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VOYAGE TO THE SOUTHERN ATLANTIC OCEAN

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THE ISTHMUS OF DARIEN

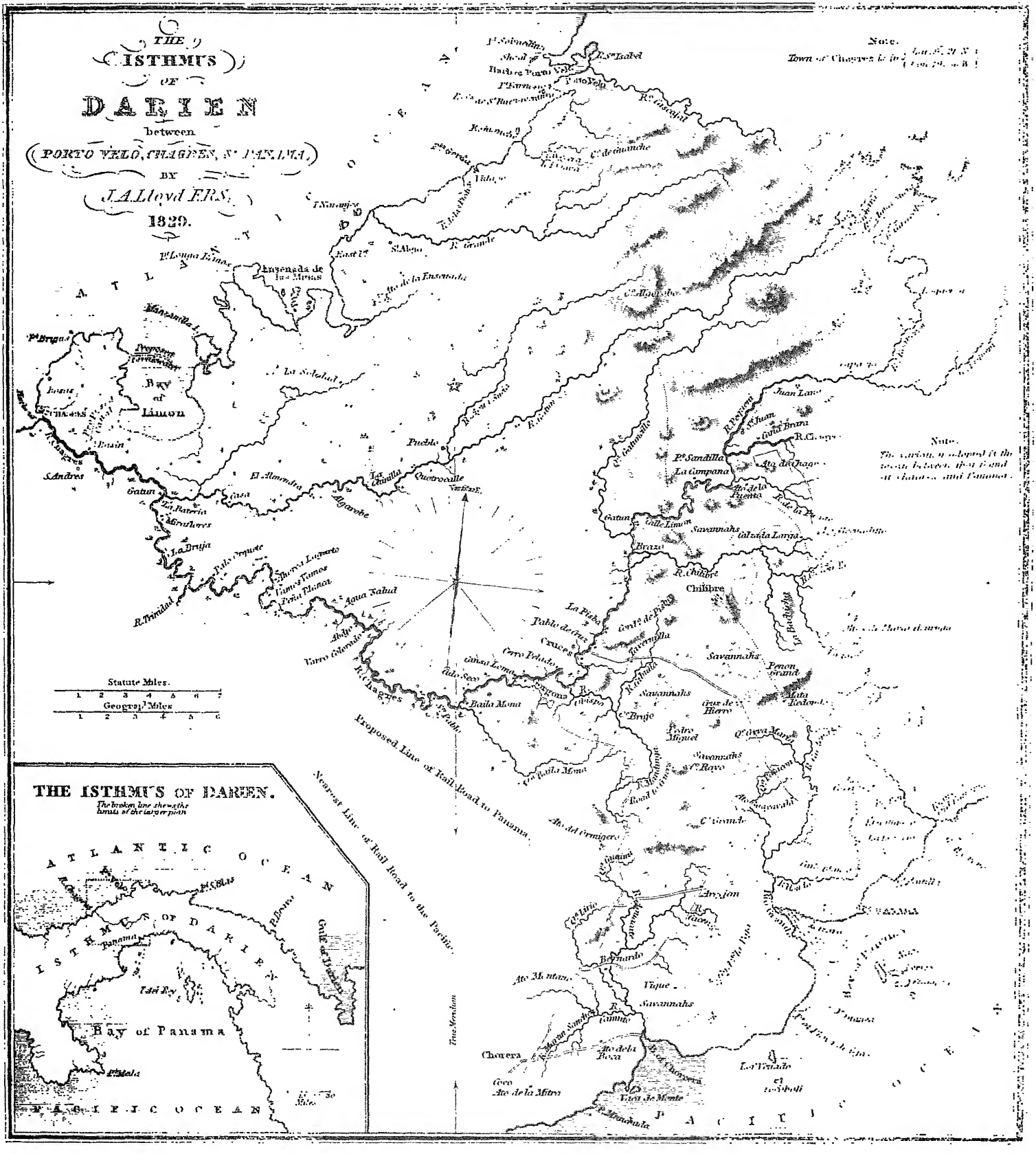
between

PORTO VELO, CHAGRES, & PANAMA.

BY

J.A. Lloyd F.R.S.

1829.



NARRATIVE

OF A VOYAGE TO THE

SOUTHERN ATLANTIC OCEAN,

IN THE YEARS 1828, 29, 30,

PERFORMED IN H. M. SLOOP CHANTICLEER,

UNDER THE COMMAND OF THE LATE

CAPTAIN HENRY FOSTER, F.R.S. &c.

BY ORDER OF THE LORDS COMMISSIONERS OF THE ADMIRALTY.

FROM THE PRIVATE JOURNAL OF

W. H. B. WEBSTER,

SURGEON OF THE SLOOP.

IN TWO VOLUMES.

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IN

HIS MAJESTY'S SLOOP

CHANTICLEER.

CHAPTER I.

Climate of Ascension.—Seasons.—Setting Sun.—Rollers.—The phenomenon accounted for.—Heights of the Mountains of Ascension.—Comparative resources of St. Helena and Ascension.

THE climate of Ascension must be regarded as singularly healthy. In the heart of the south-east trade wind — in the midst of the ocean, with the driest soil in the world, and the total exclusion of anything like swamp or marsh, and the absence of all vegetation, there is nothing to taint the air or to produce impurity. Fever has occasionally been imported from the pestiferous coast of Africa, but there is none epidemic or peculiar to this island. A mild species of dysentery is the most common

complaint, and beyond this we cannot specify any. The garrison here have been uniformly healthy, and the crew of the Chanticleer during our stay of four months were free from all disease. The people on the island have a healthy appearance, and they expose themselves to the sun without any ill effects. Sores heal readily, fractures unite quickly, inflammatory complaints are not obstinate, and every one enjoys uninterrupted good health. Such are the benefits of pure air, and so little is high temperature conducive to disease, that the enfeebled invalid from Africa recovers energy and strengthens under the refreshing effects of the sea-breeze. The thermometer ranges in the day from 84° to 92° in the shade, during the period in which the sun has south declination, the hottest time at Ascension, or from September to March. It is rarely below 82° in the night. The barometer never rises above 30·1 nor falls below 29·8, the mean for the whole year being 29·95. During the hottest period the barometer is lowest, reaching 30·0, but during the cooler half of the year the barometer stands higher, and generally above 30·0. From March to September the thermometer ranges from 76° to 82°; and in

the evening there is sometimes a little fall of dew, but it is a very rare occurrence.

The rainy season at Ascension is about March and April, and is sometimes only attended by a few slight showers; while other seasons are remarkable for the quantity of rain that falls. The average fall of rain throughout the year is very limited, and it is this circumstance that constitutes the great drawback to the natural disadvantages of the island. After the rains the air resounds with the chirruping of crickets, the plains become decked with a short-lived verdure from the purslane, the rivers of water are swollen and even glutted for a day, and the nourishing fluid is gone, not to return perhaps for years. The coolest season of the year is the driest. During the months of March and April lightning is sometimes seen in the north and north-west quarters, and an occasional clap of thunder is seldom heard. In May, the clouds have very frequently a motion from the west and north-west against the usual trade, and light airs from those quarters also occur. The rains in the lower part of the island generally occur in the night, or in the very early part of the morning.

But what has been here said of the climate of Ascension does not apply to the Green Mountain where the temperature ranges from 60° to 86°, averaging about 75°; and the height of the barometer about 27·75. The mountain is generally more or less obscured by mist some part of the twenty-four hours, and I doubt not there being ample condensation to afford a large supply of water if the bed or channel of it below could be found; but the greater part of the soil is so loose and porous that it is probably diffused over a large space, and I am much inclined to believe that in some of the plains or large runs at the base of the mountain some water may yet be found.

The weather at Ascension may be considered as too fine; it is far too hot for the enjoyment of any exercise during the day, which is passed by many there in listless idleness. The day-break, as is always the case in equatorial regions, is short, the sun bursts forth suddenly in unclouded splendour; his heat becomes oppressive in the early part of the morning, when there is generally but little wind to counteract his rays; his force throughout the day keeps the thermometer from 84° to 90° in the shade;

and the walk over the heated and rugged surface of the island, where not a solitary flower blooms to waft "its sweetness o'er the desert air," and few or no traces of the most diminutive plants can be discerned; where not a rill of water is to be seen, and where no shady groves invite the wandering step: all this is far from enticing. But let us give Ascension its due. Although the heat at times comes with the puffs as hot as the sirocco, it is tempered by a delightful sea-breeze. Towards the evening, when the sun's heat is endurable, a person may ramble out and catch a view of his beauties as he departs—one of my most delightful occupations while the Chanticleer was at Ascension. It is impossible to describe fully all the beauties of the setting sun; and to come at all near it would require greater powers of imagery than mine.

A bank of clouds generally increases the effect, their tints and hues varying as the sun descends beyond them, while they frequently resemble distant mountains lit up with his ruby beams. If the horizon is clear, he sets in all his splendour; and, as he dips beneath the distant horizon, the whole western skies glow with the

radiance of his golden beams. Suddenly, he disappears; twilight quickly fades away as he sinks, and darkness hastens on apace. But night comes with peculiar charms: where the day has no beauties to display in the land the darkness veils its nakedness: all is serenity, save the murmur of the distant waves, or the twittering shriek of some wandering sea-fowl. Not a cloud is seen to stain the purity of the firmament above, which, as a glassy sea of azure, is studded with its glorious host of clustering stars shining with peculiar lustre. The night at Ascension is the most delightful time of the whole twenty-four hours. It is in the still serene hour of night at Ascension, where neither dew nor chilly vapour falls to check the full enjoyment of it, that groups of its inhabitants are seated in social converse beneath the canopy of heaven, or dwelling on the thought of friends far away; of England, home and love, whose magic spell still holds the captive heart, although on a distant foreign strand. Each is eloquent in his cause, while some relate heroic tales of honours dearly won, or ill-requited service.

One of the most interesting phenomena that

the island affords, is that of the rollers; in other words, a heavy swell producing a high surf on the leeward shores of the island, occurring without any apparent cause. All is tranquil in the distance, the sea-breeze scarcely ripples the surface of the water, when a high swelling wave is suddenly observed rolling towards the island. At first it appears to move slowly forward, till at length it breaks on the outer reefs. The swell then increases, wave urges on wave, until it reaches the beach, where it bursts with tremendous fury. The rollers now set in and augment in violence, until they attain a terrific and awful grandeur, affording a magnificent sight to the spectator, and one which I have witnessed with mingled emotion of terror and delight. A towering sea rolls forward on the island, like a vast ridge of waters, threatening as it were to envelope it; pile on pile succeeds with resistless force, until, meeting with the rushing off-set from the shore beneath, they rise like a wall, and are dashed with impetuous fury on the long line of the coast, producing a stunning noise. The beach is now mantled over with foam, the mighty waters sweep over the plain, and the very houses at George Town are shaken

by the fury of the waves. But the principal beauty of the scene consists in the continuous ridge of water crested on its summit with foam and spray, for as the wind blows off the shore, the over-arching top of the wave meets resistance, and is carried, as it were, back against the curl of the swell; and thus it plays elegantly above it, as it rolls furiously onward graceful as a bending plume; while, to add still more to its beauty, the sun-beams are reflected from it in all the varied tints of the rainbow.

Amid the tranquillity which prevails around, it is a matter of speculation to account for this commotion of the waters, as great as if the most awful tempest or the wildest hurricane had swept the bosom of the deep. It occurs in situations where no such swell would be expected, in sheltered bays, and where the wind never reaches the shore. The strong and well-built jetty of George Town has once been washed away by the rollers, which sometimes make a complete breach over it, although it is twenty feet above high-water mark. On these occasions the crane at its extremity is washed round in various directions, as the weathercock is turned by the wind, and landing becomes im-

practicable for the space of two or three days. Such are the rollers of Ascension, and like unto them are those of St. Helena and Fernando Noronha. The season in which the rollers prevail is from December to April, not but that they do occur at other periods, and they have been felt severely in July. Ships at the anchorage are perfectly secure, and they have to apprehend no danger unless within the immediate influence of breakers. Not only are the seasons of the rollers the same at St. Helena and Ascension, but they sometimes are simultaneous in occurrence. The Chanticleer, while at anchor at St. Helena on the 17th and 18th of January, experienced some very high rollers, insomuch that Captain Foster and his gig's crew landed with the utmost difficulty. On our subsequent arrival at Ascension, I inspected the meteorological journal of my friend Mr. Mitchell, the surgeon of the island, and found it noted that the rollers were so violent on the 15th, 16th, and 17th of January, that landing was impossible. Here, then, is a coincidence as to time.

The cause of the rollers have been speculated on, and various conjectures have been formed

of them. Some have attributed them to the effects of the moon:

> "Whom Ocean feels through all his countless waves,
> And owns her power on every shore he laves."

And others have attributed them to the tides; but it is evident that these have nothing to do with them. They occur in the most tranquil season of the year, when the south-east trade wind is often very light, where the vast volume of water is constantly impelled in one direction. There is then a tendency to a back-set, or a rush of water in a contrary direction, and a tumultuous swell is produced wherever it meets with the resistance from the islands and the banks on which they are based, as well as the shores of a continent. The long steep beaches of Ascension are admirably adapted for the full display of the effect which has been just described.

We remained nearly four months at Ascension, during which time Captain Foster was employed on shore in making experiments both with the copper and iron pendulum, with the view to ascertain the influence, if there was any, of magnetism. The result, I believe, proved that there was none, although iron ore abound-

ed to a considerable extent in some parts contiguous to his place of observation. Besides his experiments in the Square, he was anxious to avail himself of the favourable opportunity of making some experiments with the pendulum at the elevated station of the Mountain House, where he was readily accommodated. But during his stay on the mountain the weather was so foggy and perpetually so overcast, (although very fine below,) that he was prevented from making any astronomical observations. Lieutenant Williams and Mr. Collinson were employed with Captain Foster, assisting in his observations, more particularly in the diurnal variation of the needle, the horary oscillation of the barometer, and the various meteorological phenomena. A series of valuable facts were recorded, which were in many particulars very interesting. They levelled up the Green Mountain, and ascertained by that process that the Mountain House was 2230 feet above the level of the sea, and the summit of the mountain 2805 feet. Cross Hill was also found to be 870 feet above it. Lieutenant Williams was also employed in surveying a part of the island, and sounding the approaches to

the reef near the anchorage. The information which I acquired relative to the island during our protracted stay, I have endeavoured to embody in the foregoing narrative; and that which I obtained by the kindness of the intelligent friends I found there, has not, I hope, been disparaged or unduly stated.

Our time, which otherwise might have passed tediously, was beguiled by the almost daily arrival of ships from India, China, and the Cape. They touched at the island merely for the purpose of obtaining turtle, or occasionally a small supply of provisions. Besides these, we were visited by several of his Majesty's ships, among which was the Pallas, Captain Fitz Clarence, on her return from India, with Lord Combermere and suite. Part of the African squadron were also here, and at one time the Sibylla, the Athol, and Ariadne; rather a large number to be quartered on the trifling resources of Ascension.

As a conclusion to my remarks on Ascension, and its sister island St. Helena, I have drawn up the following comparison between them; premising that the latter has been long colonized, and the former has not.

St. Helena.	Ascension.
Size—circumference 30 miles, extreme length 10½, ditto breadth 6¾.	Size—circumference 24 miles, extreme length 9, ditto breadth 5¾.
Highest peak, 2697 feet.	Highest peak, 2818 feet.
Acres of land under cultivation 8000.	Acres under cultivation 40, available 1800.
The water of the spring which supplies James Town gives 300 tons per day; besides which there are springs in every valley.	A lack of water: none to be seen: a hogshead of dirty stuff considered a treasure. People on the island on a very restricted allowance: cannot even keep a pig for want of water.
Anchorage good.	Anchorage good.
Port dues heavy.	Port dues, none. Vessels deserve a premium for touching.
Climate healthy: occasional droughts.	Climate very healthy—occasional droughts presumed.
Number of inhabitants 4000.	Inhabitants 160.
A profusion of water.	Short allowance of water.
Country pleasant.	Country none.
Accommodations good, but dear.	Accommodations none. Courtesy expensive.
Products: potatoes, 6000 bushels sold annually:—water-cresses, blackberries, and gooseberries, abundant.	Potatoes, a very few for the officers' table: sweet potatoes; a few gooseberries. Plenty of turtle.
Expense 50,000*l.* per year.	Expense unknown, but it will absorb a mint.

By which it appears that St. Helena is beyond a doubt the favoured island, and the proper resort for shipping.

CHAPTER II.

Sail for Fernando Noronha.—Description of this Group.—The Pyramid.—Vegetation.—The Sleep of Plants.—Establishment of Fernando Noronha.—Native Fishing.—Native Watermen.—Resources of the Island.—Capons.—Climate.

Captain Foster having completed his long series of observations, it was with no regret that we made preparations for sea, and on the 6th of June bade a final adieu to Ascension. Our course was shaped for Fernando Noronha: the weather being fine, and the wind favourable, we made this island within a few days, and came to an anchor off the village in Peak Bay on the twelfth following.

Fernando Noronha consists of three distinct and principal islands, one of which takes the distinguishing name assigned to the whole, the others being considered mere appendages.

The large island is used by the Brazilians as a place of transportation for criminals, as well as for the exile of political delinquents. This island is about seven miles long, and two and a quarter broad. Rat Island, the next in size, is about a mile square ; Booby and Egg Islands are small; and Mount St. Michael is a mere rocky islet rising vertically from the sea.

