙	156 23 00	△		
Kaikamaalaea,	" "	20 43 00	♊	156 28 00	♊		
Kahoolawe I.		20 31 00	♊	156 33 00	≋ ≋		E. Pt.
" "		20 31 30	⊙	156 42 00	⁒		W. Pt., Kealaikahiki.
" "		20 36 30	△	156 34 00	△		N. Pt.
Kaluaaha Town,	Molokai I.	21 05 00	♊	157 00 00	♊		
Kalaua Point,	" "	21 06 00	⊙	157 18 00	⁒		W. Pt.
Kawaihoa Point,	Oahu I.	21 15 00	△	157 43 00	△		
Kaena,	" "	21 35 00	⊙	158 15 00	⁒		W. Pt.
Kahana,	" "	21 33 00	⊙	157 51 00	⁒		
Kahuku,	" "	21 43 30	⊙	158 00 00	⁒		N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.		Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
		N. ° ′ ″		W. ° ′ ″			
Kaneohe,	Oahu I.	21 29 00	⊙	157 48 00	♓		
Kauai I.		22 15 00	△	159 30 00	△		N. Pt.
" "		21 48 00	△	159 38 00	△		S. Pt.
Kawai Point,	Kauai I.	21 54 00	△	159 19 00	♊		
Kapaa Point,	" "	22 08 00	△	159 18 30	△		
Kaula Rock.		21 40 00	⊙	160 34 30	△		Near Niihau I.
Kaiwaihoa,	Niihau I.	22 15 00		160 17 00			S. Pt.
Kamaiki Point,	Lanai.	20 42 00	△	156 57 00	△		S. Pt.
Kawaihae Bay,	Hawaii I.	20 03 00	⊙	155 57 00	♓		
Kaohai,	" "	20 45 00	△	156 48 00	△		E. Pt.
Kaa,	" "	20 58 00	△	157 03 00	♊		N. W. Pt.
Kaena,	" "	20 55 00	♊	157 09 00	♊		W. Pt.
Kealakeakua Bay,	" "	19 28 12	⊙	156 00 00	♓ ♒		
Kipi Point,	" "	20 12 00	△	155 58 00	♊		
Kilauea Voleano,	" "	19 26 06	⊙	155 28 05	♓	3,970 feet. †	
Kohakuloa Point,	Maui I.	21 01 00	R	156 32 00	R		N. Side.
Koloa,	Kauai I.	21 48 30	⊙	159 29 00	♓		
Kolo,	" "	22 05 00	△	159 52 00	△		
Koolau,	Niihau I.	21 56 00	△	160 17 00	△		
Kula,	Maui I.	20 45 00	♊	156 32 00	♊		S. Side.
Laupahoehoe,	Hawaii I.	19 54 00	△	155 06 00	△		
Lanai.		20 42 00	△	156 57 00	△		S. Pt.
"		20 45 00	△	156 48 00	△		E. Pt.
"		20 58 00	△	157 03 00	♊		N. W. Pt.
"		20 55 00	♊	157 09 00	♊		W. Pt.
Leohi or Diamond Pt.,	Oahu I.	21 15 00	♋	157 49 00	♓		S. Pt.
Laeloa.		21 17 00	♊	158 06 30	♊		S. W. Pt.
Lehua Islet,	Niihau I.	22 02 00	△	160 10 30	△		
Mano Point,	Hawaii I.	19 43 00	△	156 10 30	△		
Mauna Loa Mt.,	" "	20 28 00	⊙	155 36 00	♓	13,760 feet. † ♁	
Mauna Kea Mt.,	" "	19 54 00	△	155 30 00	△	13,883 feet. ♁	Highest Pt.
Mauna Hualailai Mt.		19 45 00	△	155 55 00	△	10,320 feet.	

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.		Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
		N. ° ′ ″		W. ° ′ ″			
Maui Island.		20 40 00	♊	156 03 00	♊		Papaauhao, E. Pt.
" "		21 03 00	△	156 39 00	△		W. Pt.
Makapua,	Oahu I.	21 19 00	♊	157 40 00	♒ ♒		E. Side.
Makupupu,	" "	21 20 00	♊	157 39 00	♒ ♒		E. Pt.
Molokoni Islet,	Maui I.	20 37 00	△	156 30 00	△		
Molokai Island.		21 09 00	△	156 45 00	△		Halowa, E. Pt.
" "		21 03 00	⊙	156 51 00	♊		Pailolo, S. Pt
" "		21 06 00	⊙	157 18 00	♓		W. Pt.
" "		21 12 00	♊	157 16 00	♊		N. W. Pt.
Nanavalie,	Hawaii I.	19 37 30	⊙	154 56 00	♓		Sandhills.
Napili Point,	Maui I.	20 57 00	△	156 43 00	△		
Nahaina Fort,	" "	20 51 50	△	156 39 41	△		
Niulu Point,	Hawaii I.	20 20 00	△	155 46 00	♊		
Niihau Island.		22 00 00	△	160 05 00	△		Oku, N. E. Pt
" "		21 45 00	B	160 21 00	♓		Kaiwaihoa, S. Pt.
" "		21 52 00	♊	160 08 00	♒ ♒		Pueo, E. Pt.
Oahu.		21 20 00	♊	157 39 00	♒ ♒		Mukupuku, E. Pt.
"		21 15 00	⊙	157 49 00	♓		Leahi, S. Pt.
"		21 17 00	♊	158 06 30	♊		Laeloa, S. W. Pt.
"		21 36 00	♊	158 15 00	♊		Kaena, W Pt
"		21 43 30	⊙	158 00 00	♓		Kahuku, N. Pt.
Oku Point.		22 00 00	△	160 05 00	△		N. E. Pt., Niihau.
Papaauhao Point,	Maui I.	20 40 00	♊	156 03 00	♊		E. Pt.
Pacalui,	" "	20 40 00	△	156 27 00	△		
Pailolo,	Molokai I.	21 03 00	△	156 51 00	△		S. Pt.
Pohue,	Hawaii I.	19 03 00	△	156 03 00	△		
Pueo,	Niihau I.	21 52 00	△	160 08 00	△		E. Pt.
Upolu,	Hawaii I.	20 19 30	△	155 58 00	♒ ♒		
Waiakea Creek,	" "	19 43 51	⊙✳	155 03 06	☾✳		Observatory.
Wainanalu,	" "	19 55 00	△	156 06 00	△		
Waipio,	" "	20 15 30	△	155 25 00	△		
Waipunalei Point,	" "	20 00 00	♊	155 09 00	♓		

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Waiahole, Maui I.	20 48 00	♊	156 09 00	♊		
Wailuku, " "	20 53 00	☉	156 30 00	♓		
Waianae Town, Oahu I.	21 24 00	☉	158 10 30	♓		
Waimea " " "	21 39 00	☉	158 05 00	♓		
Waimanalo Point, " "	21 24 00	△	157 45 00	△		
Wahaiwa Harbor, Kaiau I.	21 49 30	☉	159 32 30	♓		Stetson's Pt.
Waimea Bay, " "	21 56 00	☉	159 43 00	♓		Russian Fort.
Wailua Town, " "	22 02 00	☉	159 21 00	♓		
Wikili Point, Molokai.	21 12 00	△	157 16 00	△		N. W. Pt.
OREGON AND CALIFORNIA.						
Adams Point.	46 12 40	☉△	123 57 15	♓△		S. Pt., Columbia R.
Alcatrayas Island.	37 49 20	△	122 30 00	△		Bay San Francisco.
Allshouse.	47 20 00	☉	122 39 00	△		Carr's Inlet.
Allen Point.	48 02 30	△	122 20 20	△		S. Pt., McDonough I.
Allan's Island.	48 27 45	△	122 40 00	△		Centre.
Anderson Island.	47 11 35	☉	122 41 30	♓		Otso, N. Pt.
" "	47 07 50	△	122 40 35	△		S. Pt.
" "	47 09 10	△	122 43 00	△		Trouble, W. Pt.
" "	47 09 00	△	122 09 40	△		E. Pt.
Angelos Point.	48 07 15	△♊	123 23 20	♊△		
Año Nuevo.	36 58 00	B	122 08 00	B		California.
Apple Cove.	47 47 10	☉ ♒	122 27 50	♓ ♒		Pippin Pt.
Argus Bay.	48 28 00	☉△	122 39 30	♓△		Anchorage.
Ariel Point.	47 58 00	△	122 31 50	△		
Arena Point.	40 44 00	△	124 11 00	△		
Astoria.	46 12 10	☉	124 52 15	♓		
Ayock's Point.	47 30 40	△	123 02 20	△		
Barnes Island.	48 41 00	△	122 44 30	△		Centre.
Bell's Chain.	48 50 20	△	123 08 10	△		E. Pt., Brown's I.
Beal's Point.	47 28 00	△	122 24 30	△		O. T.
Bird Rocks.	48 29 10	△	122 43 50	△		

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Blanco Cape.	42 55 00	⊙	124 25 00	⁜		
Blakely Island.	48 32 10	△	122 49 30	△		Centre.
" "	48 35 20	⊙	122 46 00	⁜		S. Pt.
" "	48 33 20	△	122 46 30	△		N. Pt.
" Port.	47 35 40	⊙	122 29 00	⁜		Bainbridge I.
Blake's Island.	47 31 40	⊙△	122 27 40	⁜△		S. Pt.
" "	47 32 50	△	122 28 00	△		N. Pt.
Blunt's Island.	48 18 30	⊙△	122 49 30	⁜△		Centre.
Blue Mountain.	37 45 30	△	122 24 10	△	1087 feet.	
Bonita Point.	37 48 45	△	122 28 10	△		California.
Bolin Point.	47 41 10	△	122 34 00	△		
Bodega Port.	38 18 00	B	123 03 20	⁜		
Brown's Island.	48 33 00	△	122 57 40	△		Centre.
" Point.	47 45 00	⊙	122 44 20	⁜		
" "	47 08 10	△	122 53 00	△		O. T.
Briscoe Point.	47 09 45	△	122 51 30	△		Hartstein I.
Butes.	39 11 30	△	121 40 30	△		California.
Budd's Inlet.	47 00 30	⊙	122 53 00	⁜		Saringa Falls.
Burrows' Island.	48 29 00	⊙	122 41 00	⁜		W. End.
" "	48 29 00	△	122 39 00	△		E. End.
Case's Inlet.	47 24 30	⊙△	122 48 30	⁜△		Ex. N. Pt.
Camp Point.	47 09 00	♋△	122 58 00	⁜△		O. T.
Carroll Point.	48 06 00	△	122 40 20	△		
Chauncy's Island.	48 34 25	⊙△	122 50 30	⁜△		N. Pt.
Chikiles Point.	46 55 30	⊙△	124 11 30	⁜△		Gray's Har.
Clark's Island.	48 42 50	⊙	122 43 30	△		N. Pt.
Colsee-ed Harbor.	47 46 58	⊙	122 50 11	⁜		Rose Pt., O. T.
Cooper Point.	47 08 40	△	122 54 30	△		O. T.
Cook's.	47 11 40	△	122 55 00	△		"
Commencement Bay.	47 17 40	♋	122 25 00	⁜		Centre.
Colvo Rocks.	47 57 10	⊙△	122 30 00	⁜△		
Constitution Mountain.	48 39 30	△	122 47 00	△	2356 feet.	