On arriving at Fernando Noronha, after tarrying so long at Ascension, we were enchanted by the beautiful scenery it presented. The shore is scooped out by divers inlets, and embossed by green promontories, which are connected by circling beaches, where the rippling waves chase each other over the silvery sands, and bathe the flowrets of the skirting woods. A fresh, luxuriant verdure crowns the summits of the hills, blending its soft hue with the general contour of the island. A richness and variety of vegetation is seen everywhere, excepting on a colossal pyramid of naked rock, which, rising from the bosom of a grove, stands erect in barren ruggedness, towering majestically over the smiling and fruitful scenes around. It is a gigantic block, the summit being eight hundred

feet above the level of the sea. It is an excellent mark for seamen; and when traversing the woody dales of the island, may be seen through the breaks or above the summits of the trees, presenting a monument of grandeur and sublimity on which the eye might rest without satiety.

The scenery of Fernando Noronha throughout is all fertility and beauty. There are no romantic hills and dales, but everything is on a moderate scale and pleasing to the eye. The vegetation is that of a thickly wooded grove rather than that of the dense forest, for it admits of a walk even through its most shaded parts. There is an inland lake in the island, and one or two trifling brooks, but no permanent streams of any importance. In the wet seasons the island is one continued swamp and bog; while in the summer it is dry and arid, and occasionally altogether deficient of water. The soil is a fine rich loam of a considerable depth, and has a reddish tinge. There is upland pasture for sheep and rich plains for cultivation, besides little fairy vales, blooming in all the beauty of verdure. The sandy beaches

in the tranquil bays are sweetly picturesque, especially at evening's sober hours; the sand is as smooth as a well-rolled path, and the gentle ripple of the waves scarcely disturbs the tranquillity which reigns around.

The distinguishing feature in the vegetation at Fernando Noronha is the abundance of climbing plants which block up the woods with their descending stems, and form a thicket, in many parts, of impenetrable brush-wood. Amid the superfecundity of vegetation, the climbers are particularly conspicuous, such as the convolvuluses and the *solanums*, which mount the loftiest trees, crowning them with garlands of flowers and berries. Others again, descending from their lofty station, desirous of obtaining a hold of the ground, when their pendent stems are within a few feet of it, form a circle of fibrous roots and spread them around ready for vegetating.

Thus above and below an equal contention prevails; every spot is occupied by luxuriant vegetation fantastically intermingled. The various colours of the many-tinted foliage, the gay festoons and wreaths of flowers on the trees, fill up

the vacuities and impart a graceful charm to the whole. But these parasites repay the aid they borrow by conferring a temporary elegance, first encumbering the trees and finally destroying them. Thus the stems of the largest trees are clasped by these creepers, and wear the aspect of premature age, which is too soon realized by the numbers which beset them and deprive them of support. What a beautiful simile does this afford to man when he blindly yields himself to the dazzling but dangerous pleasures of life, which, although they afford a temporary enjoyment, please but to lead to premature age, and finally bring him to an untimely end. At Fernando Noronha a scene of perpetual and vigorous vegetation is presented of flowers fresh in hue and kissed by the breath of heaven. At the close of the day it is most interesting to watch the plants folding up their leaves and drooping their heads, as if wearied by the fervour of the sun. I do not recollect ever having noticed the sleep of plants so distinctly as here, the change in the aspect of the leaves is so very remarkable. The acacias were completely shut up, which in my opinion serves to increase the

delicious fragrance of the flowers. The cassias were folding and reclining, the liquorice pea was indeed asleep, and the whole effect of the grove was totally altered from that when the sun was up.

Fernando Noronha is garrisoned by a small party of Brazilian soldiers, under the command of a major, who fills the important office of governor of the island. He has a few staff officers and about one hundred men. The islands are protected by several forts, which at present are not all in an efficient state; but if in good condition and well manned, they would present a formidable means of defence. A small village is seated on the shore of Peak Bay, built in the form of a square. The houses composing it are not worthy of note, but are sufficient for the place. A neat chapel stands on the hill over the village, which also boasts a clean and comfortable hospital, and a respectable and commodious house for the governor. The other principal buildings consist of a set of barracks for the soldiers, a tank or large cistern for water, a bath, and a prison in which the culprits are safely lodged every night, after

being allowed the liberty of ranging about the island by day.

Fernando Noronha had exchanged governors since our visit in 1828, and the discipline had undergone a considerable change. During the time the former governor was here, all the degrading marks of their condition and the full rigour of the law was enforced; now all were unshackled and free to roam about the island, and I must say that I saw no ill effects of the new system. Lieutenant Williams, Mr. Collinson, and myself, lived on shore for a month without the least molestation, and traversed the most remote parts of the island without being stopped by them. They were always civil to us, and obliging in the greatest degree; and had we not known the fact, we should certainly not have discovered that we were living among transported felons. Most of the houses at Fernando Noronha have gardens attached to them, and the governor has a farm at a short distance from the village, from whence his table is supplied.

About a league from the village, in a south-east direction towards Tobacco Bay, are exten-

sive fields of Indian corn and cotton, besides a plantation of cocoa-nuts and a tolerable garden. A brick and tile manufactory is also carried on there, but there are no lime-kilns.

The employment of the people at Fernando Noronha consists principally in fishing, for which purpose they have a manufactory of cotton line. Agriculture is much neglected, the greater part of the island being in a state of nature; but such is the richness of the soil, that it would repay them well for any trouble they would bestow on it.

The process of drawing the seine is very interesting. This consists of a few long stems of a creeping convolvulus with the leaves on it, which are twisted together into a kind of mass or lump. Thus prepared it is dragged into the water just within the break of the surf; and when a fish is seen within the scope of their leafy net, they drag it quickly ashore with the view of entangling it among the leaves. This device is sometimes very successful. The cotton hand-nets that they also use are very neatly constructed, and with these they reap a much richer harvest. Whilst the operation of draw-

ing the seine is going forward on the beach, some are occupied angling from the rocks of the projecting points, and among them sufficient fish is caught for the provision of the whole islanders. I have frequently been amused by this animating scene, which appears to be much enjoyed by those employed in it. Groups of naked fellows may be seen seated on the beach watching the operations of the fishermen; while the pelican is diving continually about the edge of the surf, and the man-of-war bird over him, who, as the pelican rises with his prey, darts down on him with incredible rapidity and makes him instantly disgorge it. There is something exceedingly interesting to observe the man-of-war bird poising himself steadily in the air, apparently motionless, and suddenly pouncing down upon the pelican with such velocity as to make him instantly drop his prey, which is as readily taken possession of by this second plunderer.

The attempts of these islanders at navigation are confined to the catamaran, not a single boat being found throughout the whole island. On the arrival of the Chanticleer this crazy concern came off to us with a chair for the conveyance

of a person to the shore. On seeing such a miserable attempt as this, one is naturally inclined to ask himself, are these the descendants of the Portuguese of the fifteenth century, who in the nineteenth, employ such primitive means of communication with the shipping in their roads? Can it be possible that these are the descendants of those intrepid navigators, who performed miracles in navigation at that period? can it be these who are disgracing themselves by employing the rude contrivance of a mere savage, and actually placing themselves on a level with the Indians of New Holland? It is too true: and this apathy, this want of energy to employ those means which are placed within their reach by a beneficent Creator, may be observed throughout their whole proceedings. All ideas of improvement on anything are foreign to their minds; the accoutrements of their horses are the same as those used more than a century back; as for agriculture, as I have already observed, they have no idea of it. How truly applicable to them are the lines of Byron:

> "Strange that where Nature loved to trace,
> As if for gods, a dwelling place,

And every charm and grace hath mixed
Within the paradise she fixed;
There man, enamoured of distress,
Should mar it into wilderness:
And trample, brute-like, o'er each flower,
That tasks not one laborious hour,
Nor claims the culture of his hand,
To bloom along the fairy land;
But springs, as to preclude his care,
And sweetly woos him but to spare."

The ground lies untilled before them, the earth smiles in vain, while they are ever lolling in their hammocks, smoking and gaming throughout the day, the very patterns of indolence and laziness. The evenings are passed in serenading to the notes of a guitar, or singing and revelling at some lascivious fandango.

In such hands as those of its present possessors, Fernando Noronha may be truly considered as a "paradise lost," where heaven pours blessings on the lap of earth, and where man pines in want amid the beauties of nature, or, like the sons of Adam in their primitive state, subsist on the spontaneous productions of the soil. The island is supplied with flour and provisions from the Brazils. At the time of our second visit the supplies had been rather tardy in their arrival, so that the people had

none, and the governor was very glad to exchange his fresh beef for our flour and biscuits. The cattle of the island are very fine, and we had an abundant supply of good young beef for our ship's company during our stay. The governor was exceedingly attentive to us, and sent off every morning sufficient milk for the men as well as the officers: vegetables are rather scarce, although they might be raised in any quantity on the island. Rat Island yields a profusion of fine melons; they were by far the finest we had seen during the whole voyage. The water melons were particularly fine, and sometimes two feet long.

There is one art for which Fernando Noronha is famous, and that is for rearing capons of the finest description. I remember being exceedingly amused by the daily exhibition of fine mule chanticleers, or stately capons, parading up and down before our window with a large brood of chickens under their care. It appeared that they had hatched the eggs, and assiduously attended to their young brood, with all the care of a mother, calling them from around when they scratched up anything with the same noise as the hen. They were noble

birds even in this incongruous condition; the comb and gills had not attained their full size, but they had all the long feathers of the neck and the lower part of the back in full perfection.

The climate of Fernando Noronha, notwithstanding its abundant vegetation and moisture, is very healthy, as evinced not only by the garrison, but the crew of the Chanticleer. No disease appeared among us, and on enquiry none had appeared in the island during our absence. The dry season commences in July, and continues throughout August, September, October, November, and December. The wet season is from January to June inclusive. In the three first months of the rainy season thunder and lightning are common; and the heavy surfs prevail, especially about Rat Island, at the same period as those of Ascension and St. Helena, at which time the wind is light and variable from the north-west. In the dry season there is sometimes a very scanty supply of water, but in the wet season a little deluge.

During our stay at Fernando Noronha, which was from the 12th June to the 18th of July, we were kindly accommodated and most hospit-

ably entertained, as far as the means of the people permitted. There are several families on the island, whose attentions I shall remember with pleasure. We also met with the most cordial co-operation from the governor, and enjoyed ourselves as much as we could expect. The usual experiments on the pendulum and magnetism occupied the attention of Captain Foster and his assistants.

CHAPTER III.

Leave Fernando Noronha.—Arrive at Maranham.—Letters. —City of St. Louis. — Harbour of Maranham. — Swift Canoes.—Streets and Public Buildings.—Market Place.— Customs of the People.—Whims and oddities.—Travelling Hammocks. — Periodical Charity. — State of Society.— Manufactures.—Tutelar Saints.

On Sunday the 18th of July we sailed from Fernando Noronha, with a fine breeze at south-east, for the coast of South America. On the 21st we found the water turbid and discoloured besides being very shallow, and soon after discovered the land. Two days of uneasiness were passed near the coast among rocks and discoloured patches of water, and on Friday we entered the bay of St. Marcos, where we soon received a pilot for Maranham; and on the following day we found ourselves safe at anchor in the harbour.

On our arrival at Maranham, the first consi-

deration was to obtain our letters, the many letters that we had expected. We might have spared our anxiety, for none were there, and our disappointment was, great. We found to our sorrow that there is no mail or packet communication to the place direct from England, and only one by the circuitous route of Rio Janeiro. Moreover, such is the negligence in these matters, that letters conveyed in this manner are from eight to ten months in reaching Maranham. We found out that the best mode of conveying letters there is by the Liverpool ships, the trade from thence being very considerable. The average passage is about six weeks, and this mode of communication is far preferable to the packet.

Maranham, so called by the English, is the St. Luiz de Maranham of the French; St. Louis being the name by which the town is generally known. The early Portuguese established themselves in the province of Maranham in the year 1600; and in 1611 some Frenchmen, Devaux and La Ravardiere, established themselves on the island on which the town stands, and built a fort which they called St. Louis—hence the name of the town. But they were soon

driven from it by the Portuguese under the victorious arms of Albuquerque. The island on which the city stands is separated from the continent by an arm of the sea, and is about twenty-one miles long by twelve broad. This city, notwithstanding its standing on an island, is the capital of a large province of the same name, and derives all its importance from the harbour, which is the principal one on that part of the coast.

The harbour of Maranham possesses merit only by comparison with the few smaller on that coast. The entrance to it is extremely narrow and shoal, so that vessels can only enter it at high water; for when the ebb has ceased, the shoals are so bare that a person might walk across the upper part of the harbour. It is snug and well protected, affording secure and commodious anchorage for several ships. The tides are rapid, rising eighteen or twenty feet; the anchorage is close to the town, where there is a very tolerable landing-place. Strong winds seldom or rarely blow in so as to create any uneasiness among the shipping.

The harbour of Maranham presents a cheerful scene, more particularly to a stranger unac-

customed to the novelty he meets there. There is something cheerful and enlivening in seeing the numerous coasting vessels skimming along the surface of the water—the peculiarity of their rig, and the extraordinary thatched awning with which they are partly covered, their sails being of the lightest material and fit only for the fine weather and light breezes which prevail on the coast. The business of these vessels is to transport cotton from one part of the coast to the other. Whole fleets of fishing-boats are seen cruising about, some going out to their fishing-ground, and others returning, the arrival of these being announced by the sounding of horns, which may be heard far and near; and in the midst of these the attention is continually excited by the incessant crossing and recrossing of canoes manned by African negroes. Some of these canoes are large, and have crews of twelve or fourteen persons, who use their paddles with great dexterity, and all the energy so peculiar to the negro. Setting out with a few slow and regular strokes, they pause for a moment, but it is only to gather strength, and with a simultaneous impulse they exert themselves with all their might, rising from their

seats and applying their whole strength to the paddle, almost frantic with exertion; while the uniformity of their action is preserved by a kind of yell or chaunt, and an admirable ear for time: the canoe may be said to fly through the water with a velocity proportionate to the noise of their voices. I could find no music in their song, therefore can say nothing in behalf of it, except that it appears to produce inspiration to exertion, and a great degree of satisfaction among them.

The country about Maranham is by no means attractive. It is, without any peculiar features, rather pleasing, here and there picturesque, fertile, and well wooded; and when the distant hills and neighbouring heights of the main land are seen skirting the horizon of the bay, the effect is rather pretty. The banks of the river are adorned with a few country-seats, the residences of wealthy proprietors. One of these, called Taman-chao, or Belle-vue, is the handsomest in the neighbourhood of the city. The city itself is seated on the eastern shore of the harbour, upon a jutting promontory or neck of land, and is nearly surrounded by water. It occupies the highest ground in the

neighbourhood, and is ninety feet above high-water mark, being about a mile in length and half a mile in breadth, and is irregularly built. The exterior of the city of Maranham has but mean pretensions, and the most respectable parts of the interior are very little better. The streets are narrow, many of them of a low mean appearance, and without a handsome one among them. The houses are neither lofty nor elegant, generally of two stories, with a balcony above, and dirty latticed windows on the ground-floor, and many with grass growing before them. The surface of the streets is very irregular, frequently on steep declivities, and all are badly paved. They are abominably stony and very filthy, the odour proceeding from them after a shower of rain being most disagreeable. Maranham certainly boasts a few respectable houses in their outer appearance, and which are also comfortable, spacious, and airy within, the rooms being well adapted to the climate. The houses have generally a small yard or garden attached to them, which is always in a slovenly condition; and the town is of that quiet description so much desired by some of the country visiters to our large metro-

polis, its repose being undisturbed by carts or such noisy vehicles; in fact, there is but little business going forward, if we were to judge by the streets. They are said to be lighted, but I never could perceive any other source of light at night excepting the moon.

There is nothing in Maranham that particularly attracts the notice of a stranger, unless it be the cocoa-nut tree, gracefully waving its lofty plume above the houses, and imparting a tropical character to the place. The house of the president is by no means conspicuous as such, and is certainly not calculated to contribute any adventitious respect to the high station of his excellency. Immediately contiguous to this is that of the general at arms. The accommodations for the military officers are adjoining to the latter, and form a reputable row of buildings. These are all contiguous to the castle, and immediately above the landing-place. The street in which these are situated being spacious, is used as the parade for the troops. At the extremity of this street, and placed transversely, is the cathedral and the palace of the bishop of Maranham. The cathedral is on a par with the merits of the city; it deserves no enco-

mium, and may be spared any censure; neither its architecture nor decorations are chaste or splendid; it will contain about two thousand people, and has all the trappings and tirade appertaining to the ceremonies of the Catholic church. The bishop occupies the palace adjoining the cathedral with a retinue of monks and friars, and other persons connected with the priesthood. The street which leads from the landing-place to the cathedral might be considered handsome, but there is such a group of mean little huts associated with the abodes of the president and the military, that the effect is altogether unfavourable.

Near the water-side is the market-place for the sale of fruit, vegetables, and poultry, with shambles distinct from all. Beef and pork are the only meats to be had there, and these of a very indifferent quality. But the town is generally well supplied with country produce, which is both reasonable and good at Maranham. We obtained everything we desired in the Chanticleer at as reasonable a price as could be expected. Besides the above principal market-place, there are several other smaller ones in different parts of the town. The bread

is excellent, the poultry good, the fruits and vegetables abundant, wines and groceries of a good quality, especially port wine. The town is in no want of water, wells are attached to most of the houses; but the water in some parts is said to be rather brackish, so that which is used for drinking is brought by the boats from some miles distant and distributed for sale.