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Cone Hill.		△		△	780 feet.	
Cowas.	43 28 00	△	124 08 00	△		
Crowlie Point.	47 22 10	△	122 05 30	△		
Cummings Point.	47 33 30	⊙	123 01 00	☾		
Cyprus Island.	48 36 20	△	122 41 00	△		N. Pt.
" "	48 32 20	⊙	122 38 40	☾		S. Pt.
Day's "	47 15 20	⊙	122 32 10	☾		W. Pt.
" "	47 17 20	△	122 34 40	△		Vanderoort Pt.
Dabop Bay.	47 50 15	⊙	122 47 20	☾		
Dadah Point.	47 27 00	△	123 04 00	△		
Defiance "	47 19 30	⊙△	122 31 15	☾△		O. T.
Demock.	48 14 40	△	122 30 40	△		
Deception Passage.	48 23 50	⊙△	122 38 00	☾△		Entrance.
Decatur Island.	48 28 25	⊙	122 46 00	☾		S. Pt.
" "	48 31 40	△	122 45 00	△		N. Pt.
Destruction Island.	47 38 20	⊙	124 23 20	☾		
Disappointment Cape.	46 16 16	⊙△	124 01 43	☾△		
Dickerson Point.	47 09 40	△	122 49 40	△		O. T.
Discovery Port.	48 03 16	⊙	122 50 45	☾		Carr's Pt.
Dougal Point.	47 18 30	△	122 50 00	△		O. T.
Douglas Island.	48 45 00	△	123 07 40	△		"
Doughty's Point.	48 42 00	△	122 54 45	△		"
Duncan Rocks.	48 26 40	⊙	124 43 30	☾		"
Dye's Inlet, head of.	47 27 30	⊙△	122 40 30	△		"
Eagle Harbor.	47 37 00	⊙	122 28 20	☾		Entrance.
Edmund's Islet.	48 45 20	△	122 47 00	△		Centre.
" Point.	47 48 00	⊙	122 22 10	△		
Eld's Inlet, P. Sound.	47 03 40	⊙△	122 58 00	☾△		Ex. S. Pt.
Elliot Bay.	47 35 40	⊙	122 21 30	☾		Pt. More, O. T.
" "	47 39 10	△	122 24 30	△		W. Pt.
Eliza's Island.	48 38 30	⊙	122 32 00	☾		S. Pt.
" "	48 39 40	△	122 32 20	△		N. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Ellice Point.	46 15 00	⊙	123 54 00	☽		
Erie Mountain.	48 28 00	△	122 35 00	△		Perry's I.
Farallones, North.	37 44 00	⊙	122 06 30	☽		
" South.	37 36 00	♊	122 58 00	♊		
Feather River, California.	38 47 20	⊙	121 29 00	☽		Mouth.
Flat-top Island.	48 39 00	△	123 03 40	△		
Flattery Cape, O. T.	48 25 00	⊙	124 41 40	☽		
" Rocks, "	48 16 00	⊙	124 43 00	☽		
Fort Point, California.	37 48 30	△	122 25 24	△		San Francisco.
Fosdick Point, O. T.	47 16 00	△	122 33 45	△		O. T.
Fox Island, P. Sound.	47 14 40	△	122 34 00	△		N. E. Pt.
" "	47 17 15	△	122 39 00	△		W. Pt.
Foulweather Cape.	45 45 00	A	123 54 20	.		
Francis Point.	48 42 00	△	122 34 00	△		
Frazer's River.	49 07 05	⊙	123 08 57	☽		N. Bluff.
Frost's Island.	48 32 30	△	122 48 10	△		Centre.
Gardner Port.	47 59 30	⊙	122 17 20	☽		Gedney's I.
Gamble Port.	47 51 23	⊙△	122 33 42	☽△		Totten's Pt.
Gig Harbor.	47 19 50	⊙	122 33 00	☽		O. T.
Gibson Point.	47 13 40	△	122 35 00	△		Fox I.
Glover Point.	47 35 00	△	122 31 30	△		Port Orchard.
Gordon Point.	47 35 00	△	122 27 20	△		Bainbrid'e I
Gourd Island.	48 48 50	△	122 54 20	△		E. Pt.
" "		⊙△	122 56 00	☽△		W. Pt.
Gordon Island.	48 44 30	△	122 56 30	△		Centre.
Gonzales Point.	48 27 20	⊙	123 10 50	☽		
Grenville Point.	47 22 00	⊙	124 12 00	☽		
Gregory Cape.	44 04 20	A	124 05 00	☽		
Green's Point.	47 17 00	△	122 40 00	△		Carr's Inlet.
Guerriere Bay.	48 36 30	⊙	122 55 00	☽		W. Pt.
Hautboy Island.	48 33 56	△	122 42 00	△		Centre.
Hamersley Inlet, O. T.	47 10 30	⊙	123 05 00	☽		Ex. W. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Hamersley Inlet, O. T.	47 13 20	△	123 00 00	△		Ex. N. Pt.
Harris Point.	47 18 30	△	122 25 00	△		
Harmon Point, A. Inlet.	47 17 00	△	122 25 10	△		Commencement Bay.
Harmon Point, H. C.	47 53 10	△	122 35 30	△		
Hammond Point.	48 43 45	△	122 58 40	△		W. Pt. Waldron's I.
Henry's Island, O. T.	48 37 30	△	123 08 40	△		N. Pt.
" " "	48 35 30	⊙	123 09 40	☋		S. End.
Herron Point.	47 34 00	△	122 35 30	△		
Heyer's Point.	47 25 30	△	122 24 00	△		Vashon's I.
Herron's Island.	47 16 40	⊙	122 49 00	♊		N. Pt.
" "	47 15 40	△	122 49 00	△		S. Pt.
Henderson's Inlet.	47 06 00	⊙△	122 48 00	☋△		S. Pt.
Head of Carr's Inlet.	47 22 30	⊙△	122 37 00	☋△		O. Ter.
Hope Island.	48 23 30	△	122 33 00	△		W. Pt.
Holmes Harbor.	48 00 20	⊙	122 30 20	△		Head.
Hope Island.	47 11 10	△	122 54 30	△		Centre.
Hooetzen Harbor.	47 44 20	⊙	122 50 37	△		Hood's Canal.
Hornet's " O. T.	48 31 40	⊙	122 31 50	☋△		Sutton Head
Hull's Island, "	48 35 30	△	122 51 00	△		S. Pt.
" Pt. Lawrence, "	48 39 50	△	122 42 00	△		E. Pt.
" Pt. Fritz, "	48 39 00	△	122 59 30	△		W. Pt.
Hudson Point.	48 07 00	⊙	122 44 20	☋		
Hyde Point.	47 12 40	△	122 37 00	△		McNiel I.
Indian Head.	47 55 30	△	122 25 25	△		
Jack's Island, O. T.	47 10 00	⊙	122 52 20	☋		S. End.
" " "	47 13 30	△	122 54 40	△		N. End.
James "	48 30 30	△	122 44 20	△		S. Pt.
Java Head.	48 47 40	△	123 00 50	△		Gulf Georgia.
Jack's Island.	48 34 40	△	122 34 00	△		Centre.
Jefferson Point.	47 44 30	△	122 27 00	△		
Jones Island.	48 47 30	△	123 00 30	△		Centre.
John's "	48 39 40	△	123 06 00	♊		E. Pt.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
John's Island.	48 40 30	△	123 08 00	△		W. Pt.
Karquines Straits.	38 03 30	⊙	122 13 00	⋊		California.
Kalmunt Island.	48 16 00	△	122 36 00	△		Centre.
Katslum "	48 24 00	△	122 38 00	△		
Ketron "	47 10 25	△	122 36 40	△		N. Pt.
" "	47 09 10	△	122 37 00	△		S. Pt.
Killinas Lake.	47 24 00	△	122 52 30	△		Centre.
Killamook Head.	45 54 20	△	123 57 00	△		
Klamath River.	41 34 00	B	123 58 30	△		
Kwaatz Point.	47 06 40	△	122 09 30	△		Puget's Sound.
Lawrence (Port).	48 00 00	⊙	122 41 00	⋊		Anchorage.
Lawrence Point.	48 39 50	△	122 42 00	△		E. Point, Hull's I.
Lawrence Island.	48 35 30	△	122 36 00	△		N. Pt.
" "	48 31 30	⊙	122 36 40	⋊		S. Pt.
Leavitt Point.	48 02 00	△	122 35 25	△		Admiralty Inlet.
Liplip Point.	48 00 20	△	122 39 20	△		"
Little Belt Passage.	48 28 40	⊙	122 55 15	⋊		
Lookout Cape.	45 23 30	♋	123 53 40	⋊		
Lowell Point.	48 07 00	△	122 28 00	△		
Lobos Point.	37 46 40	△	122 27 30	△		
Los Angelos Island.	37 51 30	△	122 22 55	△		Bay of San Francisco.
Ludlow (Port).	47 55 20	⊙	122 39 53	⋊		Tit Pt.
Lynch Cove.	47 26 00	△	122 52 00	△		Hood's Ca'l.
Marsh Landing.	37 59 30	△⊙	121 40 00	⋊△		Sacramento R.
Madison (Port).	47 42 15	⊙△	122 30 00	⋊△		Centre.
Makamoh Point.	48 31 20	△	124 32 00	△		
McLaughlin Island.	48 45 30	△	122 40 10	△		Pt. Neighy, N.Pt.
" "	48 38 30	△	122 34 00	△		Cardinal Pt.
McNeil Island.	47 12 40	△	122 37 00	△		E. Pt.
" "	47 12 25	△	122 42 00	△		W. Pt.
" "	47 14 20	△	122 40 30	△		N. Pt.
Mendocino Cape.	40 27 00	⊙	124 25 00	⋊		California.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Mission of San Rafael.	37 58 00	△⊙	122 29 00	♓		California.
Monterey Fort.	36 36 00	B	121 52 30	B		"
Molate Islet.	37 55 00	△	122 22 40	△		"
Moore Point, Elliott Bay.	47 35 40	⊙	122 21 30	♓		Admiralty Inlet.
Moody Point.	47 10 40	△	122 48 00	△		"
Munroe Point.	47 42 00	⊙ ♒	122 30 00	♓ ♒		"
Morris Cove, Ironside Inlet.	48 40 40	△	122 52 00	△		
Musquiti Pt. Hood's Canal.	47 24 20	⊙	123 06 00	♓		
Neelim Point, " "	47 23 30	△	123 08 00	△		
Neil Point, Vashon's I.	47 20 10	△	122 28 00	△		
New Dungeness.	48 11 37	⊙ ♒	123 04 55	♓ ♒		Fuca's Strait.
Nisqually.	47 07 12	⊙✳	122 38 09	☾✳		Observat'y.
Nopoint Point.	47 54 30	△	122 30 30	△		
North Point.	48 25 20	△	124 39 00	△		
Nukolowayo Point.	47 41 00	△	122 47 30	△		
Obstruction Island.	48 35 30	△	122 46 30	△		Centre.
Olele Point.	47 58 00	△	122 40 00	△		
O'Neil Island.	48 36 30	△	123 03 20	△		Puget's Sd.
Oxford, Cape Blanco.	42 55 00	♋	124 25 00	♓		Oregon.
Orchard (Port).	47 32 00	⊙	122 39 30	♓		S. Ex.
Oro Bay.	47 08 30	⊙♊	122 40 00	♊		Puget's Sd.
Park Point.	47 10 00	△	122 44 30	△		
Partridge Point.	48 13 00	⊙△	122 45 20	△♊		Admiralty Inlet.
Perpetua Cape, O. T.	44 12 30	C S	123 59 00	♓		N. Bluff.
Peapod Rock, Ringgold Cha.	48 38 30	△	122 42 00	△		N. Ex.
Pearl Island.	48 37 20	△	123 07 30	△		Centre.
Penn's Cove.						
Pinos Point.	36 38 00	B	121 54 30	B		
Pilot Cove.	47 51 50	⊙	122 29 10	♓		Anchorage.
Piner Point.	47 20 50	△	122 25 30	△		Maury's I.
Pilash Point.	47 48 30	△	122 47 50	△		
Polnell Point.	48 16 00	⊙	122 32 00	♓△		