Maranham, like other cities, boasts its opera or theatre, although of humble pretensions, the company of performers being itinerant between it and Para. The music and dancing exhibited there is the most agreeable part to an Englishman, who may happen not to know the language of the country. The barracks are most eligibly and pleasantly situated at the upper end of the town on a piece of rising ground in the suburbs. They form a respectable range of quadrangular buildings. The Misericordia, or hospital, at the extremity of the town, is most creditable to the people, for the extreme neatness and cleanliness which pervade it. There are of course many churches and religious edifices in different parts of the town. The shops are of a middling or rather inferior cast, but most articles of merchandise are easily procured.

Maranham has no promenade or public walk of any interest; and there is but one road that leads out of the town, of a very inferior description. There are no public amusements when the opera is not open, no revelry or disturbance of the public peace—all is quietness—and from the little energy apparent among the inhabitants, it might be supposed to be of domesticated habits. But this is not exactly the case; it is rather to be attributed to indolence, for all day they are lounging in their hammocks, and at evening's-hour, like owlets, are peeping out from their latticed blinds at the wayfaring passengers. Domestic happiness is not so much impaired by conjugal infidelity as among ourselves, and the people are said to be not so sensitive on these points, although they are generally acknowledged to be most jealous and suspicious, two statements which do not appear reconcileable. Mothers scarcely ever suckle their children, because the practice is considered as derogatory to their station; and thus it is that pride makes them renounce one of their first duties. The ladies at Maranham are permitted to be escorted abroad only by their husbands; and the old English fashion of

taking the arm or shaking hands between ladies and gentlemen is an outrage on the established code of manners: in fact, it is against the *costumbre del pais,* and is reasonable enough. But, after all, this over-sensitiveness is too fragile; what does not meet the public eye revels the more in secret. It is customary for a lady at Maranham, previous to marriage, to intimate her intention of entering into that state of life to those friends whose subsequent visits she wishes to receive. In like manner, at an accouchement, a servant carries the intelligence to all those friends whom she is desirous of seeing—thus in each instance selecting her visiters.

The Brazilian ladies are fond of the guitar, and are said to have a good taste for music; but they make no great proficiency in it; and if they possess any talent for it, they are too indolent to improve it. The generality of their houses appeared dirty and disorderly. The address of the people affects politeness, but the mind is generally unimproved. The frequent firing of guns, the repeated display of rockets and other fireworks, with all the gewgaws and trumpery of childish pageants, occupy inces-

santly the place of every nobler pursuit. They are particularly solicitous of showing off their dress, and make an ostentatious display of ribbons of all sorts; these and other outward distinctions being all that they have to attract notice, are carefully obtruded on every gazer. They are so much engaged in this pursuit of finery themselves that they expect it in others, and are much surprised at not meeting with it among the English; and notwithstanding the warmth of the climate, when one is glad to throw off all useless appendages to dress, if a gentleman should happen to pay a morning visit dressed in a jacket, he is not admitted, such being considered by the natives a disreputable kind of dress. And in addition to all this outward show in dress, they adopt a pompous mode of salutation. To be styled "Your Worship" in ordinary conversation, is an insignificant title; and any person of decent reputation receives the salutation of "Your Excellency," or "Your Highness." Thus they look for the vulgar praise that fools impart. The superscription of their letters conveys an idea of great affection; they are often directed to their

"dear and affectionate friend," and some of them have as many titles as the knight of La Mancha himself.

The Portuguese hammock is used by the ladies of Maranham. The climate is hot and oppressive, and this mode of conveyance is said to be an excellent substitute for our comfortable carriages. I confess, however, that I am inclined to doubt it; and at any rate it must be allowed that they are unsociable kinds of things, as the hammock will contain but one person at a time. This is suspended from a long ornamented pole which rests on the shoulders of the two bearers; the pole passing through a grummet at either end of the hammock. The lady is seated, or rather squatted in a tailor-like fashion, in the hammock, and has a fine chintz shawl thrown over the middle of the pole, that

hangs down on each side of her, and this she draws close round her when necessary to skreen herself from the impertinent gaze of passengers. When the lady arrives at her journey's end, the slave bearers, kneeling down, lower the hammock sufficiently for her to set her foot on the ground. It is a curious mode of conveyance, but vehicles of all descriptions are very rare at Maranham. Horses even are scarce, and strangers have difficulty in procuring them.

At Maranham, that class of society called mendicants are rather numerous, and it is rather curious that they are only allowed to beg on Saturdays. I never could find out the reason for this regulation, and why Saturday should be fixed for this licence. But on this day each takes a particular district, and becomes a pensioner on some particular family to whom he is well known. In counting-houses I have observed some copper coin particularly appropriated for these claimants. There seems indeed to be an implied contract between the parties; alms are asked freely and without hesitation, and as freely are they given.

The state of society in Maranham was such as to impress me with no high idea of their

comfort, there was a total absence of the little comforts and conveniences of life. At all parties and feasts, or more especially private dinners, the dessert alone is considered as being under the lady's particular superintendence. On this account they are often splendid, the lady displaying her taste in the most beautiful manner. I remember seeing a dessert at a gentleman's table at Maranham superior to anything I have either heard or read of. There is no education among the people; a total want of police, a flagrant disregard of justice, Maranham being the place of all others where the foulest murders pass unnoticed; and yet there is great integrity among the commercial classes, and perhaps better qualities among them than a superficial acquaintance can discern.

I could not discover that Maranham possesses any particular manufacture. The workmanship of the cabinet-makers is neat and elegant, and they produce very respectable articles with the ornamental wood of the country. *Jacaranda Brasiliensis*, or bastard ebony, is heavy and strong. The *candaru* is the most common, and resembles mahogany. Veneering is generally performed with the *aroxa* or rose-wood, an ele-

gant pink wood, or with the *pao de Para*, a fine yellow satin-wood. The wood of the country is generally so hard that it will not burn with flame, which is a fortunate circumstance, as the houses never take fire from carelessness, the most fatal result being never more than a scorched hole in the floor. The mangrove is the usual firewood burnt at Maranham, and the bark of it is used to tan the small quantity of leather made there.

It has been said that the religious edifices are numerous, and form a principal feature in the city. At any rate the eternal clatter of bells denotes the ringers to be the most industrious people, and the bells to be the most indispensable articles in it. It is but lately that Maranham has had the honour of a bishop's presence. There are churches for every particular purpose. Among others is one at the farthest part of the town, in a pleasant situation, named after Nossa Senhora dos Remedios: this lady saint, being the peculiar patroness of commerce and navigation, has very naturally a tender solicitude for the safety of the poor sailors; therefore, after encountering a severe gale of wind at sea, as in duty they are bound to do, the mariners

bring their topsails in a regular procession to the lady's shrine as a token of their gratitude, and furthermore to receive her blessing as a protection to them against the next gale in which they may be caught. But her ladyship does not dispense her blessings without a consideration, and the gratuity is willingly contributed when imagined security from danger is to be obtained. The sailors are not the only class who are thus circumstanced. I believe it is much the same with other trades. All have their tutelary saints whose favour and protection they consider it their first duty to propitiate.

CHAPTER IV.

Visit a Convent.—The Lady Abbess.—Introduced to the Nuns.—Reflections on leaving them.—Population of Maranham.—Slave trade.—Peculiar character of the African Negro.—Their indecent dress.—Their treatment.—Seasons and climate.—Doctors of Maranham.—Pine-apples.—Commerce and revenue of the place.

In the midst of the city there stands a certain nunnery, to which I was admitted as a special favour by the introduction of the medical attendant. On the gate being opened I was refused admittance as a matter of course by the fair nun who officiated as porter, and the *affaire* was referred by my friend to the lady *superiora,* who immediately made her appearance and received me very frankly and cordially. This lady, as her title implies, was the superintendant of the establishment. She was a middle-aged woman, attired in the habit of a monk, consisting of a loose black gown

with a girdle round her waist, to which the keys of the apartments were appended. There was something benign and cheerful in her countenance; her manner was affable and pleasing, without that moroseness which might be expected in one of her class; and her amiable and agreeable demeanour quite won me. She conversed with fluency, and displayed a considerable store of information on various subjects; but her conciliating manners above all rendered her, in my opinion, well adapted to her station. But in the midst of my admiration of her good qualities, and which, from the circumstance of her being a nun, had disposed me to fancy she had the same personal attractions as she possessed mental, I could scarcely contain myself when I discovered that she wore a wig! Well, I thought, there is no harm in a wig either; but it was not a woman's wig; and with the habit of a monk which she had on, it gave her a very odd appearance, and more that of an effeminate man than anything else.

Being desirous of seeing as much of the establishment as was permitted, we were conducted by our female monk to the inner room, in which were several inmates of the convent.

I had pictured to myself a great deal, and expected a treat in contemplating the beautiful features and fairy forms of nuns, whose lovely and beauteous persons have been exalted into those of angels by many a lovesick swain ; but, alas ! I had no sooner entered the room than all my poetic visions vanished in an instant. The first specimen of a nun that my eyes met was no Madonna, whose placid and lovely countenance would inspire one with homage and respect for her calling, nor yet a perfect Venus attired in the habit of one ; but a great fat, unwieldy female, on the advance of forty, a woman of a gross habit and still grosser manners, one on whom retirement had produced no beneficial effect in the shape of refinement, humility, or modesty of deportment. She was lounging and swinging in a hammock, and seemed not to heed our entrance, although her position might have been improved on the score of decency. What was still worse, she squinted, and her large blue eyes were wandering after each other at a respectable distance about the room ; while, to complete the picture, she appeared to be labouring under a temporary paralysis of the muscles of the face, by which it was dis-

torted so as by no means to contribute to her beauty. Many of her companions were sickly-looking creatures, with pale and wan cheeks, and lustre-lacking eyes; others, however, were more gay and lively; and the sounds of a distant lute and voices, like those of persons dancing, raised my hopes that I had as yet only seen the dark side of the picture, and that all I had expected might yet be realized within the convent. But vain is the hope of man—I saw no beauties—I could meet with no Venuses as we were saluted by the frolicsome damsels; no overpowering charms, no Heloise, and nothing more than a group of ordinary faces, some young and others old. But I had seen enough to convince me that mirth and gaiety are not banished from a convent, nor is all silent sorrow within the precincts of walls that are guarded by bolts and bars.

The convent contained altogether about one hundred and twenty persons, of whom the young were there for the purpose of being educated, and the old had resorted to it as an asylum for retirement and support. Married ladies are admitted into it in the absence of their lords, and sometimes placed there for secu-

rity; but the restraints are not very great nor are the barriers impassable, for here as elsewhere "Love laughs at locksmiths." I observed a great number of black slaves as attendants, and was pleased to find that their outward condition appeared better than in most other places. As I left the place, I could not help thinking that it appears a mockery of common sense to suppose that religion can only be immured within the walls of a convent, or that virtue can only grow up in the shades of retirement. To withdraw from the world is a voluntary confession of weakness, a want of courage to withstand its allurements, and at once to resign the conflict at the expense of liberty. At best I thought it but a squeamish and sentimental love of the abstract principle of virtue. The establishment I had seen supports itself, and is therefore open to no objection from the economists. Needle-work is taken in there, and artificial flowers, lace, and preserves are made by the nuns.

The churches are, or ought to be, the emblems of religion in a country; and if we consider their number at Maranham as an indication of

the zeal and character of the inhabitants, we should conclude that they were religious.

The clergy there are said to be poor, and to have only a lay tithe, having some years ago sold their birth-right for a mess of potage, or, in other words, mortgaged it to the crown for some paltry stipend. By this imprudent act of their predecessors, they have lost their rich and valuable tithes, and with them much of their power. They are now merely stipendiary priests of the crown, which appropriates the revenue accruing from tithes to defray many of the public expenses. The priests have suffered in public estimation at Maranham, for what reason I know not; but their power is very limited, and they are said not to exemplify in their habit of life that rigid attention to the divine precepts of Christianity which is looked for in their holy calling. This is the impression concerning them that is prevalent among the people, and I would fain hope it were not a correct one; but as far as my own observation went, I could find nothing to counteract it. Neither the people nor the priests seemed to trouble themselves much about religion.

The sabbath is a day of business at Maran-

ham in the morning, and one of recreation in the evening; virtually equivalent to annulling it. In the early part of this day the shops are open, and the usual routine of business goes forward; in the evening the theatres are open; the forms of religion intervening, and exhibiting rather the effigy of Christianity than any accordance with its duties. But the religion of these people appears to be subservient to their amusements, sanctioning their folly and stamping it as current morality. Their religion is like a mummy; a lifeless body in a gorgeous wrapper curiously and intricately folded. The progress of political feeling has torn off the outer garments. The experiment of opening it was a dangerous one, for so long as it remained a mysterious secret the delusion might be prolonged; but, divested of its extraneous ornament, nought but its unreality remained. On exposure to the light of heaven, the mummy crumbles and falls to dust and ashes. It owed its support to its dazzling garments, and, as a relic of antiquity, is held up to ridicule and contempt.

I remember one evening seeing an afterpiece performed at the Theatre, that met with great

applause. It was called the "Horrors of the Inquisition;" and the design throughout was to hold up to public scorn and ridicule the anathemas of the church and its instruments of terror and vengeance. But the imbecility and caducity of the church is such, that it can neither support itself nor lend its aid to anything useful. "Othello's occupation's gone." Although celibacy is enjoined, and by its ordinances priests cannot have wives, yet the rule is not so absolute but that wives may have priests. The monks are few in number, and the attendants on the church are much reduced. The service is performed to empty churches, and there is little indication of holiness in their ritual. The vesper bell, the "knell of parting day," is at once solemn and pathetic; and, if rightly and duly appreciated, would secure appropriate homage for the mercies of the mis-spent day; at once a benediction and a supplication to the great Author of our being.

The population of Maranham is estimated at seventeen thousand souls, the greater part consisting of African slaves; the rest are Brazilians, Portuguese, and foreigners. Here the slave-trade flourishes, and compels me to revert with

feelings of disgust to the abominable practice. Enough has already been written on the subject, and he would be a clever moralist who could find anything new in it to hold up to public scorn. But, like the noxious weeds of a garden, it must be eradicated, and hostility to it, until that is effected, should never cease. We saw it at Rio in all its plenitude; we found it at the Cape in its mildest form, and not without emotion; but here we have it again in all its turpitude. This great question must be regarded in a two-fold light; that of the actual traffic in slaves, and that of slavery only. They cannot be considered apart, for they are essentially connected; and he that possesses slaves holds out a direct encouragement to the traders, as much as the receiver of stolen goods is the abettor of, and participator with, the thief.

That the slave-trade is an abomination to humanity, we have the concurrent testimony of all. The purchase of poor beings by wholesale from their ferocious chiefs is a cruelty of the greatest magnitude; and is it a way to civilise them by tampering with the vilest crimes, and ministering to their worst feelings? Tell me not that humanity weeps at the slaughter of

victims taken in war, and that slavery prevents the crime of murder. Such arguments are fallacious, and a mere cloak for maliciousness—for the exercise of those brutal passions of our nature over the unhappy helpless wretches under their ruthless masters, who debase themselves below their intellect.

The slave-dealer is destitute of all feeling, nor cares he for any being but himself and his crew. Such argument as the saving of life, to be protracted only in misery, is mere cant and hypocrisy. Does the slave-trade promote the diffusion of knowledge? or does it spread abroad the practice of piety and religion? Is it honourable to take advantage of the ignorance and credulity of others? The very purchase of the slave in Africa is the dissolution of all social bonds, and the incitement to perpetual war. But let the advocate of slavery see the unhappy wretches on board the vessels; let him see them manacled and absolutely jammed together as if they were logs of ebony wood stowed in bulk; let him contemplate their sufferings, suffocated as they are by intolerable stench and filth of the worst kind; sinking with unquenched thirst, or rotting in their pes-

tilence, gasping for air in a pent-up hold, and dying from an accumulation of all these evils, in time frequently to be saved only from a watery grave, as they are thrown into the sea like so much lumber when their vessel is chased by a man-of-war, in order that their remorseless masters may escape that punishment which they so justly deserve. This is no exaggerated picture; such scenes are still going forward, and such the advocates of slavery would perpetuate.

And what sophistry can soften down scenes such as this? what legal quibble can annul the charge of murder against the perpetrators and abettors of such crimes? When unrelenting cruelty, lawless rapine, and rapacious avarice, with murder in their train, are the essentials of the system, it behoves us as Christians to uproot it from the face of the earth. The frantic cheer and the shout of triumph that burst from the hold of a slaver, when, after an obstinate resistance, she is captured by a British cruiser, what are these but the spontaneous effusions of nature throwing aside all thoughts of thraldom, and rejoicing at the approach of freedom? what is it but the heart panting for relief? But the pas-

sage completed, and the vessel arrived in port, presents us with the foul contrast. The slaves are sent to the market, where they are paraded like so many brutes, but from their outraged feelings, and their treatment on the passage, are little calculated to undergo the ordeal, and are truly objects of compassion worn down with disease and anguish. No pitying eye is turned on them, no helping hand is stretched forth for their relief, and I have contemplated the appalling scene with feelings of pain and disgust. But noble hearts have felt their sorrows, and their sighs have not been unheard. Time that they were, for I was informed of the fact by Dr. Hall, who attended the establishment of the slave-importers, that one half of the number that are brought over die in the course of the first year after they are landed! Such is another of the effects produced by this unrighteous traffic.