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Protection Island.	48 08 00	△	122 53 00	△		E. End.
" "	48 07 30	△	122 55 10	△		W. End.
Punte de los Reyes.	38 01 15	♊	123 00 30	♓		California.
Pully Point.	47 27 00	△	122 21 15	△		
Quatsap Point, Hood's Canal.	47 39 00	△	122 53 00	△		
Quadra Point.	48 30 30	△	124 29 30	△		
Queenhithe Pt. Oregon.	48 03 00	⊙	124 41 00	♓		
Red Bluff, "	48 09 20	△	122 40 00	△		
Richmond Point.	47 23 20	△	122 31 00	♓		
Roberts' Point.	48 58 20	⊙	123 02 24	♓		
Rose Point.	47 46 58	⊙△	122 50 11	♓△		Colsee-ed Harbor.
Robinson Point.	47 23 15	△	122 20 30	△		Maury I.
Roberts' Point.	47 34 30	△	122 23 40	△		
Rocky Point.	48 05 30	△	122 30 20	△		
Rodgers' Island.	48 27 15	♊	122 55 20	♊		S. Pt.
" "	48 07 40	△	123 04 15	△		N. Pt.
" " Salisbury Pt.	48 32 20	⊙	122 55 30	♓		E. Pt.
Rogue's River.	42 25 00	C S	124 20 00	♓		
Sausalito Point.	37 50 50	⊙♉	122 25 26	☾✳		
San Joaquin River.	38 04 00	⊙	121 34 00	♓		Mouth.
Santa Clara.	37 25 00	⊙	121 56 00	♓		California.
Sandy Point.	47 11 10	△	122 55 20	△		
Sanford Point, Vashon's I.	47 24 20	△	122 30 20	△		
Salisbury Point.	47 51 30	△	122 55 30	△		
Sandy Point, Hood's Canal.	47 37 50	△	122 54 00	△		
" " Possession Sd.	48 01 30	△	122 20 40	△		
" " Gulf of Georgia.	48 48 00	△	122 41 00	△		
Sail Rock, Strait of Fuca.	48 23 10	△♊	124 33 10	♊△		
Sail Rock Point.	48 23 30	⊙△	124 34 00	♓△		
Scatchel Head, Whidby I.	47 54 00	△	122 53 40	△		
Scott's Point.	47 18 30	△	122 40 00	△		Carr's Inlet.
Searborough Harbor.	48 24 41	⊙	124 36 08	♓		N. Point, Neal I.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Seabock Point, Hood's Canal.	47 39 40	△	122 48 35	△	Elevated.	
" Harbor.	47 39 30	⊙△	122 48 32	)(		Sanum Pt.
Sentinel Rocks.	48 38 40	△	123 07 00	△		
Shoalwater Point.	46 42 00	△	124 10 20	△		
Shaw's Island.	48 35 00	△	122 51 50	△	Elevated.	E. Pt.
" "	48 35 20	△	122 58 30	△		W. Pt.
Sisters' Point.	47 22 30	△	123 01 10	△		
" Island.	48 41 30	⊙△	122 43 30	)(△		
Siuclair's Island.	48 37 50	⊙△	122 38 20	☊△		N. Pt.
" "	48 37 00	△	122 40 00	△		W. Pt.
" "	48 36 30	△	122 37 00	△		E. Pt.
Skipjack Island.	48 44 30	△	123 00 00	△		Canal de Arro.
Sonoma, California.	38 14 00	⊙	122 23 30	)(		
Southworth Point.	47 30 40	△	122 28 10	△		
South Point.	47 50 00	△	122 40 00	△		Hood's Canal.
Speiden Island.	48 38 15	⊙△	123 04 00	)(△	Elevated.	E. Pt.
" "	48 38 09	⊙△	123 07 20	)(△	"	W. Pt.
San Pedro Point.	37 34 00	⊙△	122 27 00	)(△	High.	California.
San Pablo Point.	37 57 20	△☊	122 22 40	△☊	"	"
San Pedro Point.	37 58 40		122 24 00		"	"
Strawberry Bay, Hautboy I.	48 33 56	⊙△	122 42 00	△		Cypres I.
San Juan Harbor.	48 30 37	⊙△	124 29 41	△☊		Mash Rocks
Stretch's Island, Carr's Inlet.	47 20 00	△	122 48 00	△	Low.	N. Pt.
" "	47 19 15	△	122 49 10	△		S. Pt.
Stuart's Island.	48 41 40	⊙	123 11 30	)(	High.	W. End.
" "	48 40 30	△	123 08 00	△		E. End.
St. George Point.	41 47 00		124 05 30			
Suqualus Point.	47 42 00	△	122 45 00			
Suquamish Head.	47 56 30	⊙△	122 35 30	)(△		Hood's Canal.
Suquamish Harbor.	47 52 10	⊙	122 38 39	)(		"
Susan's Port.	48 11 15	⊙	122 20 11	)(		Triangle Cove.
Sutter's (New Helvetia).	38 34 30	⊙	121 20 30	)(		California.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Sylopash Point.	47 41 30	△	122 52 00	△		
Table Hill.	37 55 00	△	122 31 30	△	2569 feet.	California.
Tala Point, Hood's Canal.	47 56 00	△	122 38 40	△	Low.	
Tatuocho Island.	48 36 00	△	124 43 20	♊		N. Pt.
Tchinom Point, Hood's Canal.	47 32 20	△	123 00 00	△	Sandy.	
Tekiu Point, " "	47 35 40	△	122 57 00	△		
Termination Pt. " "	47 52 00	△	122 37 51	△		
Tetusi Bay.	47 12 30	⊙	122 43 00	)(		Centre.
Tongue Point.	48 58 30	⊙	122 45 30	△	Low.	Drayton's Bay.
Thompson Point.	48 42 00	△	122 51 00	△	High.	Hull's I.
Tumbow Island.	48 40 00	⊙	123 02 00	♊		Anchorage.
Toliva Shoal, Puget Sound.	47 12 40	△	122 35 00	△		
Totten's Inlet, " "	47 05 25	⊙△	123 04 00	)(△		Ex. S Pt.
Treble Point, McNeil I.	47 09 10	△	122 43 00	△		
Triton Head, Hood's Canal.	47 36 30	△	122 57 40	△	Rocky.	
Trinidad Bay.	41 05 40	C S	124 03 30	)(		
Tskulsko Point, Hood's Canal.	47 41 30	△	122 48 40	△		
Tzu-sa ted Cove.	47 49 00	⊙	122 50 37	)(		Pasisi Pt.
Umpqua River.	44 43 30	⊙	124 06 45	)(		
Vashon's Point.	47 30 40	⊙△	122 26 40	)(△		N. Pt. Vashon's I.
Vendovi Island.	48 36 30	△	122 03 30	△	Elevated.	Centre.
Viti Rocks.	48 38 00	△	122 35 00	△		
Watmaugh Head.	48 25 00	♋△	122 47 20	△		South Pt., Chauncy's I
Wasp Islets.	48 36 00	△	122 58 30	△	Low.	
Waldron's Island.	48 41 00	⊙△	123 00 30	△		Disney Pt.
" "	48 43 45	△	122 58 40	△		Hammond Pt.
" "	48 30 00	♊	123 02 10	♊		W. Pt.
Wepusec Inlet.	47 06 30	⊙△	122 52 00	)(△		Budd's Inlet.
White Point.	47 35 20	△	122 33 00	△		
Whitehorn Point.	48 54 00	△	122 46 30	△		
Wilson Point.	48 08 39	⊙	122 44 43	)(	Sandy.	
Wilson Point, Hartstene's I.	47 12 30	△	122 49 30	△		Puget Sd.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		W. ° ′ ″			
Williams Point.	47 31 40	△	122 22 30	△	Sandy.	
Williamson's Rocks.	48 26 50	△	122 40 10	△		Argus Bay.
William. Pt. Bellingham Bay.	48 35 30	⊙	122 30 00	)(		
Yerba Buena Island.	37 48 25	△	122 19 10	△	High.	California.
Young Island, Argus Bay.	48 28 20	△	122 39 10	△		Centre.
Zelatched Point.	47 42 40	△	122 48 00	△	Low.	
SOOLOO SEA.			E.			
Alibalau.	12 17 00		122 22 10		Low.	Centre.
Ambolau.	12 13 00		121 05 00			
Anapuyan.	6 51 00		122 27 30			Panay.
Antique Roads.	10 40 00		121 59 30			
Apo Shoal.	12 38 00		120 40 00		Low.	S. Pt.
" "	12 46 00		120 34 00			N. Pt.
" Islet.	12 42 30		120 30 00		Low.	
Bacos Islets.	13 29 00		121 15 00			
Bauton.	12 54 00		122 16 00			Centre.
Bagbatan.	11 26 00		121 57 30			
Balagonan Point.	7 47 00		122 02 30			
Balambaugau.	7 20 20		116 56 00			Seeag-goot Pt.
"	7 14 50		116 48 10			Boottorn Point.
Baleta Point.	6 51 00		122 10 00			
Banco Seco.	11 17 30		121 45 00			Centre.
Basillan Island.	6 29 10		121 41 15		High.	W. Pt.
" "	6 30 00		122 29 00			E. Pt.
" "	6 39 15		122 07 50			N. Pt.
Batomande Reef.	6 12 00		121 41 00			
Bang-ing-e.	6 00 00		121 32 30		Low.	Centre.
Bangao.	5 58 00		121 26 00			S. Pt.
Bas Bas.	6 01 30		120 25 30		Low.	Centre.
Basbas Island.	6 01 00		120 26 00			"
Babuan Island.	5 23 00		120 33 00			"