Slavery, considered in its abstract form, is the badge of ignominy to man; but that must be bad indeed from which no contingent benefit can possibly arise. The Africans have appeared to me, for the most part, a brutal and deeply ignorant class. They have uniformly resisted all attempts at improvement; and, with one

or two exceptions in other parts of the world, seem to occupy the lowest point in the scale of creation. A thousand years have done nothing for them. There is something peculiar in the character of the African negro under punishment; he will endure the most agonizing sufferings without a groan or scarcely a murmur escaping his lips; but cruelty and revenge in their turn are the leading traits in his character, and slavery tends to root them more deeply. There is something in the cerebral structure of the negro that approximates unequivocally to that of the monkey—the intellectual character is reduced, while the animal features are exaggerated. The past history and present condition of Africa prove a natural inferiority in its people, which failing has been, and I hope ever will continue to be, the peculiar ground on which the Englishman extends to them his protection.

In every house which I visited in Maranham (and I had an extensive acquaintance), I was shocked at the indecent exposure of their persons; the little pot-bellied urchins were running about naked, and the shameless nudity of the adults mingling intimately with the sons and daughters of the household, must inevitably

impair that delicacy of sentiment which is the chief ornament of the female sex. But the general tendency of slavery in the negro is to harden the heart, to extinguish all sense of justice, and to encourage the most unbounded licentiousness.

I remember once witnessing the treatment of a slave, by a young lady at Maranham, that I shall never forget, and which left no favourable impression on me of the refinement of the fair sex of that place. The slave, who was a young girl, was sitting at work in company with her mistress, as is usual in the country. In the course of conversation with her she happened to say something that offended her mistress so much, that she immediately seized her scissors and stabbed the unfortunate girl in her temple. The consequence was a wound of a very serious nature in the temporal artery, from which a dangerous hemorrhage proceeded that might have been fatal. These things, I fear, are too common in that country, where there is no tribunal at which the unhappy slave can seek for justice. The power over the slave is unlimited, and to what cruel extremes will not human power be carried where it has no salu-

tary law to check it? History affords us too many examples of them.

The slave-trade is abolished by treaty, but continued by stratagem; and it is argued in the Brazils that it is absolutely necessary to import a fresh cargo of physical strength, to counteract and keep down the incorporated mass that might be disposed to rise and act a dangerous part. It was found expedient in the Roman empire to restrict the manumission of slaves without the consent of the magistrates, lest such a number should be incorporated as citizens and exercise their privilege to the injury of the state. What a painful state of conscious fear must these people be living in! the hand of retributive justice may travel slow, but certain. Like clouds surcharged, the tempest of indignation and revenge will at some future period burst on the land with the devastating fury of an African tornado, if the gathering evil be not timely checked. Ignorant of the laws of their Maker, and destitute of all religion, the slaves are living in promiscuous intercourse with each other, in open violation of the best feelings of our nature. Little or no attempt is made by their masters to improve

their condition—their amusements are few, and seem principally confined to the lascivious movements of the disgusting fandango. Those who from feelings of hatred for the slave-trade refrain from the use of West India sugar, may follow up their determination by throwing aside their garments, for even cotton is tainted with the same poison. However amiable may be such feelings, they are totally inadequate to check the progress of the evil, much less to cleanse this Augean stable.

The seasons of the year at Maranham consist of the wet and dry. The former commences in the latter end of December, or the early part of January, and continues until June or July; during the whole of these months an immense quantity of rain falls, the most awful thunder-storms occur, in which the lightning is remarkably vivid, the weather is oppressively hot, and the wind light and variable, veering all round the compass in the course of twenty-four hours. The rain that falls in the course of the year is stated by Humboldt to be 28·0 inches. The dry season lasts from July to December, in which period there is generally a fine fresh breeze from the north-east or east-

north-east. The nights are attended with lightning, but no thunder; and a few showers of rain sometimes occur. The climate of Maranham is naturally hot, and there is little variation of temperature throughout the year, the average being 82° of Fahrenheit. The general range of the thermometer is from 76° at night to 86° in the day-time, even in the most shady situations. The barometer ranges from 29·92 to 30·1, the average being 30 inches, and the horary oscillation about the tenth part of an inch; it falls from 9 A.M. to 3 P.M., and does not appear to be affected by the fall of rain.

The climate is generally regarded as healthy, the most sickly time being during the transition from the wet to the dry season, or about July. The wet season is not considered unhealthy.

In the province of Sera or Ciara, adjoining to Maranham, the droughts are occasionally severe. A few years ago some thousands of persons perished from the want of water. Many fled to Rio Janeiro and to this province, and the crops were nearly all destroyed.

I had an excellent opportunity of observing the practice of medicine at Maranham, which I

must say is established on the most enlarged scale and the most liberal principles of the age. There is a complete separation of all the various branches of the profession from each other, none of them trenching on another's province. For instance, the surgeon operates and attends to surgical cases only; the apothecary dispenses his physic, prescribes at the counter, and visits the sick occasionally; the druggist confines himself to his shop, and merely sells drugs and medicines; the barber bleeds and draws teeth; and, to crown all, the black fellow performs the operation of cupping most dexterously with a cow-horn! Such is the *modus operandi* in the medicinal way at Maranham, one which, notwithstanding the careful division of labour, does not work well.

Among the various tropical fruits that are found in abundance at Maranham, the pine-apples are remarkably fine, weighing from eighteen to twenty pounds. They are rich and of a most luscious flavour, and fully merit the lines which Thomson has written concerning them:

> "At once the best and prince of fruits; the pride
> Of vegetable life, beyond what e'er
> The poets imaged in the golden age.

Quick let me strip thee of thy tufty coat,
Spread thy ambrosial stores, and feast with Jove.

And yet the green and half-formed fruit is said to be attended with dangerous effects. Excellent yams of several kinds are also found there, but I consider the pines of Maranham to be the finest I have ever seen.

Fish are not very abundant at Maranham, although sharks are tolerably numerous, and are sold in the market; but little can be said in favour of any. Prawns are plentiful, and particularly fine; land-crabs are also in great abundance, and are considered a great delicacy.

Maranham is the residence of a British consul. Robert Hesketh, Esq., who filled that office at the time of the Chanticleer's visit, had obtained the esteem and respect of all who knew him, and had well supported the dignity of the British nation. There are about a dozen English mercantile houses at Maranham, all connected with Liverpool, which seems to be the only English port trading there.

The commerce, trade, and revenue of Maranham consist in cotton and rice, which are the two staple commodities. The cotton is the principal and most valuable. Eighty thousand

bags are annually exported to Liverpool, each bag containing two hundred pounds; therefore the whole quantity would be 16,000,000lbs. which, at five pence per pound, amounts to £330,000. The freight home is three farthings per pound, and there is a duty of six per cent. ad valorem. The cotton sells in the Liverpool market at seven pence and seven pence farthing per pound. It is considered of a good quality, and is not the produce of an annual plant, but of a perennial bush, the capsule with the cotton-wool being produced for many years from the same bush. The cotton is pressed when on board by screws, and great art is required to stow it to the greatest advantage. I am informed that the machine for packing it in the ship costs sixty pounds.

Rice is also an article of commerce; sixty thousand bags, of two hundred pounds each, are exported at rather more than one penny per pound. The rice is taken principally by the Portuguese, and the produce is about £50,000 per annum. Hides and horns are taken by Americans; the former at five pence per pound, and the latter at four dollars per hundred. The fustic or yellow dye-wood, which is of an in-

ferior quality at Maranham, is sold at the rate of two pounds per ton. Turmeric is very abundant, and is sold at twelve shillings per hundredweight. The castor oil for lamps (*azeite de mamona*) is exported coastways in considerable quantity. Farinha, tapioca, and arrow-root, are good, plentiful, and exceedingly cheap at Maranham. The tobacco is of trifling value, although mild and pleasant.

The foregoing articles are exchanged with England for Manchester and cotton goods, iron, hardware, and pottery, which covers the value of the original cotton, and leaves a balance of cash in favour of England. The Portuguese exchange their wine, brandy, dried fruits, onions, olive oil, vinegar, snuff, and pepper. The United States send their flour, candles, shoes, and soap.

Maranham is an excellent place for procuring good port wine. There is a heavy export duty of one-tenth ad valorem on all articles, being the exchequer or lay tithe. The custom-house duties on the imports are vague and fluctuating, and according to the estimated value of the goods. The above constitute the sources of trade at Maranham, there being no manufac-

tures in the city. The currency there is nearly the same as at Rio, except that copper is more common. There is a Brazilian packet from Rio Janeiro to Maranham, and from thence to Para, every month.

CHAPTER V.

Proceed to Para.—Mare Non.—Island Marajo at the mouth of the Amazon.—Anchor off Para.—Tides of the River.—Trading Canoes from the Interior.—The City of Para.—The Cathedral.—Churches.—Market.—Surrounding country.—Church and Fair of St. Nazaré.—Literature of the People.—Current Coin.—Market Prices.—Observations on the place.—Brazilian Tribes.—Manufactures of Para.

On Sunday, the 5th of September 1830, we sailed from Maranham, having previously hired a pilot to conduct us to Para for the sum of fifty pounds, on account of the intricate navigation of the river. We kept at a moderate distance from the coast until the morning of the seventh, when we stood-in and made the land near the mouth of the river. In a few hours afterwards we found ourselves in the "Maranhon," the name bestowed on it by the early navigators, who in sailing along the coast were surprised on finding the water fresh.

They therefore very expressively named this mighty water "Mare Non,"—"Not the sea," its freshness being the only indication that they were not in the ocean. It is now better known to us as the Amazon.

We entered the river by the smaller or eastern branch, the only navigable one for large ships, as a bar lies across the principal mouth, or the great western branch of the river. It may be observed here, that the island Marajo, which is nearly a hundred miles in circumference, lies in the mouth of the river, dividing it into two unequal branches. The greater body of water passes to the westward of it, while the deeper and navigable channel flows to the eastward. The island Marajo is a low, flat, alluvial formation, covered with brushwood and grass, and abounding in cattle. This luxuriant island supplies Para with cattle and horses. In the rainy season it is much flooded, and is peculiarly unhealthy when the waters have quitted it and the sun begins to exhale the malaria. At this time violent remittent fevers prevail. It is overrun with alligators, snakes, and wild beasts.

The mouth of the Amazon is 130 miles in breadth, and its course extends through a dis-

tance of 3400 miles, rising from the mountains of Peru. But the source of this river and its various tributary streams are involved in much obscurity, and much time and patient investigation will be necessary to acquire a correct knowledge of the sinuosities of this majestic stream. The eastern branch, which we had entered, is only twenty-five miles broad. The land on each side is low; and we kept along the eastern shore, which displays a boundless continuity of shade and one uninterrupted scene of forest green skirting the water's edge, and extending with one level surface to the horizon. Accustomed as we were to the continual monotony of such scenery, that of the Amazon produced no new feelings among us farther than the gratification of being able to obtain fresh water alongside of the vessel. This water, however, was extremely muddy, but tranquil, and without the heavy swell of the ocean.

We had a fine breeze from the north-east, which gradually subsided towards the evening; nevertheless we made good progress up the river. The navigation is intricate and dangerous, and we had some difficulty in avoiding the numerous shoals and sandbanks, owing to the

strength of the tide. We passed Selina, the pilot station at the mouth of the river, and a few villages, which afforded an agreeable break in the continuous line of the woods. By the evening we had reached within thirty miles of Para, and anchored in the river for the night. Early on the following morning we got under way, and proceeded onwards. As we continued our course, we found the river gradually became narrower, and we had a nearer view of the banks; but we found the same character as at first, a low rich country covered with dense forests. As the little Chanticleer moved gracefully up the stream, the utmost tranquillity prevailed around, and her form was reflected on the unruffled surface of the water. Occasionally we passed a small islet; and having left a fort on the eastern side of the river intended to guard the navigation, the city of Para appeared before us, and in a short time we gained the anchorage.

A rapid flood-tide sets up the river at the rate of between four and five miles per hour, and this flows with a current stronger than the ebb for seven hours, while the latter does not run more than four or five. The water at all

times is fresh, and may be used, although it is turbid and filthy. This prevalence of the flood-tide, both in strength and duration over the ebb, may be accounted for in some measure by the immense breadth of the river's mouth at the sea-side, and its sudden contraction here (fifty miles up), where it is two miles broad. The rapid tide is dangerous to boats, in consequence of their liability to be drifted on to the cables and warps of the shipping. One of our boats, in coming alongside, was drifted in contact with a boat at the guestwarp, and was taken completely over it without any mischief being done.

The banks of the river are exceedingly muddy, affording but little facility for landing; and where they do allow of it, houses are generally erected, the advantage being not disregarded. In the lower parts of the river are some sandy beaches. The chief novelty that we found was the number of thatched and cabined canoes of the country, and the small river craft with their lofty spindle masts and thin cotton sails, having some resemblance to Chinese vessels. It is not unusual to see them with a large mat, or a bush with all its leaves,

to answer the purpose of a sail, in these canoes. We found a Brazilian brig of war in the river, and a prison ship, besides several Portuguese merchant vessels. The principal business of the river seems to be carried on in these canoes, which are continually arriving and sailing, and literally crowd the shore near the town. They bring the produce of the country from all parts, and come from a distance of six and seven hundred miles from up the river. They are navigated by various native tribes of Brazil Indians, each canoe generally containing a whole family or more of people. It is quite common to see little low canoes, nearly even with the surface of the water, containing a man in the bow with his paddle, and a woman in the stern steering with another, while their children, a pack of little copper-coloured urchins, are crouching beneath a matted awning amidships. The larger canoes have a raised awning abaft, in which hammocks are slung, and in these the canoe-men may be seen lounging and swinging all day, smoking or feasting.

The city of Para stands on the right bank of the river Amazon, at the distance, as before observed, of about fifty miles from its mouth. As

it appears from the anchorage in the river, it presents nothing particularly attractive or conspicuous, excepting its numerous churches;—no lofty ranges of buildings are to be seen in this city of the western world, but environed by wood and the waters of the river, and built on lower ground, it has altogether a humble appearance. It occupies the bank of the river about two-thirds of a mile, and is half that in breadth, the highest point of ground, that on which the church of St. Ann is situated, being about seventy feet above the surface of the river. The city was founded by the Jesuits in 1615, and contains at present about twenty-two thousand people.

If at the first sight of it Para does not convey any exalted idea of its grandeur to the mind, certainly an intimate acquaintance with it is still less likely to do so. It is dull, noiseless, and cheerless; without vehicles or the activity of business. The streets are laid out at right angles to each other, but they are narrow; and the houses, generally about two stories high and of a moderate size, have latticed blinds for windows, which add still more to the sombre effect of the whole. None of the streets are paved, if

we except some few, which have a quantity of rough pebbles in them; of course they are neither lighted nor cleaned, and towards the river are particularly filthy.

The city of Para is not without its public buildings, among which the cathedral takes precedence, followed by eight churches, a palace, custom-house, &c. The cathedral is built in the form of a Latin cross, and I was pleased with its structure and decorations: they were neither gaudy nor too plain. The exterior is somewhat dilapidated, but still preserves a respectable appearance. The interior is very neat, and affords ample room for a large congregation. The altar-piece is good; it represents the crucifixion: and there are several large paintings of the Apostles. The bishop's palace is in the Cathedral Square, and faces that building. It is a respectable edifice, appended to which is a church or chapel for the domestic service of the bishop and his establishment. In the same square is a comfortable hospital, and the remaining part is filled up with a few houses. The palace, which is the abode of the president, is a handsome and commodious building, most agreeably situated on an open spacious lawn

at the south-west end of the city. The interior of it is every way worthy of its purpose. Adjoining the palace are the walls of a building which was intended to have been a theatre on a magnificent scale. The design was good, but the whole was a failure.

In the middle of the town is the church of St. Ann, yet incomplete, and with the view of raising sufficient funds to finish it, a mendicant friar may be seen standing in the street all day soliciting contributions for that purpose. The church of Los Mercez stands close to the water-side; adjoining to it is the custom-house and prison; and these three form the most conspicuous range of buildings in the city, but they are nevertheless by no means remarkable. The convent of St. Antonio is situated at the eastern extremity of the city. Most sea-ports have their arsenals, whether on a large or small scale, and whether public or private property, and therefore Para is not without one. When we were there a frigate was on the stocks, but for want of funds all work on her had ceased. Although Para possesses but few attractions in itself, its public and numerous shady walks about it form an agreeable retreat for its inha-

bitants. The principal of these is the public walk near the palace, that affords a fine promenade.

The streets of Para have nothing attractive about them. The shops and warehouses are numerous, and are tolerably well supplied with merchandise; but there is neither taste nor elegance in their arrangement: those of the apothecaries seemed to be the neatest and cleanest. The markets are held by the water-side, near the church of Mercez, where women with vegetables and fruit herd together for the most part of the day; but butcher's meat is not to be had after ten in the forenoon, a very salutary regulation on account of the heat of the place. Nor can fish be depended on, in consequence of it, for more than three or four hours after it is out of the water. The Largo de Polva, is a large open and extensive common in the south-east quarter of the city. It is, perhaps, not the most respectable place in Para, although it is the most airy, and from the rural little cottages in it is very pleasant. The gibbet for the execution of culprits is in this square, and also a *well* of ants.