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Bawgennang Island.	7 52 00		118 50 00			Centre.
Bancoran Island.	7 55 00		118 47 00			"
Bajos Nuevos.	8 00 00		117 40 00			"
Banguey.	17 20 30		117 20 00			N. Pt.
Banguey Peak.	7 16 05	△	117 05 40	△		
Balabac.	7 49 00		117 00 00			S.Pt.Island.
Balabac Peak.	8 00 00		117 02 00			
Bugsok Island.	8 15 00		117 20 00			S. Pt.
Belawn Island.	6 05 00		121 43 00			Centre.
Bilinan Island.	6 01 15		121 21 30			"
Billanggaan.	5 45 00		120 10 00			"
Biche de Mar Shoals.	7 44 00		117 16 00			N. Ex.
" "	7 35 00		117 18 00			S. Ex.
Ballook Ballook.	6 33 40		121 35 00			Centre.
Botobalon.	6 28 00		121 22 00			
Boto Balon Rock.	6 27 30		121 21 30			
Bookoongan.	6 30 30		121 29 30		Low.	Centre.
Boosoo.	6 34 00		121 27 00			
Boobooan.	6 15 00		121 50 00			Centre.
Bookocloo.	6 06 06		121 42 30			"
Boobooan.	6 09 00		120 53 00			N. Pt.
Boohpongpong.	5 38 00		120 45 00			Centre.
Brothers (Two).	12 57 00		122 07 30		Low.	"
Buyalloa.	12 25 00		121 32 00		"	"
Bucara Shoal.	7 55 00		117 20 00			"
Camelo Island.	13 41 00		120 24 30		Low.	"
Calapan Mountain.	13 25 00		121 18 00			Mindoro.
Caluhia.	11 56 00		121 35 00			Centre.
Camden Shoal.	11 50 00		121 22 00			"
Cap Island.	11 35 00		121 45 00		Low.	"
Caldera Bay (Fort).	6 55 00	⊙	122 00 45	♓		Mindano.
Cagayanes.	9 42 00		121 20 00		Low.	N. Ex.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Cagayanes.	9 30 00		121 19 00		Low.	S. Ex.
Caluja.	9 28 00		121 05 00		"	Centre.
Cavalli.	9 15 00		120 42 00		"	"
Carandaga Island.	10 55 00		120 20 30			E. Pt.
Cap Island.	6 04 00		119 58 00		Low.	Centre.
Cagayan Sooloo.	7 02 00		118 38 00		High.	E. Pt.
" "	7 02 00		118 32 00			W. Pt.
Cadalamar.	7 53 00		117 10 21			Centre.
Cama Reef.	7 27 00		117 17 00			E. End.
" "	7 27 20		117 12 00			W. End.
Calavite Peak.	13 30 00		120 24 10		2080.	Mindoro.
" Point.	13 28 30		120 18 00			
Carabao Island.	12 06 00		122 00 00		Low.	Centre.
Cuyos Island.	10 51 00		121 11 30			W. Pt.
Dayagan Point, Mindoro.	12 39 00		121 40 00		Low.	E. Side.
Datu Point.	6 00 25		120 54 40			Sooloo.
Damaloc Point, Mindanao.	6 58 00		121 55 00			
Dafaan Island.	6 37 30		121 21 00		Low.	Centre.
Damay Island.	5 48 00		120 22 00		"	"
Datu Shoal.	7 23 00		118 43 00			"
Deolo-Batas.	5 55 00		120 13 00		Low.	"
Diporlool Islands.	6 07 30		121 45 00		"	
Dog Kan Island.	5 57 30		120 03 00		"	Centre.
Duobolod.	6 12 00		121 30 00		"	
Dumaran.	10 28 00		120 04 00		"	S. Pt.
"	10 40 00		120 15 00		"	E. Pt.
Dumah Point.	13 07 00		121 40 00		High.	Mindoro.
Dyangappik Point.	6 02 20		120 56 30		Low.	Sooloo.
East Island.	8 55 00		118 25 00		"	Centre.
Escarceo Point.	13 33 00		121 05 00		"	Mindoro.
Falmouth Bank.	11 56 00		121 05 00			Centre.
Galera Point.	13 34 30		121 02 00			Mindoro.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Galera Mount.	13 25 00		120 49 00			Mindoro.
Golconda Shoal.	10 00 00		125 35 00			Centre.
Goopooan West.	7 21 30		117 16 30		Low.	"
" East.	7 21 30		117 20 00		"	"
Griffin Rock.	6 40 00		121 20 00			"
Guimari Island.	10 27 00		122 25 00		Low.	S. W. Pt.
Hegad Island.	6 06 50		120 55 30		"	Centre.
Helix Shoal.	7 24 00		117 17 30			"
Influenza Island.	12 08 00		121 35 00			"
Kalublub Island.	6 37 00		121 22 00		Low.	"
Kapooal.	5 59 30		121 20 00		High.	"
Kabingaan Island.	5 41 00		120 58 00		Low.	"
Kanlipiara.	5 29 00		120 08 00		"	"
Kenaposan.	7 11 00		118 32 00		"	"
Kinapoossan.	5 15 00		120 28 00		"	"
Kisand Patch.	7 27 00		118 12 00		"	"
Koohangan Island.	6 01 30		121 11 30		"	"
Koolassian.	6 20 00		120 40 00		"	"
Kooneelaan.	6 04 00		120 28 00		"	"
Laminlao Point.	12 29 00		121 00 00		"	Mindoro.
Lapak Island.	5 30 00		120 40 00		"	W. End.
Libagao.	12 12 00		121 27 00		"	Centre.
Loombooean Islet.	7 49 00		117 10 00		"	"
Luban Island.	13 45 30		120 16 00		"	S. Pt.
" "	13 59 00		120 06 00		"	N. Pt.
Maricaban.	13 40 00		120 53 30			Centre.
Marcolot Peak.	13 44 00		121 10 00			Luzon.
Maestro de Campo Island.	12 59 00		121 50 00		Low.	Centre.
Maranduque Island.	13 32 30		121 54 00		"	St. Andre, N. Pt.
" "	13 22 30		122 15 00		"	E. Pt.
Masin Islet.	12 10 00		121 25 00		"	Centre.
Mangsee Great.	7 29 15		117 18 00		"	"

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Mangsee Little.	7 30 04		117 17 11		Low.	Centre.
" " Reef.	7 29 50		117 19 00			E. Ex.
Mataha.	6 27 00		121 36 00		Low.	S. Pt.
Mamanook.	6 04 00		121 32 00		"	Centre.
Mannud.	6 05 00		121 39 00		"	"
Marongas.	6 03 00		120 52 30		"	W. Pt.
Malapoolhas.	6 04 00		120 21 00		"	Centre.
Mamman.	5 42 00		120 16 00		"	"
Maincolan.	5 25 00		120 29 00		"	"
Manocan Shoal.	7 48 00		118 53 00			"
Marongar Shoal.	7 25 00		117 58 00			"
Mangoath's Islands.	7 19 30		117 01 30		Low.	"
Meenes Meenesan.	6 30 00		121 25 30		"	"
Middle Point.	11 44 00		121 58 00		"	Panay.
Minis Island.	6 03 00		120 58 30		"	Centre.
Midnight Shoal.	7 30 00		117 55 00			"
Mindoro Island.	13 28 30		120 18 00		High.	N. W. End.
" "	12 13 00		121 17 30		Low.	S. End.
Nasog Point.	10 25 00		121 57 30		"	Panay.
Negros Island.	9 54 00		122 22 00		"	Pt. Sojolon.
" "	9 32 00		122 23 00		"	S. W. Pt.
Nulu Rock.	7 45 00		118 50 00			Centre.
Obian.	6 06 00		120 25 00		Low.	"
Oosadda.	6 05 00		120 31 00		"	"
Pandan Island.	12 48 30		120 50 00		"	"
" Point.	12 47 00		120 52 00		"	
Paguayan.	11 02 30		121 25 00		"	Centre.
Parol Island.	6 02 30		121 33 00		"	"
Pancasinan.	6 05 00		120 56 00		"	E. End.
Palyancan.	6 07 00		120 51 30		"	N. Pt.
"	6 05 00		120 48 00		"	S. W. End.
Pata Island.	5 47 30		121 09 30		High.	E. End.

TABLE III.—*Continued*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Pata Island.	5 45 00		121 04 00		High.	W. End.
Pandookan.	6 12 00		120 35 00		Low.	S. Pt.
Pangootaaraang.	6 12 30		120 25 00		"	W. Pt.
"	6 18 00		120 31 00		"	N. Pt.
Parangan.	5 30 00		120 38 00		"	Centre.
Papuan Shoal.	7 16 00		118 05 00		"	"
Pagoda Island.	8 24 00		117 35 00		"	"
Panay.					3000 feet.	N. End.
"						S. End.
Pearl Bank.	5 55 00		119 50 00			N. E. Ex.
" "	5 40 00		119 30 00			S. W. Ex.
Piedra Blanca Rock.	10 30 30		121 14 00			
Pilas Island.	6 34 00		121 30 00		Low.	N. End.
" "	6 27 30		121 30 00		"	S. End.
Polalu Shoal.	7 26 00		118 20 00			Centre.
Pole, Sooloo I.	5 51 00		120 53 00			S. W. Pt.
Potol.	11 59 00		122 00 00			Panay.
Quinilubam.	11 35 00		121 07 00		Low.	Centre.
Santiago Point.	13 46 00		120 40 30			Luzon.
Samboangan (Town).	6 52 30		122 07 00			Mindoro.
Santa Cruz Island.	6 50 00		122 05 50		Low.	Centre.
Saddle Island.	6 42 30		122 27 00		"	"
Sangboys Island.	6 40 00		121 27 20		"	"
Sallecollakkit.	6 35 00		121 20 00		"	"
Saanga Reef.	6 08 00		121 35 00			"
Sangampamatte.	6 20 00		121 40 00		Low.	"
Scengan.	5 45 00		120 23 00		"	"
Salinsingan Island.	7 32 00		117 17 00		"	"
Sandy Isle.	7 41 30		116 40 00		"	"
Semarara.	12 10 00		121 25 00		"	N. Pt.
"	12 00 00		121 26 30		"	S. End.
Semeepa.	5 55 00		121 28 00		"	Centre.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Serroogang, Sooloo.	5 50 20		120 59 30		High.	S. End.
Seeaggoot, Balambangan.	7 20 00		116 56 00		"	N. Pt.
Sinanahan Island.	7 33 30		117 21 30		Low.	Centre.
Sigboye.	5 25 00		120 22 30		"	"
Sirloon.	5 38 00		120 40 00		"	"
Siassi.	5 28 00		120 45 00		"	W. Pt.
Silangaan, Sooloo.	5 55 00		120 48 00			W. End.
Sibago.	6 40 00		122 22 00		Low.	Centre.
Silucco Point, Mindanao.	7 05 00		121 54 00			W. Ex.
Siam Shoal.	11 51 00		120 46 00			N. Pt.
Simara Islet.	12 48 00		122 14 00			S. E. Pt.
Sigayan Point, Luzon.	13 40 00		121 27 30			
Silonay Islets.	13 28 00		121 20 00		Low.	
Sombrero.	10 46 30		121 24 00			Centre.
Soung Roads, Sooloo.	6 01 00		120 55 51			Obser. Pt.
Sooloo Island.	5 57 20		121 21 00		High.	E. Pt.
Soladdle Island.	5 48 00		120 23 00		Low.	Centre.
St. Miguel Shoal	7 50 00		118 25 00			"
Table Mount, Marauduque I.	13 17 00		122 08 00			
Tablas Island.	12 39 00		122 15 00		Low.	N. Pt.
" "	12 30 00		122 00 00		"	W. Pt.
Tambaron.	12 16 00		121 25 00		"	Centre.
Talabasi Point.	13 04 00		120 47 00		"	Mindoro.
Tab Taboon.	6 50 30		122 12 30		"	S. E. Pt.
Taykela.	6 23 00		121 41 30		"	Centre.
Tapeantana.	6 13 00		121 50 00		"	"
Tamook.	6 17 00		121 42 00		"	"
Tattaran.	6 10 00		121 43 00		"	"
Tappool.	5 42 00		120 50 00		High.	"
Tambagan.	5 25 00		120 17 00		Low.	"
Tawi Tawi.	5 24 00		120 15 00		"	E. End.
" "	5 13 00		119 45 00		"	W. End.