Although Para possesses in itself few attractions, the numerous shady walks in the environs of the city deserve notice, as they form an

agreeable retreat for its inhabitants. There is, however, a public walk in the city, near the palace, which is resorted to daily in the cool of the evening, for the delightful promenade it affords. The others are principally formed by rows of lofty silk cotton trees, which bear no little resemblance to our elegant horse-chestnut tree. The mango, with its pendulous fruit, and the orange and lime mingled with each other, form the sides of the walks and afford a grateful shade. The country in the immediate vicinity of Para is very beautiful, and the outlets to it are abundant. In the suburbs of the city are several elegant little villas with extensive gardens rich in all the variety of tropical produce. The roads, which are not amiss, are lined by large spreading trees, among which may be seen here and there some little hut or cottage embowered in foliage, which in this part of the world may all be considered as evergreen. I have contemplated these happy-looking abodes in the course of my walks from Para; and if the minds of their inhabitants are as peaceful, nothing more is required to complete the "happy valley" alluded to by Dr. Johnson. At some intervals the eye is attracted by these little cottages, and at

others by some neat villa in sequestered solitude, the country residence of some merchant of Para, presenting to the feverish spirits of the world a scene of happiness and peace. Here the winds are loaded with a balmy fragrance, while the graceful palms, presenting in their various stages forms so remote from the rest of the forest, impart grandeur and sublimity to the scene.

The road to the Nazaré church, distant about a mile from the city, is a favourite resort of the people of Para. The church, which is built on a small scale like that of a village, is simple and neat, and most romantically situated on the skirts of a wood, with a small open area in front. In the month of October, which is no doubt well remembered by every inhabitant of Para, and anticipated with feelings of delight by the young and gay, a grand scene of festivity takes place at this little church. It is called the fair of St. Nazaré, and is attended by every one in Para. On the arrival of the day, the fair opens under the auspices of the church. Mass is performed in the first style, and the inauguration of the whole festival is the office of the clergy. The usual business of fairs, such

as frolic and feasting, is the order of the day, presenting a strange incongruous mixture of folly and religion. This lasts for a fortnight, to the great delight of those who frequent it, some I believe, for the purely innocent enjoyment of dancing, and others to indulge in the common propensity for gambling. However, the whole business is closed with the benediction of a grand mass.

Para is lamentably deficient of public institutions for education: the whole town can only boast of one school, and that is under the direction of the clergy. This deficiency is evident to a stranger on going even into the first houses in the place. A city that does not boast of a single bookseller's shop is certainly something extraordinary in the present day; but where this is the case, there is little hope of finding those valuable articles among its people. But of the two sexes, the most complete ignorance is found in the female, as might be expected, and it is a common thing to find those of the most respectable families incapable of either writing or reading. Such a state of things is certainly lamentable. All appears wrapped in the shade of profound ignorance. There certainly is a

weekly gazette published in Para; but even this publishes little to the honour of her people. It is small, and is the regular channel through which the edicts of Government are circulated: the rest of the matter it contains, alas! is mostly of bad stamp, and by no means calculated to raise the character of the people. It may not be necessary to make quotations, but the gazette is certainly not calculated to make any favourable impression on a stranger, of their morality in general; and the crowded state of their prisons is equally against them in the same point of view. Murder is not unfrequent at Para no more than other countries; but the laws are bad, and badly administered, for justice is tardy, and a criminal may lie in prison for several years without being brought to trial.

The currency of the province is a good criterion of its general poverty. There is no other circulating medium than copper, and even that is of the basest kind. The existing government call in, at pleasure, the old copper coin, and stamp it afresh with a crown, by which magical influence it becomes of twice its former value. Such is the wretched trash in circulation, that the stamped and unstamped pass in

common; and it often happens in payments, that one dollar's worth weighs and is intrinsically worth three times as much as some of the other. It would appear that this province is the very sink of the empire in respect to currency, as all the base copper coin which is not passable in the other parts of the empire, finds here a ready circulation. No better idea of it can be given than the fact, that what passes for one hundred pounds, in copper coin, is really and intrinsically worth only eight pounds. Silver was at a premium of twenty-five per cent.; and the very sight of a dollar when we were there was quite a rarity. Hence the necessaries of life are cheap. House rent is moderate, and there are no direct taxes. The following were the market prices at the time of our visit: meat, 2*d.* per lb. indifferent quality; bread, 6*d.* per quartern loaf, very good; sugar, white, 3*d.* per lb. very good; rice, 1*d.* per lb.; tapioca, 1*d.* per lb.; spirits of the country, 1*s.* 3*d.* per gallon; coffee, 2*d.* per lb.; cocoa, 1*d.* per lb. very cheap; a beautiful and delicious pine apple of 6 or 7lbs. costs 3*d.*; oranges, 3*d.* per 100, basket included, which alone is worth the money; alligator pears, four for 1*d.*; melons, 2*d.* each. Fowls dear, being

one dollar the pair; horses are worth 16*s.* each, and are generally fed with rice chaff. Foreign produce is by no means high at Para; the wines of Portugal and the manufactures of England being comparatively cheap.

Notwithstanding the natural riches and the superabundant advantages of Para, it is the poorest city in the empire, and receives a subsidiary stipend from the neighbouring province of Maranham, amounting to 40,000 dollars, or £8000, annually, to defray the expenses of its government. In consideration of this gratuity, Para receives the goods imported into Maranham duty free, and likewise defrays the expenses of the packets and men-of-war on the station. There is something radically wrong in the government of this province; and a miserably perverted policy keeps in the back-ground the capabilities and resources of the country. There can be no doubt, that the Empire of Brazil is far too large to be governed well as it is. Corruption lurks in every department.

The province of Para is equal in size to France, and has an inland navigation of six hundred miles. It is at once the paradise of the Indies and Brazils, according to the gene-

ral opinion of the inhabitants of that great empire, which occupies the whole extent in latitude of the southern tropic. Para is sufficiently capacious to receive all the redundant population of Europe, and to maintain them in luxury; it is a region of endless fertility, one where every rood of ground would maintain its man. It is said, that it was the miserable policy of the Marquis de Pombal not only to keep foreigners but the Portuguese themselves ignorant of the value of this province; a policy which was realising the character of the dog in the manger illustrated by the fable. He did everything in his power to degrade it and keep it in the back-ground. The situation of it is well adapted for rendering it the depôt of an extensive and lucrative trade; but the commerce, in consequence of such short-sighted policy, is extremely small, a kind of petty retail rather than any extensive or liberal trade. A merchant is obliged to buy, from time to time, small scraps and parcels. Such for instance, as a pound or two of isinglass, by which means he is long in accumulating a stock.

All the produce is brought to Para in canoes, from a distance of six or seven hundred miles in

the interior. But the whole country, as before observed, is too large for its present mode of government. When we see nations swayed by intelligent rulers, rising in grandeur and importance, or when cursed with vicious and imbecile leaders sinking into contempt and misery, it is evident that,

> " Of all the ills that men endure,
> How small the part that kings can cure."

The Brazilian tribes about Para appear to be a fine healthy and well-conditioned race of people; their skin is of a good firm copper colour, without a tinge of black; they have long jetty hair with a rubicund face, made up of an intelligent set of features, in which a general expression of mildness and good nature predominates. If heat had anything to do with colour, they would be black enough; for at Para, directly under the equator, and in a low level country, it is intolerable. The superiority of the Brazilians over the poor African tribes of slaves at Para, is particularly remarkable, and the contrast is sadly against the latter.

It is customary for the negro slaves to come

down in groups every morning to the river side, to purchase various articles of produce brought down from the interior by the native canoes. On these occasions, it is amusing to see the negroes up to their knees in the water with their petticoats tucked around them, the whiteness of which contrasts well with their jet black skins, their woolly hair and their repulsive countenances, and appearing in the presence of the Brazilian boat-men a very inferior order of beings, as they really are. The precision with which they carry things on their heads is also exceedingly amusing; but it has often been a subject of admiration in other countries. Here they may be seen with a basket of fruit, or a jar of oil, or a calabash of milk, or a jug of water, all placed on the head; in fact, whatever they may have to carry is invariably placed on their heads. At this usual morning rendezvous by the river-side, some bring coffee ready made for breakfast, while others bring a favourite liquor, called "wassaree," an infusion of a small kind of palm. This beverage has the colour of port-wine, and when sweetened is highly esteemed by these people. In fact, with a

banana, or alligator pear, it forms the principal fare of many, while others prefer the farina of the cassada with it. Cocoa is the staple article of Para, and is produced in vast quantities; but it is so depreciated in the foreign market, that it will not defray the expense of freight. There is in fact no sale for it, and the aroba, or thirty-two pounds of cocoa, when we were there, was only worth twenty pence. Hence the cultivators of it were ruined. Rice is very abundant; but cotton is scarce. Sarsaparilla, balsam copayva, tonquin beans, vanilla, farina, oils and India rubber, are the chief articles of exportation. The importations are flour, spermaceti candles, soap, shoes, &c. from the United States; cotton goods and hardware from England; wines, vinegar, olive oil, limestone, drugs, chestnuts, &c. from Lisbon.

The manufactures of Para are ladies' combs, polished with the leaf of the *curatella Americana;* good leather from the skins of the *goats* or *hares* of the country; coarse and bad pottery, chocolate, coarse hammocks, cotton bags, and lime, grass hammocks, straw and

palm hats, lace, salt-fish, and jerked beef. The Indians bring down from the country elegant wands of beautiful feathers called sceptros, besides superbly-ornamented hammocks, feather dresses, bows and arrows, and stained calabashes.

CHAPTER VI.

Departure from Para.—Enter the Gulf of Paria.—Columbus —Arrive at Port Spain of Trinidad.—Size of this Island. —Paria, a province of Columbia.—Description of the Gulf.—Its prevailing Winds and Currents.—The Town of Port Spain.—Its Description.—Laws of the Town concerning Slaves.—Population and Mortality.—Current Coin.—Grievances.—Sir Ralph Woodford.

On Monday, the 11th of October, we sailed from Para, with a light air and the advantage of the ebb tide. We embarked the best pilot of the place to conduct us down the river, and as soon as the flood made we dropped anchor for the night. On the following day, we were under way again with the ebb, but having scant adverse winds, we were obliged to anchor above Colares. On the 13th we reached to within a few miles of the south-east point of the river. The water at night was glowing with light. On Thursday, the 14th, we cleared the river and discharged the pilot, and were once more

upon the ocean waves, where the freshness of the breeze was cool and reviving. We carried a fine breeze from the south-east, and crossed the equator on the 16th.

On the 18th, 19th, and 20th of October we were becalmed in latitude 5° North, the sea being as smooth as glass, and most repulsive to contemplate from the strong glare of light it reflected. The fervid rays of the nearly vertical sun, and the total absence of any cloud to mitigate their force, produced an almost insufferable heat. In the coolest part of the Chanticleer, in the shade, the thermometer was at 86°, and our crew were tormented with a prickly heat. On the 21st, the calm terminated in a thunder-storm and a deluge of rain, followed by a fine breeze again from the south-east. On Tuesday, the 26th, we made the Island of Trinidad, and ran along shore to the Serpent's Mouth, or the Boca del Drago, named by Columbus, and entering the Gulf of Paria, by the Soldier's Passage, we anchored in the evening off Point Breea. We met with nothing at the Bocas to excite our attention, nor did we experience any of the violent currents he speaks of; and we were equally unfortunate in not

finding the waters of the gulf to be fresh, and in not experiencing that balmy fragrance, or delicious coolness of the evenings, that induced the veteran navigator to compare them to those of an Andalusian spring. But his circumstances and ours were widely different. Posterity can never sully his fame, nor can they add by their praise to the glory of his name. Columbus stands pre-eminent among men for wisdom, ability, courage, and intrepidity. His mind and powers were of the first order, and justly is he ranked among the first of intellectual beings. "The narrative of his troubled life is the link which connects the history of the old world with that of the new," as it has been most justly said of him.

It was Friday, the 29th of October, before we reached the anchorage of Port Spain, having been detained by calms and baffling airs. The island of Trinidad, the southernmost of the West India islands, and nearest to the continent of South America, is situated between the parallels of 10° 4′ and 10° 54′ north, and the meridians of 60° 57′ and 62° west of Greenwich, being about forty-five miles across from north to south, and thirty-two miles from east to west.

It is separated from the continent by the Gulf of Paria, and is ten miles broad, and presents an area of two thousand and twenty miles, six hundred and forty of which only are under cultivation.

This island must be regarded as one of the richest and most productive of the West Indies; but its resources are for the most part lost from a deficiency of labourers. The scenery in many parts is extremely beautiful and picturesque, the valleys teem with their rich produce, and the hills are covered with a perpetual verdure. The southern shores of the island are hilly and abrupt, with very little level ground; the northern part of it is also hilly, while the western shore is for the most part a swamp. The valleys are particularly fine; and Marival has been celebrated by Coleridge for its luxuriant charms.

Paria, one of the provinces of Columbia, from whence the gulf obtains its name, forms its western shore, the land being somewhat higher than that of Trinidad. Columbus with rapture alludes to the beauty and fertility of this favoured land, which in his enthusiasm he concluded to be contiguous to the terrestrial paradise. He

even went so far as to imagine that the fresh water flowing into the gulf of Paria was supplied from the fountains mentioned in Genesis as springing from the tree of life in the garden of Eden. The country is indeed most beautiful, as it really might become a paradise, yielding all that man could wish, did not his vile nature debase him, and render him unable to reap the fruits of the earth in peace and comfort. The querulous and idle disposition of the present race of people who inhabit it, render it very different from a paradise, for there a conflict of evils embitter its fruits, and rapine holds her ruthless sway.

The Gulf of Paria is a considerable sheet of water, being forty-three miles from the Boca on the south to the Boca del Drago on the north, these bocas being narrow straits formed by each extremity of Trinidad with the main land. In its widest part the gulf of Paria is eighty-three miles, *i. e.* from the shores of Trinidad to those of Columbia. Both shores bend, and mutually approach each other to form the bocas by which the waters of the gulf communicate with the ocean.

On the south side of the Serpent's Mouth,

which communicates with the Atlantic ocean, and receives in the rainy season the vast flood of waters from the Oronooco and its tributaries, a considerable current is found, rushing into the gulf, which is thus said to have its level raised four or five inches above its usual height. The surface water at this time, which is during the months of July, August, and September, is also said to be fresh.

It was this current that Columbus met in his little craft that gave him so unfavourable an opinion of the gulf, and produced so much uneasiness to him. It is most violent during the rainy months, but a current generally sets into the gulf through the Serpent's Mouth to the northward, although trifling and unimportant during the dry season.

In the months of December, January, and February, the tide sets through the Dragon's Mouth from the northward, by which the current is occasionally overpowered. The water of the gulf of Paria is generally of a turbid and dull green cast, but it presents the most tranquil and glassy surface to be found anywhere. Embayed by land on all sides, the swell of the ocean is completely shut out of the gulf.

The winds are in general very light, never increasing to more than a gentle breeze, excepting in autumn, when its severity is disturbed by a few transient squalls. It may be considered as a vast basin affording secure anchorage in all its parts, and no one in it need be alarmed about gales or storms, or accidents, for if ships should get aground the soft muddy bottom receives them without injury. The nights are generally calm and tranquil; the principal complaint being that of the want of wind, insomuch that coasting along the shores of the gulf is extremely tedious and troublesome. The waters of the gulf abound with fish, and numerous flocks of pelicans and terns may be seen here and there, busily employed in catching their prey.

Shaguaramus Bay is the usual place of rendezvous for men of war visiting Trinidad, being six or seven miles distant from the town of Port Spain, the capital of the island. There is a snug little harbour at Gasparee, where his Majesty's ship Espiegle hove down and refitted, but the merchant shipping generally anchor opposite the town of Port Spain, where they lie in perfect safety.

The town of Port Spain is situated on the

northern and western part of the island, or the northern shore of the gulf, on a very low part of the island contiguous to the water, and is flanked in the rear and on the sides by high ridges. The aspect of the town from the anchorage is exceedingly agreeable and pleasing; it is perfectly rural, and its general neatness, combined with the verdure and beauty of the surrounding hills, presents a rich, varied, and most interesting picture. The cleanliness and order of the town, and the air of comfort and respectability which it presents, besides the regularity and neatness of its houses, produce a most favourable impression on the visiter who has just left the Portuguese settlements.

It has been said by many that Port Spain is the best and neatest town in the West Indies. In my opinion it is far superior to that horrid place Port Royal, or even Kingston; but it does not rival the capital of Curacoa. Port Spain occupies about a mile and a quarter in length; it is well laid out, the streets being at right angles to each other, and of a good breadth with a capital macadamized road. The houses are of the second rate order, but comfortable, tradesmen-like residences, generally of two

stories, with large projecting covered balconies. King-street, which may be considered as the principal, is of considerable width, having a spacious public promenade in the middle of it. This is enclosed by a parapet wall, and shaded on each side by lofty and elegant umbrageous trees. At the angles near the entrance are placed a pair of areca palms, in a most tasteful and judicious manner. The regular and even trunks of these majestic trees form graceful pillars and very suitable ornaments to the promenade. They are surmounted by a waving plume of leaves, and their effect, when first seen by a visiter, is most gratifying. The houses in King-street have a heavy dullness about them, arising from the lumbering balconies, which form a continuous line on either side; but this is amply compensated by the luxurious shade and shelter from the sun which is afforded by the piazza beneath them. The effect of these balconies on the eye gives the idea of a range of booths or stands at a race ground. The houses in the other streets are devoid of this appendage, and are in the common style, and the streets cannot become favourite promenades.