TABLE III.—*Continued.*

LATITUDES, LONGITUDES, AND HEIGHTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

Islands, Capes, &c. &c.	Latitude.	Signs.	Longitude.	Signs.	Height.	Remarks.
	N. ° ′ ″		E. ° ′ ″			
Tawi Tawi.	5 25 00		119 58 00		Low.	N. Pt.
Talanlam Shoal.	5 43 00		119 25 00			Centre.
Teynga.	6 44 00		121 29 00		Low.	"
Teypoono.	6 28 00		121 41 30		"	"
Temerario.	8 40 00		120 00 00		"	"
Teoomabal.	5 48 00		120 57 30		"	Centre.
Three Kings.	13 12 00		122 00 00		"	"
Tilad.	12 14 00		121 20 00		"	"
Tolo.	13 44 00		120 16 30		"	Centre.
Tong-kil.	6 03 00		121 37 00		"	"
Tob Bataha.	8 00 00		119 38 00		"	"
Toolyan Island.	5 59 00		121 14 00		High.	Centre.
" Bay.	5 58 00		121 14 00			Sooloo.
Tong Tong Bay.	6 04 20		120 49 40			Palyan-can I.
Tobigan.	6 22 00		120 42 30		Low.	Centre.
Toobaboobook.	5 57 00		120 22 30		"	"
Toogbabas Islets.	5 48 00		120 15 00		"	"
Tosan-Bagao.	5 12 00		119 38 00		"	"
Tree.	7 21 30		117 12 30		"	"
Turtle Shoal.	7 43 00		117 10 00			E. End.
" "	7 43 00		117 06 00			W. End.
Tubili Point.	13 20 00		120 30 00		Low.	Mindoro.
Usang Point.	5 22 00		129 20 00		"	E. Pt., Borneo.
Verde Island.	13 34 00		121 07 00			N. W. Pt.
" "	13 32 00		121 11 30			S. E. Pt.
Vincennes Shoal.	12 06 00		121 15 00			Centre.
Ylin East.	12 10 00		121 10 30		Low.	S. Pt.
" West.	12 12 30		121 08 00		"	S. Pt.

CURRENTS.

TABLE IV.

In the Introduction to this volume, I have stated that I should combine, in this Table, the currents and magnetic variations; but, as I found it would become necessary to place the variations with the magnetic results, and these could not be introduced in the present volume, I therefore preferred separating the tables, rather than repeating a part of them, thereby avoiding an extra expense at a slight inconvenience to the navigator, who can refer to them in the next volume, where the actual observations are given, and the variations divested of local attraction of the ship. The local attraction of a vessel is so intimately connected with correct navigation, that it seems almost incredible how much it has been disregarded. The endeavors to rectify it, by patent compasses and appliances to overcome the effect of the subtle fluid, have all proved failures. The deviation, caused by the iron, should always be practically ascertained by swinging the vessel before leaving port, noting the bearings of some very distant object, or that of a compass on shore, where an observer may be stationed, to take the opposite bearing of the observer on board ship. The differences found in these sets of observations, will be the corrections, to be applied to the compass on board. When the latitude is changed from North to South, the corrections are to be applied with a contrary sign.

The Table of Currents will readily point out to the navigator the set of the current, its force, and how determined. These, combined with the variation at the position, with the direction of the ship's head, will enable him to compare his own results with those recorded.

C. W.

TABLE IV.

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 38° AND 14° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1838.	N. ° ′	W. ° ′			Miles.	
August 30.	37 43	54 36	N. E. ½ E.	East.	16	
" 31.	38 00	51 24	E. by S.			
Septem. 1.	38 00	46 53	E. N. E.			
" 2.	38 00	43 50	E. by S.			
" 3.	37 23	42 30	S. by E. ½ E.	S. 48° E.	12	
" 4.	35 53	41 34	S. W.		7	
" 5.	36 44	41 00	N. by E. ½ E.	None.		
" 6.	37 04	40 06	E. by N.	"		
" 7.	37 20	36 34	E. by S.	S. ¾ W.	19	
" 8.	37 15	34 08	"	S. W. ½ W.	12	
" 9.	37 19	32 03	"	E. by S.	22	
" 10.	37 39	29 29	East.	South.	6	
" 11.	37 55	25 44	N. E. by E.	W. ½ N.	¾	per hour, experiment. Near St. Michael's.
" 12.	38 08	24 57	N. by E. ½ E.			
" 13.	37 08	23 42	S. E. by S.	E. S. E.	½	per hour, experiment.
" 14.	36 21	22 38	S. E.	S. S. W. ½ W.	14	
" 15.				N. W. ¾ W.	31	
						Madeira.
Septem. 25.	31 09	17 58		South.	20	Left Madeira.
" 26.	28 57	19 00	S. W.	West.	11	
" 27.	27 17	19 40	"	N. E. by E.	½	per hour, experiment.
" 28.	25 00	20 03	"	"	⅜	" "
" 29.	24 32	20 53	"			
" 30.	21 47	21 00	S. W. by S.			
October 1.	18 59	20 52	S. S. W.	South.	18	
" 2.	17 22	20 36	S. by W.	"	"	
" 3.	16 31	20 39	E. ½ S.	N. E. by N.	½	per hour, experiment.
" 4.	16 03	21 56	W. S. W.	E. N. E.	⅝	" "
" 5.	15 26	22 49	West.	N. by W.	1	" "
						Porto Praya.
October 9.	11 36	24 20	S S. W.			
" 10.	11 02	24 35	S. W.			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 12° AND 0° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1838.	N. ° ′ ″	W. ° ′			Miles.	
October 11.	9 36	24 32	S. by E.			
" 12.	9 27	24 21	S. W.			
" 13.	9 21	24 02	S. ½ E.	S. E. by E.	½	per hour, experiment.
" 14.	8 41	23 40	S. S. W.	S. E. by S.	⅜	" "
" 15.	7 20	22 30	S. E. by E.			
" 16.	None.					
" 17.	6 36	20 22	East.			
" 18.	6 48	20 35	N. E. by E.	S. W. by S.	⅝	per hour, experiment.
" 19.	6 39	20 38	E. by S.			
" 20.	6 30	21 35	W. S. W.	East.	⅝	" "
" 21.	5 34	22 32	S. W. by W.	"	12	
" 22.	5 40	21 39	S. E. by E.	S. E. by E.	⅝	per hour, experiment.
" 23.	5 39	20 14	"	S. E. by S.	½	" "
" 24.	5 14	21 24	W. by S.	S. W.	¾	" "
" 25.	5 07	21 40	S. W. ½ S.			
" 26.	4 00	21 37	E. by S. ½ S.	Sd. & Ed.	10	
" 27.	4 05	20 42	"	N. W. ½ W.	½	per hour, experiment.
" 28.	3 55	19 21	S. E. by E.	None.		
" 29.	3 42	16 54	"	None.		
" 30.	3 37	15 53	"	None.		
" 31.	3 37	16 59	S. W. by S.			
Novem. 1.	2 51	15 11	S. by E. ½ E.			
" 2.	2 40	14 11	S. W. by W.			
" 3.	1 40	15 40	"			
	S.					
Novem. 4.	0 08	17 01	S. W. by W.			
" 5.	0 18	17 25	W. N. W.			
" 6.	0 34	18 02	"	N. W. by W.	¾	per hour, experiment.
" 7.	0 15 30	18 47	"	W. N. W.	¾	" "
" 8.	0 18	19 05	E. N. E.	West.	¾	" "
" 9.	1 16	20 26	S. W. ½ S.			
" 10.	2 53	21 03	S. W.	Sd. & Wd.	8	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 0° AND 40° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1838.	S. ° ′	W. ° ′			Miles.	
Nov. 11.	2 35	20 41	N. N. W.	West.	25	
" 12.	4 25	22 31	S. W. ½ W.	"	25	
" 13.	5 55	24 25	S. W.	"	28	
" 14.	8 35	26 29	"	"	30	
" 15.	11 13	28 27	"	"	30	
" 16.	13 34	30 18	"	S. W.	27	
" 17.	16 17	32 06	"	S. W. ½ W.	20	
" 18.	17 45	34 22	"	S. W.	20	
" 19.	19 57	35 18	"	"	25	
" 20.	21 11	36 58	S. W. by W.	"	15	
" 21.	21 51	38 39	W. S. W.	S. ½ W.	12	
" 22.	22 48	41 27	"	"	10	
1839.						Rio Janeiro.
Jan'y 8.	23 34	43 12	S. S. W.			Left Rio Janeiro.
" 9.	24 02	42 58	E. N. E.			
" 10.	24 59	44 31	S. W.	S. W.	12	
" 11.	27 11	45 47	S. S. W.	S. 38 W.	22	
" 12.	29 29	47 11	"	N. E.	¾	
" 13.	None.					
" 14.	32 02	49 46	W. ½ S.	2 days, S. 60 W.	60	
" 15.	32 38	50 15	S.W. by W. ½ W.	W. ½ S.	15	
" 16.	33 31	50 57	S. S. W.	N. by W.	12	
" 17.	34 48	51 35	S. ½ W.			
" 18.	36 50	52 42	S. by W.			
" 19.	39 00	54 39	"	N. E. by E.	12	
" 20.	39 26	56 01	S. W. by W.	N. E. by N.	12	
" 21.	40 03	55 51	"			
" 22.	40 04	57 16	S. W. by S.			
" 23.	40 14	59 25	S. W.			
" 24.	40 51	61 32	S. W. by S.			
" 25.	41 04	62 57	"			
" 26.	41 03	62 46	N. E.	W. S. W.	½	per hour, experiment.