I do not recollect ever having seen so pleasing a distribution of gardens to the houses in any other town as that which I found at Port Spain. There they present a gay and lively appearance, which is peculiarly desirable in that climate. Many of the houses are built entirely of wood, and near the outskirts of the town many may be seen of the handsome cottage-style, having only a ground floor. The houses are generally built of the limestone of the place, or of a brick made there; the slate that is used being brought from England, and the shingle from the United States. This shingle is commonly used also in Canada. It is the wood of a resinous pine split into the form of our tiles, but considerably larger, and, from the nature of it, is well calculated to resist the effects of the weather. The pieces being also split off, the fibres of the wood are unhurt and better calculated to keep the wet from soaking into it.

The town of Port Spain contains two churches besides a Methodist chapel. The English church is a neat, commodious, and respectable building, and the Catholic church is handsome and ornamental, and equally large. The next principal building is the cabildo, or

town-hall, for the illustrious board of Cabildo, or in other words the Corporation of Port Spain. There is, besides, a small custom-house and treasury: a very clean airy market-house, a small fish-market projecting over the water, and a small and efficient gaol are all the public buildings of the town. To mention them is to describe them. The king's wharf affords every convenience for landing passengers and goods, and it contains, besides, a little shabby hut, dignified with the title of the Public News-room.

The whole town is divided into five wards, each being under the jurisdiction of two magistrates, whose duty it is to maintain peace and order, to see that all the public-houses are shut by eight in the evening, to suppress gambling, to remove suspicious and idle persons, to inspect the weights and measures, and register the number of inhabitants yearly.

These guardians of the public safety at Port Spain perform their office well in one respect, and I have no doubt they do so in all others. But that which has fallen under my observation, relates to laws about retirement in the evening, and certainly the system of our ancient curfew has been improved on here. The streets

after eight o'clock are remarkably quiet, and well they may be, for no one is to be seen in them. But the laws regarding the poor slaves are most amusing. These people may be permitted to dance until eight in the evening in any place that the chief of the police may please to approve of, but both they and coloured people being desirous of assembling their friends together, to rejoice in dancing, or any kind of amusement after eight o'clock, must apply for permission to do so from his Excellency the Governor! and any slaves found in the streets after nine in the evening, without a written permission from their masters, are apprehended and whipped the next morning at their expense! What a pity that the masters are not whipped in their stead! These are a sample, although not the worst by any means, of the laws that are enforced by the abettors of slavery. In fact, I have selected these as the very lightest points of grievance, as I would give the slave-holder his utmost due. Such a state of society must be irksome to any well-disposed being. The slave-holders have recriminated on England, and have tauntingly held up our laws to public scorn and derision. There is no

doubt that countenancing slavery by our laws, was the blackest spot in our national policy; but that has been removed, and Great Britain had no right to sully her fair name by legalizing such infamous laws at the solicitation of the mercenary slave-holder: the dawn of a better course has arrived, and reform has at length banished the odious appellation of slave from our colonies.

I was repeatedly requested to notice the happy condition of the slaves, and was repeatedly asked, where is their wretchedness? But I saw no such happy state realized; on the contrary, the temper in which the services of the slaves were commanded by the masters, fully convinced me that happiness was not their lot. "Why, our slaves issue their invitations on embossed cards," we were repeatedly told with exultation. "It is thus that they give notice of their balls and parties? what better proof could you have even of their refinement in happiness?" But this is a fallacious argument, and one that may be turned against those who offer it. For my part, I look on it in its real light, that those slaves are the more capable of receiving civilization; that they are not so destitute of a sense of propriety as supposed by some, and are desirous

of imitating the superior forms of civilized life, which they see practised by Europeans; in fact, that they thus evince a natural sense of manners and customs, to which their own are so far inferior, and a desire to follow them. Such a mode of proceeding I augur well from, and instead of accepting it as a reason that their slavery should be perpetuated, in my opinion it bespeaks them to be more worthy of their liberty. Such arguments betray the weakness of the cause equally as much as those which adduce the revelry of cyprians and libertines as the proofs of happiness. But what else can we expect from slave-holders against emancipation, whose judgments are biassed by self-interest, and debased by the ill-effects of habitual cruelty?

The population of Port Spain, when we were there, consisted of eleven thousand, divided as follows: Free blacks, 6000; slaves, 3500; white, 1789. The deaths at Port Spain, for the year 1829, were 367, or one in thirty, which was considered as the result of a healthy year. The population of the whole island was 41,868, of which free blacks were, 16,000; slaves, 21,000; whites 38,000; being sixty-five people to every square mile; and the annual deaths were 1114, or one

in thirty-six. The births annually were 1240, giving an excess over the deaths of 126 in the year, and these statements may be relied on as strictly accurate, as I took great pains to investigate the subject. But it is always useful to connect one fact with another. The deaths at Trinidad are one in thirty-six annually. Now the mean for England is one in fifty-eight, and the births at Trinidad are one in thirty-three, and in England one in thirty-five. So that the increase of mortality is compensated by a slight addition in the number of births. Of the white inhabitants at Trinidad the French form the principal part, and it is the general language used in the shops. There are many Spanish families, and of our own people the Irish are the most numerous.

The law as administered at Trinidad is a glorious medley of uncertainty and confusion, a mixture of Spanish, French, and English. A person may be cited in either, according to the taste of the prosecutor. There is much litigation notwithstanding, mostly for the recovery of small debts. The taxes at Port Spain seem to produce great discontent. The house-tax is five per cent. on the annual rent, whether the

house is inhabited or not, and house-rent in consequence is exorbitantly dear. Another principal tax is the one on slaves at 1*l.* per head,—the wharf-duty 6*l.* per ton, is paid to the illustrious cabildo, and a tax of three and a half per cent. on all imports and exports, all of which contribute to render everything dear at Trinidad. At Para we found fault with the copper currency; here the evil is remedied indeed, for no such thing as copper coin is to be seen. The lowest price of money at Trinidad is termed a "stumpee," being a little mite of silver, value $1\frac{1}{4}d$; the next in value is "half a bit," worth $2\frac{1}{2}d$, the "bit" being worth 5*d.* The next are quarter dollars, half dollars, "ring" and cut dollars, the latter having a piece cut out of the centre in order that they may be useless anywhere else but on the island, and hence may not be worth carrying away. A Spanish dollar has the nominal value of 10*s.* and two dollars are considered equivalent to a pound sterling. When we were at Trinidad the exchange was 245*l.* for 100*l.* sterling, or four and nine-tenths Spanish dollars for 1*l.* English.

The inhabitants of Port Spain live somewhat

luxuriously, and dine at late hours. The provisions are in general good, and the beef we were supplied with particularly so. There seems to be a large proportion of pork there, and poultry and fish are both abundant and good; but living there in general is very expensive. Monkeys are sold in the market and eaten by many as a delicacy.

The principal subjects of complaint at Port Spain, for they must have their grievances like all other places, are the interference of Great Britain with the slaves, the want of a House of Assembly, and the reduction of duties on their produce. The first and last are decidedly unreasonable, and as to a House of Assembly, it can be matter of little moment to Great Britain, and might as well be conceded to them, for I see no reason why they should not have the regulation of their own affairs. But in admitting this claim, would it not be more desirable that emancipation should be given by them to their slaves?

The colony of Port Spain, is I believe, greatly indebted to the late Sir Ralph Woodford for its present improved condition, who to the manners of a gentleman in his office united many qualities that well befitted the high sta-

tion of governor. He embellished the town and improved the country; but was occasionally arbitrary and abrupt in his manner. It is said of him that he once gave an instance of this which has never been forgotten, and I am not surprised at it, for it broke through a very ridiculous custom. It was the general practice for the ladies after childbed to be churched in their maiden names. On one of these occasions, whether accidentally or purposely I do not know, Sir Ralph was present. The clergyman in the usual course of the service said, "Miss Mary Ann Colton begs to return thanks for her safe deliverance in childbirth." "What's that?" said Sir Ralph, rising before the whole congregation. The clergyman repeated the sentence. "Pooh, Pooh!" said the governor, "let us have no more of that nonsense." The hint was taken, and the custom of churching the ladies as misses in their maiden names was dropped for their more homely ones as matrons; but I am not certain whether the officiating clergyman was not the greatest loser by the change, for to ensure the delightful sounds of the maiden name being pronounced in the ears of the congregation a douceur of a doubloon was the usual reward.

CHAPTER VII.

Healthiness of Trinidad.—Mails for Europe.—St. Ann's.—The Hospital.—Climate.—Sugar-cane.—Whaling season.—Tea-plant at Trinidad.—The mud Volcanoe.—Pitch formations and Tar compared with those of Coal.

TRINIDAD is regarded as comparatively healthy to some of the West India islands, yet it is subject to that scourge, the yellow fever, in its utmost virulence. Fever is at all seasons and at all periods common; but the Michaelmas summer, or immediately after the heavy autumnal rains is the most sickly season. Showery seasons are much more unhealthy than wet ones. Some years are very healthy and others quite the reverse, without any assignable cause. We hear much said about caution, and some peculiar mode of living recommended to avert the danger; but it is not to be warded off so slightly. A regular and temperate life is no

doubt conducive to health at Trinidad, as every where besides; and the best preservation in this, as in all other danger, is the fear and love of the Almighty. There is a vast quantity of marsh land about Port Spain and extensive swamps, therefore remittent and intermittent fevers are very common. Some of the hills near the town are dreadfully sickly, much more so even than the low grounds.

The communication between Trinidad and England is very good. Two monthly mails are made up in London, and considered due five weeks after sailing. Four days from Barbadoes to Trinidad is the average passage of the mail-boat.

The governor of the island resides at a place called St. Ann's, about a mile and a quarter from the town, which affords a pleasant ride to visiters. The roads in the vicinity of the town are very good, and the adjacent country exceedingly picturesque and interesting. The race-ground is a fine piece of clear ground, and may not only be considered an ornamental, but a useful appendage to the town towards promoting the health of the inhabitants. At a place called St. James's, a short distance from the

town, are the soldiers' barracks, a remarkably elegant and commodious building, having nothing prejudicial to the comfort of those lodged in it. Belonging to it is an hospital which is well constructed, and is the most cleanly and as well conducted as any I have ever seen. I say this, with a full knowledge of many of our best infirmaries, not excepting even the admirable one at Derby. At the time we were at Port Spain in the Chanticleer, the barracks were occupied by the 1st Royals, and it was our good fortune to find in their officers all the estimable and noble qualities of generous friends.

The climate is hot and oppressive at Port Spain, the general temperature being 84° of Fahrenheit in the shade throughout the year. In fact, the thermometer during our stay in one of the cool months ranged frequently from 88° to 92° in the shadiest place, the temperature at night being as low as 76°, with very heavy dews. The breeze is neither constant nor regular, either at Port Spain or in the Gulf. Earthquakes are of frequent occurrence, but rarely severe. In 1815 the church and part of the town were thrown down by one.

Port Spain is not without its melodies. The

inhabitants have the advantage of multitudes of whistling frogs, which are even more melodious than its birds. Of snakes and reptiles they have their due share, many of the former being poisonous. They have also the boa constrictor, which makes off with his due share of deer.

The sugar cane at Trinidad is the principal object of attention. While it is young and feathering, or beginning to flower, it forms a very pleasing object. As it grows it first assumes the appearance of Indian corn, and when it has attained its full size it becomes like a large marsh-reed. The long stems are cut down every year, and they shoot up again from the same stalk for fifteen or sixteen successive years, fully as vigorous as ever. Hence the sugar-cane requires little care in its cultivation, and no labour beyond that of clearing the ground of weeds, &c. The leaves are good fodder for cattle; and the stem, after the juice has been expressed from it, answers the purpose of fuel. A rich luxuriant soil is the best adapted for it. The months of January, February and March are the harvest months for cutting the sugar-cane. An average crop from an acre

of ground is about an hogshead and a half of sugar; when the soil is very good the return is as much as three or four hogsheads. But the sugar of Trinidad is not reputed good.

The whaling season is in January, February, and March, and there is an establishment for that business at Gasparee. The fish is the common hump-backed whale.—Other fish are abundant in the gulf, the water of which is sometimes turbid and red, as if a large quantity of blood were mixed with it. This must no doubt proceed from the streams of fresh water, which fall into the gulf, bringing down large quantities of colouring matter in the bark of red mangroves. I was told that it proceeded from the spawn of fish deposited on the roots of the mangrove trees, but on investigating the matter, it proved to be from the bark of the red mangrove. This wood is the best firewood of the country; it burns well even in a green state. The boats are always much stained that are employed in obtaining it, and ships' decks will be much reddened by it. The bark of the mangrove is a good astringent, and is used for tanning. It is of a red colour internally. The simple infusion of the bark is of a light red

colour, sometimes like blood and water mixed. A solution of iron does not blacken it, but rather deepens the colour; alum has a very trifling effect on it. An alkaline infusion is of a vivid bright blood red colour, which dyes cloth a permanent red brown. The alkaline infusion, in drying, concretes with a gummy mass or pellicle, retaining all the fine colour of solution. Neither the simple infusion nor the alkaline show the least disposition to fade, but for a considerable time preserve their virtues unimpaired.

Some years ago Chinese labourers were introduced into the island of Trinidad with a view to free labour, and likewise to attempt the cultivation of the tea-tree. But the Chinese did not like Trinidad, and the tea failed with their departure. Lately an idea has prevailed of cultivating the nutmeg, and there are some thousand plants of this tree ready for distribution from the governor's garden.

The mud volcanoe in the south-west part of the island is well worthy of notice. It is usually called "The Mud Volcanoe," but would more properly be designated "The Mud Fountain." It is a circular basin of one hundred and twenty

feet in diameter, about one hundred feet above the level of the sea. The surface of the basin is generally a little agitated, having numerous little mud cones of a few inches elevation, from whence air escapes in bubbles. The whole however is subject to violent paroxysms, attended with a rumbling noise, a detonation, and vomiting forth of columns of mud and water. Sometimes also, in these ebullitions a few shells are thrown up. The water of it is brackish, and the temperature below that of the atmosphere. A thermometer plunged into it several feet below the surface, indicated the temperature of 65°. Sulphuretted hydrogen is sometimes emitted, and a number of round hard balls of earth, composed of clay and pyrites. Heat does not appear to be the cause of this curious phenomenon, and therefore when earthquakes may occur, they are probably without volcanic agency, since any gaseous matter pent up may give rise to vibrations of the earth.

But there is nothing more extraordinary in the structure of the whole island of Trinidad than the extensive pitch formations it contains. The part of the island in which the pitch grounds, as they are called, are found is about

twenty-four miles from Port Spain at a place called Point Breea. There, it is said that they are fifteen hundred acres in extent. On landing at Point Breea, which is done on a sandy beach, a person is naturally surprised to see large black rocks of pitch towering above the sand, and pieces of them rolled smooth and plentifully about the beach like pebbles. Every step he takes is on pitch ground. Extensive masses of it are also found presenting a broad and smooth surface. In some places the road has been entirely made over them, sometimes passing between large pieces, rising some feet above the surface. In some parts it seems as if a barrel of pitch had been upset, and left to mix with the soil. The pitch in general is merely a superficial coating on the surface of the ground; and nothing but strict examination would allow one to believe that the fertile scene around is situated on pitch grounds. But it is so; cottages and gardens are implanted on it, and on it vegetation thrives most luxuriantly. The pitch ground is not one continued mass of this substance, but is a series of broken and irregular patches of it; the soil intervening for considerable spaces. After walking up a

gentle ascent of a mile and a quarter from the sea over the pitch ground, the visiter reaches an elevated basin which is called the pitch lake. This is a vast mass of pitch naturally collected in the form of a lake. The surface of it, moreover, assumes the appearance of one, and it is completely surrounded by a wood. The length of this lake is about half a mile, and its greatest breadth about half a furlong.

Numerous pools of water abound on the surface, and the deep cracks and fissures in the pitch are filled with it, in which little fish and frogs sport about. This water is perfectly fresh and good. The pitch appears to be in some parts of great depth, if such an opinion may be justified from the cracks and fissures. It is hard enough to sustain the weight of a person walking on it, but becomes a little softened by the heat of the sun, so that persons at a little distance from each other sometimes disappear by sinking gradually into the hollows formed by their own weight. On the confines of the lake, vegetation is abundant and vigorous, and pineapples grown on the pitch-grounds are said to be remarkably good. Many plants also grow in the pitch itself without a vestige

of earth for their roots; but they are stated to have been more barren formerly than at the present time. The name of pitch lake can only with propriety be given to this small spot, for by considering the whole as a lake, a person naturally expects to find one very large lake of pitch, which is not the case.

The question naturally arises whether the lake is to be considered as the basin or origin of the whole, from which the sides of the hills and the adjacent country have been overflowed. I think appearances are against such a conclusion. A little to the northward of the pitch is a well or fount of liquid tar. But the pitch itself is not confined to the lake, for there are submarine beds of it. Midway between Point Naparina and Point Breea is a very extensive pitch bank, with no more than ten or twelve feet water on it, the approach to which may be generally known by a strong unpleasant smell, and by the water having a pellicle of tar on its surface. Sometimes at low water ships have grounded on this bank, and should they come to an anchor, the anchor and cable are found covered with pitch. The water about the pitch bank abounds with fish, and fish-pots are gene-

rally set on it. At the Serpent's Mouth there are some reefs, formed of pitch, which occasionally increase and again disappear, and are supposed to be connected with the mud-volcano.

The pitch itself is a dull, black, solid substance, breaking with an even fracture, easily scratched by a knife; it emits a peculiar nauseous smell like coal-tar, it sinks rapidly in salt water, and marks paper a dull brown. At about 310° Fahrenheit it fuses imperfectly into a soft mass, more like the softening of coal than the melting of pitch, for it does not run into a flaccid mass. Spirits of wine, nitric acid, strong alkali had no effect on it whatever. It differs therefore in chemical composition from pitch, and is incapable of being used for the same purposes. It is used in mending and reparing the roads at Trinidad, and for cementing and binding stones under water. It has also been employed to obtain gas Some years ago, when speculation soared with prying eye over the surface of the globe for treasures, the pitch-lake came into notice, but was soon disregarded.

Whatever speculations may be indulged in

about the origin of this substance, its affinity to coal cannot be doubted, and notwithstanding the authority of the names in favour of the theory respecting the vegetable origin of coal, it is by a remote analogy only, and philosophers have never yet made one atom of coal by their processes. It is a very vague inference, because hard woods become charred by submersion, to say that coal is formed by it. In respect to the circumstance of finding the remains of the vegetable kingdom in the coal strata, we may observe on this pitch-lake and ground a very remarkable coincidence.

The remains of the coal-field exhibit the vegetation of a hot climate and a moist situation; the vegetation of a country abounding in ferns, arundinaceous plants, as the bamboo, and palms. About the pitch-lake all these abound in a remarkable degree; they are, in fact, growing on it, and with them a palm called the pitch-lake palm, from the peculiarity of its thriving there. Supposing, therefore, that coal was of similar origin, it may have been similarly situated with respect to vegetation, and we have no difficulty whatever in discerning how it is that vegetables become so abundant in it. If the pitch-grounds

at Trinidad were now to be covered or buried beneath other rocks, the vegetables already collected in them, or about them, would hereafter occasionally be found. We have seen that there are pitch-beds in the sea in a soft state, sufficient to receive the anchor of a ship, and therefore shells of marine origin may be found in this substance.

In the deep fissures of the pitch-lake are pools of fresh water, containing fish; and at a very short distance from them the marine beds may also receive salt-water fish. Besides this, a river may run over the pitch-grounds, and then we shall have every variety. Hence some very puzzling and opposite appearances may be found in juxta-position. The coal formations of our own country may probably have been originally in the same state as now are the pitch grounds of Trinidad, which would tend considerably to explain some of the present anomalous appearances. The pitch grounds, in my opinion, are primordials, and do not result from the conversion of vegetable matter. The botany of the pitch-grounds would tend to elucidate the subject of organic remains

found in the coal strata; and I am satisfied that a very surprising conformity would be discovered between them. No one dreams of the pitch lake being formed from the surrounding vegetation.

CHAPTER VIII.

Departure from Trinidad.—Anchor off the Town of La Guayra.—Coast Scenery and Fortifications.—Observations on La Guayra.—Proceed to Porto Bello.—Anchor off the Town.—Visit from the Authorities.—Ruinous state of the Place.—Inhabitants of Porto Bello.—The Governor.—Filthiness of the People, and dirty finery.—A Ball.—Slavery at Porto Bello.—Schools.—Trade of Porto Bello.—Indolence of the People.—Former state of the Place.

We sailed from Port Spain on the afternoon of the 8th of December, with a fine favourable breeze. By some singular mistake, we passed by the Bocas, and were detained two days in the Gulf beating against light baffling winds. On the evening of the 10th we passed the Great Boca, where our little vessel experienced an awkward bubbling sea, accompanied by a deep rolling swell. We were not long in clearing this, and soon shaped our course to the westward, keeping sight of the land. On the 13th, we anchored off La Guayra, a sea-port belong-

ing to the province of Caraccas. This town is very singularly and romantically situated in the lower part of a mountain glen, near the wild and open beach, on which the surf beats with the utmost violence. The site of the town appears to have been most injudiciously selected, and has nothing in its favour. The scenery about it, however, is bold, and majestically mountainous. A ridge of four or five thousand feet in elevation runs parallel to the coast, and lifts its rugged and towering peaks far above the misty vapour, produced by the wind from the sea. The anchorage off La Guayra is exposed to the whole swell of the Carribbean sea; it is in fact, an open roadstead, and one of the most unpleasant imaginable. The only reason of its being available is the pacific nature of the climate, and vessels have only to use a large scope of cable to avoid the effects of the swell. Landing, as may be supposed, is extremely bad and difficult, and is effected from the canoes of the country.

The fortifications of La Guayra are extensive and imposing; the town, in fact, being circumvallated by forts. A very large one fronts the sea, and there are some strongholds in the

mountains. Why all such pains have been taken to do this I cannot imagine, for there seems to me nothing worth taking from such a place. La Guayra is a mean and irregularly built town, dirty of course, and all its houses of an inferior order. It stands partly in a narrow valley, or ravine, and partly on the side of a hill; some of the houses being considerably elevated. It must have required no little boldness to found a town in such an unpromising situation, where there is no port, and the coast is so unfavourable for ships; where there is no adjacent land for cultivation; where a mountain ridge flanks the town, and where all is one irregular mass of hills and ravines, affording no roads whatever, excepting for mules. But La Guayra is the seaport of the Caraccas, and after all, that is not saying much for La Guayra in the present day, although it possesses even a vice-consul and one British merchant.

The city of Caraccas is about ten miles from La Guayra, and, when we were at this place, was the residence of our consul Sir Robert Kerr Porter. The ride there from La Guayra occupies about three hours. At the time of our visit, the city belonged to the Republic of Ve-

nezuela; but it would puzzle any one to say how long it will remain so. The temperature of the city is very different from that of La Guayra, and is said to produce the finest chocolate in the world. Indigo, sugar, and coffee are also grown there, and some spirits are made.

During our short stay at La Guayra, we found bread exceedingly dear, and also fowls; we obtained beef at $2\frac{1}{2}d.$ per pound, and found fruit in abundance. The remains of the houses which were destroyed by the earthquake of 1812 had not been cleared away by its listless inhabitants, who do nothing but idle away their time in gambling, or in the pursuit of some frivolous conceit. These people have sadly degenerated from the state in which even the Spaniards left them. The coin of this rich province presents the most barbarous specimen of the state of the arts among them in the nineteenth century that can be imagined. They have shown an utter contempt for the beauty of the Spanish dollar, which they had for a model, and at the same time have displayed their own barbarous ignorance by a despicable coin, which they have constructed of the basest material, and with the vilest hieroglyphics ima-

ginable. Most of us mistook it for some coin of the wild Indians.

We found an American vessel at anchor off La Guayra when we arrived. We had a fresh breeze generally from the eastward during our stay. The temperature of the evenings was cool and agreeable, the thermometer being generally at 76°, we found no dews although the nights were very clear. In the mornings the clouds obscured the hills, and the vapour hung about the mountains during the day. But the hills were uniformly uncovered at night, and their summits clear and well defined. I particularly noticed this circumstance, because it accords precisely with what occurs at the Table Mountain of the Cape of Good Hope.

A remarkable circumstance took place some years ago at this anchorage, which is well worthy of notice, as it was not only a very curious phenomenon, but also tends to show the insecurity it has for vessels from the effects of the sea alone. It occurred during one of those terrific hurricanes which are common in the West Indies, and are too well known from their devastating effects. Suddenly a tremendously high swell rolled in from seaward, that swept all the vessels

from their anchors, and drove them with the utmost fury on the rocky shore, while not a breath of wind was stirring, for it was even observed that a lighted candle in the open air was not blown out. So extraordinary a circumstance must have been the effect of the hurricane on the sea, where it raged with its utmost violence, and from whence the waves produced by it must have gradually rolled towards this coast. In the autumn La Guayra is considered sickly.

On the 17th of December we sailed from La Guayra, and arrived at Porto Bello on the 22nd, running along the coast within sight of the land. About Porto Bello the country is very hilly indeed; it may be termed mountainous, as it rises to a considerable height; but we found the most dull and murky atmosphere hovering over it that I ever saw. The entrance into the harbour is neither difficult nor dangerous, and there is plenty of room for a small vessel to work up to the anchorage. About the coast there is nothing that denotes the residence of man; all appears to be primitive wildness, and it is only when you are well in the harbour that a few miserable-looking huts situated on the

western shore at the bottom of the bay can be discovered. And these form the town of Porto Bello.

The harbour is small, very quiet and rural, no gay and bustling activity is here; but the anchorage is secure from the prevailing winds in eight or ten fathoms. A southerly wind would, however, bring in a heavy swell that might no doubt be productive of mischief among the shipping. The country is entirely covered with trees, from the very summits of the hills down to the water's edge, and not a vestige of cultivated ground is anywhere to be seen. The boughs, bending beneath their foliage, overhang the very rocks on the shore of the harbour, affording a shade which is taken advantage of by groups of pelicans. Not a vessel, not even a coasting schooner, nor a solitary boat, was to be seen; not a sound to be heard but the echo of our own voices; everything around was wrapt in death-like stillness, and nothing was there to attract the attention save a few canoes lying on a part of the beach, near which might be seen the dilapidated remains of a few houses that once had been, and the vestiges of some fortifications with a few miserable

huts among them; so mean and insignificant is now the once famous and celebrated Porto Bello!

After we had anchored, a canoe came alongside the Chanticleer, in which were seated the public functionaries and constituted authorities of the place. The captain of the port was one of these, and fortunately he could converse in English. In fact he was a Hanoverian, and to the quick and hurried questions which were put to him by us, gave replies very readily, that led us to anticipate but little in the way of comfort at Porto Bello. We learned from him that there was no such person as an Englishman in the place; that no vessel had entered the harbour for ten months previous to our arrival; that the greatest poverty and wretchedness prevailed among the few people there, and that nothing in the shape of supplies could be had; all of which we certainly found to be very true.

As soon as we became acquainted with Porto Bello and its people, we found little reason for wishing to renew that acquaintance at another time. In 1831, at the time of our visit, it had not the smallest pretensions to the name of "town," and scarcely that of a village. We

found it containing about five hundred inhabitants, huddled together in mud huts, or taking up their residence with bats and vampires in the old ruins of some of the more respectable buildings. But throughout the whole place all was decay, everything appeared to be mildewed, wormeaten, and rotten. We found the remains of some noble forts, and some beautiful pieces of brass ordnance; the castle and the custom-house had been spacious and elegant buildings, the pillars of the arcades being faced with coral. We found noble flights of stairs in some of the buildings, propped up with stakes; the rooms were spacious but unsafe to tread, and plants were springing up from the sills of the windows; the walls were moss-grown, and the rain found an ample number of cracks and crevices whereby to enter.

The large bell of the castle, which had once summoned its inmates to the banquet, now lay rusting in neglect; the superb and costly balance of the scales, which had formerly been used in weighing the treasures of the earth, was lying corroded and useless; the balconies of the houses were falling, and gradually used as firewood by the remaining inhabitants; the stairs of the

best houses were dangerous to ascend, every joist of timber was rotting and everything bespoke decay; the streets, which had been once paved with madrepores, were the resort of herds of wolves, frogs, and toads; and, to complete the picture of destruction, even the churches were hastening to ruin. One had fallen indeed, and the other was rapidly approaching the same condition. This description applies to the better portion of the town, composed of about thirty houses; the other is a mean assemblage of miserable huts, built for the most part on the edge of a morass. Such was the condition in which we found the once celebrated Porto Bello.

The inhabitants of Porto Bello we found to be principally African negroes, native Indians, and Spaniards, the latter consisting of about six or seven families. A tolerably correct opinion may be formed of the people by an account of their governor, for even in this desolation such a personage is to be found. Captain Foster having visited his Excellency found him exceedingly ill, and requested that I would go and do him all the good in my power, to which request I assented most cheerfully.

It has been my lot to attend many of the poor in the hour of sickness, but in the course of a very extensive practice I have rarely found more abject poverty and wretchedness than I did in the person and abode of the governor of Porto Bello. I found his Excellency occupying a room of considerable dimensions in the principal house; the walls were full of holes, and the ascent to it by the stairs was most dangerous. There were neither chairs nor furniture of any kind in the room, except a miserable bedstead, on which he was lying in a state of utter destitution! He was labouring under a severe attack of intermittent fever, besides an enlargement of the spleen, and his only attendant was a black woman. I was shocked at such wretchedness, and did all I could to relieve him.

After a few days, when he had improved a little under my care, I desired that he should have a little panada, to which he replied that he had no flour. I then desired him to take a little broth; even that was not to be had—no, not for the governor! These, however, we supplied, and more besides; for a day or two after, on recommending him some wine, we found to

our astonishment that there was none in the town. Captain Foster made up this deficiency, but we had not only to supply him with medicines, but even the necessaries of life. Such a thing is scarcely credible, and yet I cannot find in my heart to accuse the poor old man of deceiving us, although we observed this to be a prominent feature among the people.

On a subsequent visit, I found the old man very busy in putting some fillets round his wrists, and on asking him what he did it for, he replied, "to make the pulse strong." He had dipped the fillets into the port wine, and kept constantly applying them to his wrists, instead of having drunk it. What such a course arose from, I cannot say; probably he thought he would derive more benefit from that manner of using than by drinking it.

When I told him that such a mode of using the wine was useless, he took them off in despair, and seemed to lay them aside in the most sorrowful manner. But he had already used most of the wine in this manner, and had taken very little internally. I endeavoured to explain to him that the pulse depended on the action of the heart, and that if he drank the wine in

small quantities it would be sufficient. The treatment was successful; and when I went to take my leave of him, and to ask him if he wanted anything, he thanked me with much sincerity and regretted our departure, begging at the same time in the most earnest manner for a few pounds of flour.

Such was the governor of Porto Bello when we visited it in the Chanticleer. His nominal pay was one hundred and fifty dollars per month, but he could never obtain it; after repeated urgent solicitations he would sometimes get twelve or fourteen dollars. His was no regal splendour. One evening he was required to write a letter to Captain Foster, and he was literally obliged to borrow a candle of a neighbour; in fact, besides a bedstead and a few clothes, he had absolutely nothing. Most of the officers have a year or two arrears of pay due to them, and little prospect of getting it. So much for the republic of Columbia!

I could discover neither gardens nor orchards in Porto Bello, and my ingenuity was of no avail in seeking for a butcher or baker. I suppose the good people each perform these offices for themselves. There were certainly a few pigs

and fowls wandering about, feeding as well as they were able on what they could find. But I think I made out that their owners subsisted chiefly on fish, cocoa-nuts, and rice, with a few baked plantains as a variety. Anxious enough were they to buy flour from our men, and most gladly did they exchange some fish for their biscuit. These people we found greedy and avaricious in their dealings, always afraid of selling anything too cheaply, and suspicious of the actions of those they have anything to do with. For a common shell on the beach they demanded a shilling.

Captain Foster was desirous of purchasing a silver tea-kettle from an old woman, to which she assented, and four shillings per ounce was agreed on as the price. The tea-kettle was sent to be weighed, and the slave who had taken it on his return told the old lady it was worth a doubloon per ounce. The old lady thought so likewise, and at once refused the former price agreed on, which depended on the weight; and as she would listen to nothing but the name of doubloon, the kettle was again deposited under lock and key.

Filthy and indolent as the people of Porto

Bello are in their habits, and notwithstanding all the poverty and distress we have mentioned, the remains of departed wealth may be seen among them, for in the dress of the poorest there is a mixture of rags and tinsel. Flounced gowns and gold chains are associated with the meanest habiliments, and, with the assistance of a superb tortoiseshell comb, only served to render them more conspicuous.

In their miserable dwellings, here and there may be seen a silver cup or a rich china goblet, and the former generally so dirty as to lead any one, not knowing the contrary, to suppose that it was pewter. It is not, however, likely that they should pay more attention to this part of their household furniture, and it must not therefore be supposed as exempt from their antipathy to cleanliness.

I believe the Spaniards of this part of the world hold us in derision for taking the pains we do to keep our silver articles clean by washing and rubbing, asserting that they would not think of wasting theirs in such a manner. It may be good economy, but it is at the expense of all sense of decency and comfort, and I

strongly suspect that such reasoning is a mere cloak for their idleness.

In the course of our stay at Porto Bello, we discovered one evening that a ball was going forward, and of course we contrived to be present. I forget the exact occasion, but believe it was mere holiday-making among the people at one of their houses; but it gave us an opportunity of seeing them to advantage, and that was a sufficient inducement.

Accordingly, at the appointed time, we repaired to the place of rejoicing, and were cordially received by the people of the house. In fact, on these occasions, it is well known that the room where anything of this sort is going forward, is always open to any who may choose to enter. We soon found ourselves among a goodly collection of guests, all people of the place; and I was glad at having so fair an opportunity of seeing them. It was not long before I discovered that I had underrated them with respect to their dresses, if I had not in the point of cleanliness; for I found myself surrounded by white flounced dresses, white satin shoes and silk stockings, elegant gold chains, of the finest workmanship, round their

necks, suspending a gold coin of some fancied kind, large tortoiseshell combs, besides other ornaments, all of which served to raise them no little in our opinion. But I cannot say the same of the ladies themselves; they were brunettes, it is true, but certainly some shades even browner.