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 40° AND 58° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
	S.	W.				
1839.	° ′	° ′			Miles.	
Jan. 27.	None.					Rio Negro.
" 28.	41 03	62 32	S. W. by S.			
Feb. 2.	41 26	62 23	S. E.			
" 3.	42 45	61 46	"			
" 4.	43 42	61 27	S. W. by W.	N. by E.		
" 5.						
" 6.	44 32	57 55	S. E.			
" 7.	45 32	59 05	South.	N. by E.	¾	per hour, experiment.
" 8.	46 35	59 42	S. E.	W. S. W.	⅜	" "
" 9.	47 14	59 31	"			
" 10.	48 23	61 38	S. W.			
" 11.	49 04	62 32	S. W. by S.	E. S. E.	⅜	" "
" 12.	50 54	65 37	S. S. E.			
" 13.	51 58	65 02	S. S. W.			
" 14.	53 11	65 35	S. W.			Straits of Le Maire.
" 15.	55 30	66 16	S. S. W.			" " "
" 16.	55 48	66 44	S. W. by S.	N. by W.	½	Tierra del Fuego. per hour, experiment.
						Orange Harbor.
April 22.	56 09	69 48	S. W.			
" 23.						
" 24.						
" 25.						
" 26.	57 28	75 03	N. W.			
" 27.	55 40	76 18	W. N. W.			
" 28.	None.					
" 29.	50 40	80 52	W. N. W.			
May 1.						
" 2.	46 12	78 52	E. N. E.			
" 3.	42 59	77 05	North.	S. by E.	½	per hour, experiment.
" 4.	42 12	78 08	W. ½ N.			
" 5.	1					
" 6.	40 23	78 03	N. W. by W.			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 40° AND 15° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1839.	S. ° ′	W. ° ′			Miles.	
May 7.	40 20	76 37	N.E. by E. ½ E.			
" 8.						
" 9.	39 07	75 43	W. ½ S.	N. E. ½ N.	½	per hour, experiment.
" 10.	38 33	75 02	W. by S.			
" 11.	}					Off Island of Mocha.
" 12.	}			N. N. E.	¾	per hour, experiment.
" 13.	36 12	74 36	N. E.	E. ½ S.	½	" "
" 14.	34 08	73 13	N. by E.	East.		
						Valparaiso.
June 8.	32 30	73 43	N. E.			
" 9.	32 38	74 48	N. E. by E.		⅜	per hour, experiment.
" 10.	32 12	74 21	E. N. E.			
" 11.	31 05	74 40	N. E.			
" 12.	28 15	74 54	N. W. by W.			
" 13.	25 20	76 38	N. by W.			
" 14.	22 13	76 39	"			
" 15.						No observations.
" 16.	19 23	76 40	N. by W.			
" 17.	17 12	76 51	"			
" 18.	15 17	77 02	"	Westerly set.		
" 19.	12 59	77 06	N. ½ W.			
" 20.	12 05	77 12	N. N. W.			Off San Lorenzo.
						San Lorenzo Island.
July 19.	13 02	88 44	W. by S.			
" " P.M.	13 06	86 40	W. S. W.			
" 20, "	13 38	89 15	"	S. E.	5½	
" 21, A.M.	14 04	91 10	"	S. 76° W.	5	
" 22, M.	14 26	93 55	"			
" 23, A.M.	14 59	96 47	"	S. 77° W.	9	
" " P.M.		97 14	"			
" 24, A.M.	15 35	99 39	W. by S.	N. 59° E.	8	
" 25, P.M.	15 40	103 11	"	S. 72° E.		

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 15° AND 18° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1839.	S. ° ′	W. ° ′			Miles.	
July 26, A.M.	15 51	105 56	W. by S.			
" " P.M.	15 53	106 08	"			
" 27, A.M.	16 56	108 15	S. W. by W.	S. 78° W.	8	
" " P.M.			W. ½ S.			
" 29, A.M.	17 54	112 53	S. W. by W.	S. 72° W.		
" " P.M.		112 59	"			
" 30, A.M.	17 35	113 31	N. W. ½ W.	N. 80° W.	10	
" " P.M.		113 48	W. N. W.			
" 31, A.M.	17 05	115 04	W. S. W.	N. 31° E.	11	
Aug. 2, A.M.	18 08	118 43	West.	S. E. by E.	3	
" " P.M.		118 52	W. by S.	S. 37° W.	10	
" 3, A.M.	18 05	119 40	West.	N. 28° W.	10	
" " P.M.		120 05	"			
" 4, A.M.	18 09	121 03	W. by S.	S. 37° W.	20	North ½ knot,
" " P.M.		121 19	West.			per hour, experiment.
" 5, A.M.	18 07	122 31	"	S. S. W.	10	N. E. ½ knot,
" " P.M.		122 47	N. W.	South.		per hour, experiment.
" 6, A.M.	18 03	124 19	West.	S. 75° E.	7	
" " P.M.		124 35	W. by S.			
" 7, A.M.	18 14	125 00	S. S. W.	S. 31° W.	15	N. E. ½ knot,
" " P.M.			S. S. E.			per hour, experiment.
" 8, A.M.	18 09	125 39	West.	S. 21° W.	12	N. E. ½ knot,
" " P.M.		126 20	W. ½ S.			per hour, experiment.
" 9, A.M.	18 10	128 27	"	S. 16° W.	12	N. E. ½ knot,
" " P.M.			"			per hour, experiment.
" 10, A.M.	18 22	131 15	"	S. 5° W.	20	
" " P.M.		131 36	"			
" 11, A.M.	18 21	133 22	"			
" " P.M.		134 01	W. S. W.			
" 12, A.M.	18 33	135 08	"			
" " P.M.		135 23	W. ½ S.			
" 13, A.M.	18 30	136 00	"			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 18° AND 15° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1839.	S. ° ′	W. ° ′			Miles.	
Aug. 13, P.M.		136 10	W. ½ S.			
" 14, P.M.	18 28	136 26	S. W. ½ S.			Off Clermont Tonnerre.
" 16, A.M.	18 21	137 04	W. by N.			Off Searle Island.
" 17, A.M.	18 05	137 12	N. E.			
" 18, P.M.	16 30	137 59	N. N. W.			
" 19, A.M.	15 23	138 46	"			Off Honden.
" " P.M.			N.			
" 20, A.M.	14 55	138 47	"			
" 21, A.M.	14 47	138 55	S. E. by S.			
" 22, A.M.	14 14	140 04	W. ½ S.	S. 33° W.	9	Honden Island.
" " P.M.			W.			
" 23, A.M.	14 02	140 59	"	N. 57° W.	15	
" " P.M.			W. S. W.			
" 24, A.M.	14 10	141 17	S. S. E.			Off Disappointment I.
" 25, A.M.	14 14	141 10	N. by E.	S. 78° W.	16	" "
" 26, A.M.	14 04	141 32	N. ½ W.			" "
" 27, A.M.	14 53	142 34	S. W.			
" 28, A.M.	15 46	143 49	"	N. 20° W.	8	
" " P.M.			"			
" 29, A.M.	15 44	144 37	W. N. W.	N. 40° W.	15	
" " P.M.			N. E.			
" 30, A.M.	16 04	144 57	S. by W.	N. 10° W.	13	Off Raraka.
" 31, A.M.	16 01	144 59	"			"
Sept. 2.	15 52	145 14	N. by E.	N. 22° W.	8	Off Carlshoff.
" 3, P.M.	15 29	145 39	N. by W.			
" 4, A.M.	14 38	145 36	N. ½ E.	S. 54° W.	12	
" " P.M.			S.W.byW.½W.			
" 5, A.M.	14 28	145 53	S. E.	S. 52° W.	16	Off Waterland.
" 7, A.M.	14 34	146 25	N.			
" " P.M.						Nairsa Island.
" 8, A.M.	15 00	147 31	S. W. by W.	N. 72° E.	11	
" 9, A.M.	15 53	148 13	S. S. E.			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 17° AND 13° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1839.	S. ° ′	W. ° ′			Miles.	
Sept. 9, P.M.			S. E.	S. 58° W.	4	Metia.
" 10, P.M.	17 15	149 21	S. by W.	N. 32° W.	10	
" 11, P.M.						Arrived at Tahiti.
" 26, A.M.						Eimeo.
" 27, A.M.	17 16	150 10	W. N. W.	None.		
" " P.M.			N. W.			
" 28, A.M.	16 06	151 49	W. N. W.	None.		
" " P.M.			W. by N.			
" 29, A.M.	15 55	153 31	W.	None.		
" " P.M.			S. W. by W.			
" 30, A.M.	15 47	154 34	"			Off Bellinghausen I.
" " P.M.		154 47	"			
Oct. 1, A.M.	15 38	156 06	W. ½ S.	None.		
" " P.M.		156 20	S. W.			
" 2, A.M.	15 12	156 41	W. N. W.			
" " P.M.		156 43	S. by E.			
" 3, A.M.	14 49	157 38	W. by N.	S. 14° E.	15	
" " P.M.		158 12				
" 4, A.M.	14 21	160 34	W.	N. 68° E.	12	
" " P.M.		161 26		W. ½ S.		
" 5, A.M.	14 09	163 39	W. ½ S.	N.	10	
" " P.M.		164 27	W. N. W.			
" 6, A.M.	13 56	166 26	W. ½ S.	N.	10	
" " P.M.			W. N. W.			
" 7, A.M.	14 25	168 02	S. W.			Off Rose Island.
" 8, A.M.	14 17	169 16	W.			Off Manua.
" 10, A.M.	14 11	170 06	W. S. W.			Off Tutuila.
						Samoan Group.
" 26, A.M.	13 59	171 15	N. N. E.			
" 27, A.M.	13 49	171 35	S.			Off Apia.
Nov. 11, A.M.	13 06	173 09	W. by S.			
" 12, A.M.	13 33	175 58	W. S. W.			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 14° AND 38° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1839.	S. ° ′	W. ° ′			Miles.	
Nov. 13, A.M.	14 31	178 36	S. W.	W.	30	
" " P.M.	14 57	179 35	W. by S.			
		E.				
" 15, A.M.	15 40	177 40	S. W. by W.			
" " P.M.	16 08	177 13	S. S. W.			
" 16, A.M.	17 47	175 51	"			
" " P.M.	18 20	175 35	S. by W.			
" 17, A.M.	20 45	174 32	"			
" " P.M.	21 14	174 00	S. W. by S.			
" 18, A.M.	22 41	171 55	W. N. W.	N. 10° W.	10	S. S. W. 6 fathoms,
" " P.M.	23 11	171 22	S. W. by S.			per hour, experiment.
" 19, P.M.	25 08	169 12	"			
" 20, A.M.	25 59	168 15	W. S. W.			
" 21, A.M.	27 10	166 43	S. W. by S.	N.	15	
" " P.M.		166 26	"			
" 22, A.M.	29 01	164 37	"	N. 5° W.	10	
" 23, A.M.	30 51	163 09	N. W.	N.	15	
" " P.M.			S. W. by S.			
" 24, A.M.	32 10	161 18	"	S. 17° W.	20	
" " P.M.		160 20	W. S. W.			
" 25, P.M.	32 56	160 22	W. N. W.	N. 17° E.	15	
" 26, A.M.	31 55	159 11	"	N. 61° E.	10	
" " P.M.		158 31	W. by N.			
" 28, A.M.	32 15	155 06	S. W. by W.	E.	7	
" " P.M.	32 30	154 24	S. W. ½ W.			
" 29, A.M.	33 07	152 46	"	S.	2½	per hour, experiment.
" " P.M.		151 58	"			
						Port Jackson.
Dec. 27, P.M.	35 42	151 04	S. by E.			
" 28, A.M.	36 48	151 00	S.	S.	30	
" " P.M.	37 04		S. S. E.			
" 29, A.M.	38 35	150 54	S. by E.	S. S. W.	17	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 39° AND 66° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1839.	S. ° ′	E. ° ′			Miles.	
Dec. 29, P.M.	39 04		S. S. E.			
" 30, A.M.	40 41	151 03	"	S. W.	20	
" " P.M.	41 15		"			
" 31, A.M.	42 47	151 47	"	N. W.	10	
" " P.M.	43 16		S. by E.	S. 85° E.	7	
1840.						
Jan. 1, P.M.	46 20	151 56	"	S. 10° E.	10	
" 2, A.M.	48 11	151 48	"			
" " P.M.			S. E.			
" 6, A.M.	53 24	157 15	S. E. by E.	N. 48° E.	30	
" 7, A.M.	54 20	160 47	"	S. S. E.	15	
" 8, P.M.	56 02	162 40	"	E. S. E.	20	
" 9, A.M.	57 54	162 56	S. S. E.			
" " P.M.	58 38	163 11	S. E. by S.			
" 10, A.M.	61 04	162 42	"			
" 11, P.M.	64 11	164 53	S. by E.			
" 13, A.M.	64 52	164 37	S. W. ½ S.			
" " P.M.			N.			
" 14, A.M.	63 55	164 01	N. by W. ½ W.	The currents could not be ascertained	after 10th January.	
" 15, A.M.	64 59	160 32	S. by W.			
" " P.M.	65 37	159 25	"			
" 16, A.M.	66 00	158 56	E. by N.			
" " P.M.			W. by N.			
" 17, P.M.	65 54	157 05	S. S. W.			
" 18, A.M.	65 45	156 07	S. ¾ W.			
" 19, A.M.	66 19	154 12	W. N. W.			
" 20, A.M.	65 41	153 46	N. W. ½ N.			
" " P.M.	66 09	152 34	S. S. W. ½ W.			
" 21, A.M.	66 07	151 25	S. W. by S.			
" " P.M.	66 27	151 05	S. E.			
" 22, A.M.	66 12	149 43	W. N. W.			
" 23, A.M.	66 46	148 04	N. W. by N.			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 67° AND 49° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1840.	S. ° ′	E. ° ′			Miles.	
Jan. 25.	67 04	147 42	S. W. by W.	Little or no current was found along the Antarctic Continent.		
" 27, A.M.	65 54	142 20	W. N. W. ½ W.			
" " P.M.	65 45	141 56	W. N. W.			
" 28.			S. S. E.			
" "	66 32	140 24	S. S. W.			
" 29.	65 30	140 50	S. S. E.			
" 30.	66 13	140 02	S. S. W.			
Feb. 1, A.M.	65 52	138 02	"			
" " P.M.	66 12	137 22	N. ½ W.			
" 5, A.M.	64 06	133 42	W. N. W.			
" 6.	63 40	134 35	S. S. W.			
" 7.	64 19	131 12	S. W.			
" 8.	65 03	128 50	N. W. by W.			
" 9, A.M.	65 03	125 19	W. N. W. ½ W.			
" " P.M.	65 08	124 20	W.			
			E.			
" 10, A.M.	65 27	121 35				
" " P.M.	66 44	120 06	W.			
			"			
			E.			
			"			
" 11, A.M.	65 04	116 20	N. W. ½ W.			
" 12, A.M.	64 57	112 16	"			
" " P.M.		111 20	W.			
" 14, A.M.	65 59	106 18	E. N. E.			
" 18, A.M.	63 31	98 50	S. S. W.			
" 20, A.M.	62 08	101 43	N. N. E.			
" 21.	61 34	100 49	W. N. W.			
" 22, A.M.	59 42	101 57	N. E. by N.	N. 50° E.	10	
" 23, A.M.	56 04	105 16	E. N. E.	N. 66° E.	10	
" 29, A.M.	50 01	133 10	E.	N. 84° E.	15	
Mar. 1, A.M.	49 25	135 45	E. by N.	N. 61° E.	17	

TABLE IV.—*Continued.*

CURRENTS.

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 49° AND 28° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1840.	S. ° ′	E. ° ′			Miles.	
Mar. 1, P.M.		136 49	E. ½ N.	N. 61° E.		
" 2.	49 32	139 45	"	S. 90° E.	12	
" 3.	49 42	143 35	N. E.	S. 50° E.	13	
" 4, P.M.	46 56	146 34	W.	N. 55° E.	10	
" 5, A.M.	46 08	147 40	N.	N.	12	
" 6, A.M.	43 36	149 51	N. by E.	N. 65° E.	25	
" 7, P.M.	41 58	151 32	N.	N. 12° E.	35	
" 8.	40 13	151 09	W. N. W.	N. 75° E.	12	
" 9, P.M.	38 19	151 15	N. ½ W.	N. 83° E.	20	
" 10.	36 30	150 43	N. N. W.	S.	17	
" 11.						Arrived at Sydney.
" 20.						
" 21.	35 26	154 26	N. by E.	S. 43° W.	15	
" 22.	34 54	156 41	N. E. by E.	S. 62° E.	10	
" 23.	34 14	157 17	E. N. E.	N. 5° W.	15	
" 24.	34 00	159 42	E. by N.	S. 17° E.	23	
" 25.	34 23	161 09	E. N. E. ½ E.	S. 51° E.	17	
" 26.	34 24	163 25	"	S. 53° E.	19	
" 27.	34 15	166 10	"	N. 22° W.	15	
" 28.	33 49	170 39	E.	N. 60° W.	25	
" 29.	33 45	173 44	S. E. by E.	S. 59° E.	15	
" 30.	35 07	174 18	S. E. by S.			Anchored at Bay of Islands, New Zealand.
April 7.	33 50	175 58	N.	S. 60° E.	10	
" 8.	32 48	177 07	N. by E.	N. 65° W.	12	
" 9.	32 24	177 51	N.	S. 20° E.	7	
" 10.	31 11	178 06	"	S. 50° E.	9	
" 11.	29 16	178 22	E. S. E.	N. 45° W.	10	
" 12.	30 19	178 52	E. N. E.	S. 55° W.	22	
" 13.	29 36	179 41 W.	N. E. by N.	E.	12	Off Raoul Island.
" 14.	28 58	178 35	E.	E.	10	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION DURING 1838, 39, 40, 41, 42.

BETWEEN 28° AND 4° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1840.	S. ° ′	W. ° ′			Miles.	
April 15.	28 41	177 46	N.	N. 66° E.	12	
" 16.	28 27	177 03	S. E.	S.	10	
" 17.	27 25	176 20	N. N. E.	S. 85° E.	8	
" 18.	26 07	175 25	N.	N. 33° E.	12	
" 19.	25 26	174 45	E. N. E.	"	10	
" 20.	24 26	174 47	N. by E.	"	15	
" 21.	22 39	174 49	N. by W.	S. 31° W.	15	
" 23.	21 36	175 10	S.	S. 61° E.	10	Anchored at Tongataboo.
May 4.	20 54	175 32	W. N. W. ½ W.	None.		
" 5.	19 51	177 43	W. N. W.			
Aug. 11.		E.				
" 12.	14 45	179 45	N. N. E.			
		W.				
" 13.	11 49	178 36	N. E.	W.	7	
" 14.	9 56	177 03	N. E. by N.	S. 45° E.	12	
" 15.	7 25	176 22	N. by W.	N. 85° W.	15	
" 16.	5 49	175 48	N. ½ W.			
" 17.	5 35	175 15	N. N. W.	N. 32° W.	18	
" 18.	5 58	174 41	S. E.	S.	15	
" 19.	4 37	174 40	N. by E. ½ E.			Off Gardner's Island.
" 20.	3 41	174 20	N. by E.			W. ½ N. 6 fms. pr. hr. ex.
" 21.	3 11	174 22				Off McKean's Island.
" 22.	2 47	174 12	E.			
" 23.	3 28	173 42	S. E.			S. by W. 4 fms. per hour, experiment.
" 24.	3 33	172 57	E.	S. 35° W.	15	
" 25.	3 46	172 36	S. E.	S. 30° W.	12	
" 26.	4 29	172 21	S. ½ E.			Off Hull's Island.
" 27.	5 02	172 14	S. E.			
" 28.	4 40	172 03	N. N. E.			
" 29.	3 08	171 08	N. E. by N.			
" 30.	3 48	171 50	S. S. W.	S. 35° W.	24	
" 31.	4 45	171 43	N. E.	S. 32° W.	20	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION DURING 1838, 39, 40, 41, 42.

BETWEEN 5° S. AND 24° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
	S.	W.				
1840.	° ′	° ′			Miles.	
Sept. 1.	5 47	170 35	E. ½ S.	None.		
" 2.	4 44	169 46	N. E.	None.		
" 3.	1 50	168 23	"	N. 54° W.	20	
	N.					
" 5.	3 13	167 25	N. E. by N.	N.	10	
" 6.	4 40	165 57	E. N. E.	N. 19° W.	25	
" 7.	6 12	164 09	N. E. by E.	N. 40° E.	15	
" 8.	6 48	163 03	N. E.	N. 76° E.	20	
" 9.	7 10	162 33	"	S. 70° E.	15	
" 10.	8 00	161 10	"	S. 80° E.	15	
" 11.	10 00	161 13	N. ½ W.	N. 85° W.	10	
" 12.	12 12	161 02	N. ½ E.	N. 40° W.	12	
" 13.	13 58	161 22	N. ½ W.	N. 42° W.	10	
" 14.	15 56	161 27	N. by W.	N. 28° W.	10	
" 15.	17 39	161 35	N. ½ E.	N. 80° W.	8	
" 16.	19 52	161 27	N. ½ W.	N. 35° W.	15	
" 17.	21 33	161 31	S. E. by E.	N.	5	
" 18.	20 12	160 26	"	W.	13	
" 19.	20 21	159 40	N.	N.	5	
" 20.	21 13	158 54	"			Current setting to the
" 21.	21 11	158 42	"			westward, but of no
Dec. 4.	22 03	156 16	N. N. E.	Westward.		strength.
" 5.	22 52	154 30	E. ½ S.			
" 6.	22 12	153 18	S. E. by E.			
" 7.						Anchored at Hilo.
1841.						
April 7.	22 10	159 11	N. W. by N.	Variable.		
" 8.	23 38	160 09	"	N. 52° W.	25	
" 9.	24 08	160 39	W. N. W.	S. 25° W.	15	
" 10.	24 46	161 54	N. W.	N. W.	5	
" 11.	24 46	160 31	E. N. E.	S. 28° E.	20	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION DURING 1838, 39, 40, 41, 42.

BETWEEN 25° AND 20° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1841.	N. ° ′	W. ° ′			Miles.	
April 12.	25 34	160 23	N. W. by N.	N.	8	S. E. 2 fms. per hour, experiment.
" 13.	25 55	160 43	N.	N. 37° W.	10	
" 14.	26 43	160 25	N. by E.	W.	10	
" 15.	28 28	159 32	"	S. 33° E.	8	
" 16.	30 14	157 06	N. E. by N.	N. 84° E.	15	
" 17.	31 11	155 30	"			
" 18.	32 11	154 16	"	N.	5	
" 19.	33 12	152 36	N.	S 88° E.	12	
" 20.	34 42	153 42	N. W.	S. 52° W.	10	
" 21.	37 14	152 21	N. N. E.	S. 33° E.	8	
" 22.	40 01	149 30	"	E.	10	
" 23.	43 01	146 07	N. E.			
" 24.	44 32	142 10	N. E. by N.	S. 23° E.	45	
" 25.	45 56	137 06	N. E.	"	15	
" 27.	46 10	128 13	E. N. E.	"	40	
May 2.						Anchored in Port Discovery.
Nov. 5.	32 11	126 05		S. 25° W.	33	
" 7.	27 01	131 47		S. 41° W.	5	
" 8.	25 02	134 01		S. 73° E.	10	
" 9.	23 15	136 03		S. 5° E.	8	
" 10.	21 09	138 30		S. 41° W.	8	
" 11.	21 02	141 35		N. 50° W.	20	
" 12.	20 50	144 37		N. 63° E.	12	
" 13.	20 44	148 29		S. 61° E.	10	
" 14.	20 08	150 49		N. 85° W.	8	
" 15.	20 07	153 23		N. 42° W.	15	
" 16.	21 05	156 37		W.	10	
" 17.						Anchored at Honolulu.
" 28.	21 19	158 46				
" 29.	20 26	160 27		N. 82° W.	22	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 19° AND 14° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1841.	N. ° ′	W. ° ′			Miles.	
Nov. 30.	19 02	162 31		N. 65° W.	8	
Dec. 1.	19 19	165 25		S. 81° E.	7	
" 2.	19 21	167 36		N. 71° W.	12	
" 3.	18 21	171 04		N. 65° W.	8	
" 4.	16 34	173 20		N. 14° W.	25	
" 5.	15 18	175 25		N. 22° W.	17	
" 6.	15 07	176 58	W. by S.	N. 66° W.	25	
" 7.	15 08	178 20		N. 39° W.	5	
		E.				
" 9.	14 55	179 57	"	*N. 86° W.	32	* Two days.
" 10.	14 56	178 52	"	S. 84° W.	19	
" 11.	14 58	177 44	"	N. 84° W.	19	
" 12.	14 47	176 45	W. N. W.	S. 81° W.	25	
" 13.	14 57	175 39	W. S. W.	N. 85° W.	13	
" 14.	15 00	174 50	W. by S.	N. 10° W.	6	
" 15.	15 33	172 34	W. ½ N.	N. 55° W.	13	
" 16.	16 02	170 55	W. by S.	S. 49° W.	11	
" 17.	16 54	168 55	N. W. by N.	N. 83° W.	16	
" 18.	18 29	168 25	N. by W. ½ W	N. 35° W.	5	
" 19.	19 04	167 36	W. by N.	S. 11° W.	5	
" 20.	19 14	166 30	W. by S.	S. 88° W.	27	
" 21.	19 24	165 04	"			Off Wake's Island.
" 22.	19 13	163 40	"	N. 56° W.	15	
" 23.	18 54	162 11	"	N. 50° W.	10	
" 24.	18 42	159 44	"	S. 50° E.	13	
" 25.	18 15	155 41	W. S. W.	"	4	
" 26.	18 48	152 28	W.	E.	2	
" 27.	18 57	150 02	"	S. 67° E.	8	
" 28.	19 13	147 50	W. ½ S.	N. 35° W.	17	
" 29.	19 15	145 25		S. 84° W.	11	
" 30.	19 32	144 48				Off Assumption I.
" 31.	19 34	114 20	W. by N.	N.	2	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 19° AND 2° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1842.	N. ° ′	E. ° ′			Miles.	
Jan. 1.	19 40	140 54	W.	N. 73° W.	8	
" 2.	19 59	138 08	W. S. W.	E.	11	
" 3.	19 35	134 28	W. by N. ½ N.	N. E.	3	
" 4.	20 11	131 24	W. ½ N.	W.	9	
" 5.	20 17	129 20	"	S. 80° W.	22	
" 6.	20 23	126 30	W.	N. 35° W.	10	
" 7.	20 26	124 28	W. by S.	N. 5° E.	15	
" 8.	20 10	121 33	"	N. 21° W.	23	Basbee Passage.
" 9.	19 08	119 35	S.	N. 17° W.	25	
" 10.	15 56	119 29	"			
" 12.						Anchored in Manilla Bay.
" 24, A.M.	12 03	121 08	S. E. by E.			
" " P.M.	12 13	120 58	N. by W. ½ W.			
" 25, A.M.	12 06	121 09	S. E.			
" " P.M.	12 13	121 21	N. N. W.			
" 29.	10 55	121 51				
" 30.						Anchored at Caldera.
Feb. 2.	6 37	121 12		S. by E. & N. N. W.		In the Straits of Basilan, tides set N.N.W. and S. by W.
" 6.	6 07	120 41	W. ½ N.			Anchored at Sonng. Off Soung tides irregular, influenced by winds. Current sets in Feb'y northw'd and westw'd.
" 7.	7 03	118 49	N. W. by W.	W. S. W.	¾ per hr. expm't.	
" 13.	7 36	115 07	W.	N. 5° E.	18	Anchored near Mangsee Islands.
" 14.	6 50	112 52	W. by S.	N.	22	Current setting to the W. S. W. 6 fms. pr. hr.
" 15.	6 35	110 30	"	"	13	Tide sets S. S. E. and N. W. by N.
" 16.	5 48	108 44	S.W.byW.½W.	W.	12	
" 17.	4 50	106 41	S. W.	S. W.	10	
" 18.	2 59	104 45				Anchored at Singapore.
						Straits of Banca. Current in Straits S. W. ½ S. 1 mile per hour.

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 7° AND 35° S. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1842.	S. ° ′	E. ° ′			Miles.	
March 7.	7 30	103 42		W.	5	
" 11.	15 53	99 07		S. 40° E.	15	
" 12.	17 05	98 04		S. 50° E.	7	
" 13.	17 21	96 15		S. 35° E.	12	
" 14.	17 46	94 06		S. 50° W.	9	
" 15.	18 19	91 49	W. by S.	N. 80° E.	15	
" 16.	18 20	90 19		"	15	
" 17.	18 36	88 12	W. ½ S.	N. 40° W.	20	
" 18.	19 09	84 56	W. by S.	N. 50° W.	15	
" 19.	19 53	82 02	"	W.	5	
" 20.	20 33	79 28				
" 21.	22 31	79 07	S. S. W.	S. 50° E.	15	
" 22.	23 47	78 26	S. W. by S.	"	10	Indian Ocean.
" 23.	23 08	76 10	W. by N.	N. W.	15	
" 24.	22 48	72 40		"		
" 25.	23 16	68 43	W.	N. 50° W.	12	
" 26.	23 42	64 49	"	"		
" 27.	24 17	60 48	"	"	10	
" 28.	25 11	56 24	"	N. 10° W.	12	
" 29.	26 10	52 09	"	"	12	
" 30.	27 01	48 47	"	"		
" 31.	27 31	46 06	"	"		
April 1.	28 12	44 02	W. ½ N.	N. 40° W.	20	
" 2.	28 22	40 57	W. N. W.	S.	10	
" 3.	29 04	37 31	W. by S.	N. 50° W.	23	
" 5.	31 53	31 30	N. W. by N.	"	25	
" 6.	32 39	30 45	W. S. W.	S. 30° W.	25	
" 8.	34 37	24 23	N. N. E.	N. 30° W.	8	
" 9.	34 26	23 48	"	"	10	
" 10.	34 38	23 39	S. W. by S.	S. 30° W.	30	
" 11.	36 04	22 54	W. S. W.	N. 40° W.	10	
" 12.	35 12	19 54	N. W. by N.			

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 32° S. AND 1° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1842.	S. ° ′	E. ° ′			Miles.	
April 14.						Anchored in Table Bay.
" 19.	32 37	15 25	W. by S.			
" 20.	31 22	13 45	N. W. by W.	N. 35° W.	20	
" 21.	30 50	12 36	N. W. by N.	"	13	
" 22.	29 53	11 34	W. ½ S.	N. 10° E.	15	
" 23.	28 25	8 51	N. W. by N.	"	12	
" 24.	26 48	6 25	N. N. W.	N. 10° W.	12	
" 25.	25 25	4 53	N. by E.	"	7	
" 26.	24 45	4 06	N. N. W.	N. 5° W.	10	
" 27.	23 36	2 42	"	"	10	
" 28.	22 23	1 17	"	"	10	
		W.				
" 29.	20 33	0 50	"	"	10	
" 30.	18 20	2 41	N. by W. ½ W.	N.	15	
May 1.	16 18	5 17	N. N. W. ½ W.	"		Anchored at St. Helena.
" 3.	14 41	7 14	"	S. W.	13	
" 4.	13 22	9 10	N. W. by N.	N. 15° W.	10	
" 5.	12 01	11 04	"	"	10	
" 6.	10 56	12 34	"	N. 10° E.	10	
" 7.	9 46	14 02	N. W. by W.	"	10	
" 8.	9 19	16 00	"	"		
" 9.	8 53	17 15	"			
" 10.	8 24	18 48	"	E.	10	
" 11.	7 09	21 11	N. W.			
" 12.	5 52	23 37	"			
" 13.	4 12	25 26	N. W. by W.			
" 14.	3 10	27 51	N. W. by N.	S.	8	
" 15.	1 46	29 31	N. N. W.	S. W.	30	
" 16.	0 30	30 30	"	S. 67° W.	28	
	N.					
" 17.	0 33	31 02	N. W. by W.	S. 49° W.	30	
" 19.	1 44	32 57	N. by W. ½ W.	S. 10° W.	10	

TABLE IV.—*Continued.*

CURRENTS,

BY THE EXPLORING EXPEDITION, DURING 1838, 39, 40, 41, 42.

BETWEEN 2° AND 34° N. LATITUDE.

Date.	Latitude.	Longitude.	Ship's Head.	Current.		Remarks.
				Direction.	Velocity.	
1842.	N. ° ′	W. ° ′			Miles.	
May 20.	2 58	34 02	N. W. by N.	S. 14° W.	30	W. S. W. ¼ mile per hour, experiment.
" 21.	4 37	36 19	N. W.	S. 20° W.	10	
" 22.	6 40	38 46	N. W. by N.	W.	25	
" 23.	8 52	40 56	"	N. 85° W.	10	
" 24.	11 17	43 17	N. W. ½ W.	S. W.	15	
" 25.	13 22	45 44	N. W.	"	18	
" 26.	15 47	48 29	"	"	20	
" 27.	18 02	51 25	"	"	10	
" 28.	20 18	54 17	"	S. 15° W.	10	
" 29.	22 16	57 09	N. W. ½ W.	"	10	
" 30.	23 50	59 26	"	"	12	
" 31.	25 13	61 23	N. W.	"	10	
June 2.	29 35	68 39	N. W. by W.	S. 10° W.	25	
" 4.	30 40	70 16				
" 5.	31 00	71 03		N. 20° W.	10	
" 6.	32 18	71 49	N. N. W.	S. 40° W.	15	
" 7.	34 01	72 50	"	N. 50° E.	35	

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