In one part of the room were violins, triangles and drums, and such kinds of instruments, to the music of which the party stood up in turns. A series of Spanish minuets was performed in the true Castilian style, which I enjoyed very much. The women who performed in them, I found on enquiry, were some of the lowest in rank of Porto Bello, and yet they were dressed as well as the others. This I could not comprehend; it was quite unaccountable to me to see persons as low in condition as our humblest peasantry, and yet in the garb of those far above them.

After the minuets had been performed, and the company had got pretty well acquainted with each other, the more lively and vulgar fandango was commenced. This was continued in succession by different parties in the room; and it was a curious and interesting sight to

observe the grotesque appearance of the different persons grouped together, and the singular writhings in the persons of the little children who had stood up to keep time with the music. After staying until it was very late, and our curiosity had been quite satisfied, we left them, well pleased in having seen so much more of the people of Porto Bello.

Slavery at Porto Bello may be said to be on the wane, as all the children of the slaves are free by birth, so that with the present generation slavery expires. There was one very remarkable peculiarity in the children at this place, miserable as it is, which I could not help observing, and with which I was well satisfied. The diffusion of education is so considerable, that the children of all the negroes can read and most can write; in fact, I saw more books in the hands of the little black children at Porto Bello, than I observed at Maranham and Para together. Schools for instruction, if other things were, were by no means wanting here.

In the negro judge and priest, we found the most polite and gentlemanly manners; indeed their general deportment and conversation were quite as good as those of white persons in simi-

lar situations. They evinced as much intelligence as the Spaniards of the place, if not more, and were by no means deficient in shrewdness or sagacity. But the rest of the black population were in no way distinguished from their brethren in other countries. They are as black as ebony, and of the true African cast.

This place, amidst all its poverty, gave a convincing proof of the capabilities of the negroes. They were superior to the half-breed of whites by whom they were surrounded, and the government of the country might be transferred to them without either detriment or indignity.

The general poverty of Porto Bello is not to be attributed to a pressure of taxes, for it pays no contribution whatever to the state. The remains of walls and fortresses may be found there, but it is destitute of soldiers, and the people seem to do very well without them; for they were living in peace and amity with each other, and a happy indifference to everything that might be going forward in the world beyond the confines of their own beautiful harbour and its dirty town.

But it may be naturally asked, from whence they get the little money they require for pur-

chasing their finery and the few articles which they do possess. I believe the answer will be, from turtle-catching. This employment commences on the coast in January, and is continued through February, March, and April, from which they obtain great quantities of tortoise-shell. Each turtle yields two or three pounds of shell, which is sold at eight dollars the pound. A canoe, with only two or three men in it, is considered to have made a good season's work, if they bring home eighteen or twenty turtle, from which they realize sixty or seventy pounds sterling. Herein, then, lies their riches, the source of all their wealth, for they have nothing else to dispose of excepting some old silver relic saved from the wreck of former grandeur. But their necessities are amply supplied by nature. The calabash is invariably their bowl, and smaller parts of it are very ingeniously fashioned into spoons and drinking cups; the sea-fan serves them for a sieve; the cloth-like leaf of the palm makes a good strainer for liquids, as well as a good net in which to boil their vegetables; the cocoa-nut is their substitute for milk and butter, and the strong prickly stem of a tree serves to grate this principal article

of their food; and the woods supply strong fibrous creepers wherewith to form the cables for their canoes. And because all this is found them, and the productions of the ground are spontaneous and require no labour, they must needs pass their time in gambling and cock-fighting—the two chief amusements of Porto Bello! O man, thou art indeed fallen!—But they all seemed very happy; and I doubt whether an amelioration of their present condition would tend to improve their happiness. This commodity appears sometimes to be formed of very simple ingredients; at others it is a complicated system of refinement, eluding our grasp in proportion as the number of its component parts are more or less numerous. What a magnificent proof have we here of the wise and beneficent intentions of Providence! How little completes the measure of happiness to some; to others how hopeless to attempt such an undertaking! Some can reap all they require in a scanty field; others cannot find sufficient in any one, be it ever so extensive,—ever so full of gifts,—something more is always wanted.

In treating on the condition of Porto Bello, it is interesting to revert to the history of

former times. Robertson, in his "History of America," says, "The galleons destined to supply Terra Firma and the kingdoms of Peru and Chili with almost every article of luxury or necessary consumption that an opulent people can command, touch first at Carthagena, and then at Porto Bello. To the former, the merchants of Santa Martha, Caraccas, the new kingdom of Granada, and several other provinces resort. The latter is the great mart for the rich commerce of Peru and Chili. At the season when the galleons are expected, the product of all the mines of these kingdoms, together with those other valuable commodities, is transported by sea to Panama. From thence, as soon as the appearance of the fleet from Europe is announced, they are conveyed across the isthmus, partly on mules, and partly down the river Chagres, to Porto Bello.

"This paltry village, the climate of which, from the pernicious union of excessive heat and continual moisture and the putrid exhalations of a rank soil, is more fatal to life than any perhaps in the known world, is immediately filled with people. From being the residence of a few negroes and mulattoes, and

of a miserable garrison, relieved every three months, Porto Bello assumes suddenly a very different aspect, and its streets are crowded by opulent merchants from every corner of Peru and the adjacent provinces. A fair is opened, the wealth of America is exchanged for the manufactures of Europe, and during its prescribed term of forty days, the richest traffic on the face of the earth is begun and finished with that simplicity of attraction and that unbounded confidence which accompany extensive commerce."

Such was the former condition of Porto Bello; but the galleons are gone by, the treasures of Chili and Peru find their way out of the Pacific by way of Cape Horn, and Porto Bello has long since ceased to be the high road for its conveyance to Europe. This town was once indeed the treasury of the Old and New World; bars of silver and ingots of gold were piled in the streets, without fear or anxiety for their safety. On these occasions the most gorgeous display of specie was to be seen at Porto Bello, revelry and feasting were kept up; the presence of ships laden with merchandise, the vast influx of traders, contributed to enliven

the scene; and at this time the rent of a floor in some of the houses cost the prodigious sum of 1000 dollars per month. But this was in the "good old times" of Porto Bello—her golden age, that is not likely to return, nor any incitement to renew the system of buccaneering.

In the year 1668 Porto Bello was sacked by a body of men under Sir Henry Morgan, who marched to Panama. The piratical marauder Dampier landed there on the 5th April 1680, crossed over to Panama, cruised about the Pacific, and returned again across the isthmus. In 1739 Porto Bello was captured from the Spaniards by Admiral Vernon. Thus it has been subject to predatory incursions, and an object of contest; at present it lies neglected and undisturbed. It is one of the most defenceless places on the face of the earth; a boat's crew would capture it with ease, but would find nothing in it to repay them for the trouble.

CHAPTER IX.

Lieut. Austin despatched to seek Rocket Stations.—Mountain ridges of the Isthmus.—Mr. Loyd's Account of the Isthmus. — Northern Cordillera. — Chagres. — Adjacent Country. — Route from Porto Bello to Panama. — Navy Bay.—Panama.—Derivation of the name and Description of the place.—Panama Chains.—River Chagres.—Gorgona.

THE novel and extraordinary duties on which the Chanticleer was employed, enabled us to see something of the isthmus of Darien; we had in fact to traverse it in various directions, and to visit a considerable number of places on it, by which means we became acquainted with its general features.

Our object in visiting Porto Bello was not only to make the usual pendulum experiments, but also, if possible, to measure the difference of longitude across the isthmus by means of rockets, or in other words to connect the two oceans by knowing exactly the meridian dis-

tance between two points on either shore, which, once done with correctness, would enable any one hereafter to take up the point in the Pacific, and measure short meridian distances across it, and thus a series of observations might be taken round the world. This magnificent scheme was now to be commenced, and the attention of Captain Foster was immediately directed to the best mode of effecting it.

On our arrival at Porto Bello, Lieut. Austin, our first lieutenant, had been despatched by Captain Foster across the isthmus, to report to him on the practicability of conveying the chronometers across the isthmus by the route from Porto Bello, and also to ascertain which were the hills, adapted from their height and situation on the isthmus, from the summits of which the rockets might be fired with the best advantage.

Lieut. Austin had directions when he had satisfied himself on these points to rejoin the Chanticleer at Porto Bello.

During the absence of Lieut. Austin the pendulum experiments went forward as usual, under the management of Captain Foster. As we shall have, in the course of the future narra-

tive, to allude to several places in the isthmus which formed the theatre of these operations, and which unhappily were terminated by an event as unexpected as it was lamented, it may be well, while Lieut. Austin is absent, and the pendulum operations at Porto Bello are going forward, to take a brief survey of the Isthmus of Darien.

This extraordinary neck of land, as the reader is aware, forms the grand connecting link of the two continents North and South America. It is so narrow that in one part east of Point San Blas, the Atlantic and Pacific oceans, that wash each side of it, approach within twenty-eight miles of each other. The general feature of the isthmus on the map is that of an arc or bow, the chord of which lies nearly east and west. The great chain of the Andes does not extend over the isthmus, but this is occupied by an irregular series of hilly mountains, the highest of which is scarcely two thousand feet above the level of the sea. The principal mountain ridges are the Gatun Grande, east-south-east of Porto Bello ; Peñon Grande, north of Panama ; Cerro Ancon, near Panama ; and

Algoroba, a very lofty hill south of Porto Bello.

The following description is by Mr. Lloyd, a gentleman who surveyed the isthmus sufficiently to carry a series of levels across to determine the difference of height between the Atlantic and Pacific oceans. The result of his observations will be found in the "Philosophical Transactions;" the following is from the first volume of the Geographical Society's "Transactions."

"The northern Cordillera exhibits the first indication of depression in Nicaragua, but again rears itself for a time in the province of Veragua, and is there crowned with a very fine crown called La Mesa. In the eastern part of the province it breaks into detached mountains of considerable height, and of the most abrupt and rugged formation;—thence proceeding still to the eastward, innumerable sugar-loaf mountains appear, not above three or four hundred feet high, with their bases surrounded by plains and savannahs; and finally about Chagres on the one side, and Chorrera on the other, these also disappear for a few miles, and

the country becomes almost uninterruptedly low and flat. Presently, however, the sugar-loaf mountains again thicken, and, becoming connected, form a small cordillera running from about opposite Porto Bello to the bay of Mandingo, where is the second break. The land then continues low through the provinces of Darien and Choco, and is most abundant in rivers, those on the north side tending to the gulf of Uraba or Darien, and those on the south to that of St. Miguel; beyond which point the Cordillera again rises itself on an extended scale and enters South America.

"The general direction of the mountains near Panama is north-east and south-west; elsewhere they vary, maintaining some relation to the line of coast, though not always parallel to it. Near Panama they do not exceed one thousand or eleven hundred feet in height; east of Porto Bello they are greatly higher, and are generally covered with thick and almost impenetrable wood, growing on an extraordinary fruitful soil of great depth."

The mountains which I enumerated were measured by us, and found to be less than two thousand feet high. The principal ingredients

of the hills are hornblende, jasper, hornstone, and trap porphyry; basalt, agate, and quartz rock. A crumbly arenacious quartz rock prevails near Chagres, containing iron, pyrites, and lead. In the bed of the river Chagres are some excellent specimens of agates and jaspers, in very large masses; the plain at Cruces also affords many. The stones at Porto Bello have the volcanic character, and the sand on the beach is of a black description like that of Fernando Noronha.

The streets at Porto Bello are paved with basalt nodules. Quartz rock is very abundant throughout the isthmus, in many varieties; several beds of clay, boles, ochres, and fullers earth are also to be found, and near Chagres it is said there is a gold mine.

Mr. Lloyd however visited the gold-mines of Santa Rita and Pequeni, both in the mountain of Porto Bello; but could discover nothing but a few shafts, or rather holes of little depth which, if they ever were productive, seem now exhausted. He very much doubts whether the places shown him as the mines are really those where (according to tradition) large quantities of ore were once obtained; and thinks that

some deception was employed—probably to deceive the Spanish Government—when they were in activity. They are now almost abandoned.

Chagres is about thirty-two miles west of Porto Bello, it is an assemblage of dirty, ill-conditioned huts situated on the north bank of the mouth of the river Chagres which falls into the Caribbean sea. It has no harbour except for vessels of a very small draft, and nothing more than an open roadstead for ships, where they are exposed to the swell of the ocean. In north-east winds this is often very dangerous. The town is said to contain about two thousand people. The houses are built of reeds, and are of the most rude description. The castle of San Lorenzo stands on an eminence on the north bank of the Chagres, and commands the mouth of the river and the small harbour with ten large guns. No supplies of any kind of provisions were to be obtained, not even vegetables, so that it was just as bad as Porto Bello. In point of trade, however, Chagres has the advantage of Porto Bello, for it is the medium of communication with Panama. A small sloop or two come here annually from Jamaica with

goods which are transferred across the isthmus and some specie is conveyed back in return.

The country about Chagres is of moderate elevation, presenting cliffs of one or two hundred feet high, with the appearance of horizontal stratification. It is also wooded, and is luxuriantly fertile, presenting an appearance well adapted for cultivation.

Ships frequently send their boats up the Chagres for water; but the place is reputed to be exceedingly unhealthy. A mail boat from Jamaica goes there monthly, and the duty of taking it generally falls to the lot of some man-of-war. Chagres and Porto Bello are the only towns or villages on the Atlantic shore of the isthmus, and they are of the most inferior description as we have already seen. The narrowest part of the isthmus, which, as we before observed, is not more than twenty-eight miles across, is not traversed. This is from Mandingo bay, or the head of the gulf of San Blas, to the bay of Panama. The nearest road or path to it by which the isthmus is traversed is that from Porto Bello to Panama. The direct distance between these two points is thirty-six; but the road increases it to fifty-five miles. The route

from Porto Bello to Panama is over lofty ridges of hills, across rapids and rivers, through swamps and woods. The traveller finds no houses to shelter him at night. He must sleep beneath the trees, and carry his own provisions with him. Mr. Lloyd has given a very good idea of the country when he said that, " there is hardly a mile in this whole province that is not in the rainy season intersected by some little river or *quebrada,* which carries off the superfluous water, and is occasionally difficult to pass." The other principal route to Panama is from Chagres. The river is ascended from Chagres to Cruces by means of a canoe. The distance, which is much increased by the windings of the river, is about fifty miles. At Cruces the traveller disembarks and takes the usual road to Panama, which is a distance of about twenty miles more.

Navy Bay, called also the bay of Limon, is immediately to the eastward of Chagres. It is large and spacious, being three miles wide at the mouth. The distance to it from Chagres by water is about nine miles. The best anchorage is under the new port of Manzanilla Point, in five or six fathoms water. Mr. Lloyd with

the view of making this a safe anchorage at all seasons, proposes to construct a breakwater to extend from the western point of the bay. From this side of it he also proposes to cut a canal to join the Chagres, and to communicate with Panama by ascending the Chagres as far as the river Trinidad, from which river he proposes a rail-road to Panama, either by Chorera or by a route to the eastward. As it does not appear likely that his plans will ever be put into execution, we will not discuss their merits now. In Navy Bay there is no vestige of a building.

We found Panama presenting a poor dilapidated appearance, with grass growing in the streets, the fortifications gone to ruin, and not affording that place above all others which an Englishman first looks for, namely, an inn to stop at. Indeed to us the streets seemed half deserted as we were contemplating the beautiful, tranquil Pacific from the ruins of one of the batteries. There were two Columbian schooners in the harbour, and a delightful sea-breeze was blowing in. We found two or three long brass guns in the fort we had entered, besides four mortars, the rest having been

sold, as we were informed, to pay the troops. Of these there were not more than two hundred and fifty efficient, and these were quartered in one of the convents. Panama has little or no trade. We found four or five British residents with a consul; but the principal traffic is carried on with adjacent parts of the Pacific. The city at present contains between three and four thousand inhabitants; and Mr. Lloyd, who passed sometime there when he was preparing for his observations across the Pacific, gives the following account of it:—

"The site of Panama has been once changed. Where the old city stood, which is about three miles east of the present situation, was already, when the Spaniards first reached it in 1515, occupied by an Indian population, attracted to it by the abundance of fish on the coast, and who are said to have named it 'Panamà,' from this circumstance,—the word signifying much fish! They, however, were speedily dispossessed, and even so early as in 1521 the title and privileges of a city were conferred on the Spanish Town, by the Emperor Charles the fifth. In the year 1670 it was sacked and reduced to ashes by the

buccaneer Morgan; and was only after this built where it now stands.

" Its present position is in latitude 8° 57′ N. longitude 79° 30′ W. of Greenwich, on a tongue of land, shaped nearly like a spear-head, extending a considerable distance out to sea, and gradually swelling towards the middle. Its harbour is protected by a number of islands, a little way from the main-land, some of which are of considerable size, and highly cultivated. There is good anchorage under them all, and supplies of ordinary kinds, including excellent water, may be obtained from most of them.

" The plan of the city is not strictly regular; but the principal streets extend across the little peninsula from sea to sea; and a current of air is thus preserved, and more cleanliness than is usually found in the Spanish American towns. The fortifications are also irregular and not strong, though the walls are high, the bastions having been constructed from time to time, as the menaces of pirates, or other enemies, have suggested. The buildings are of stone, generally most substantial, and the larger with courts or patios. The style is the old Spanish. Of

public edifices, there are a beautiful cathedral, four convents (now nearly deserted) belonging respectively to the Dominican, Augustin, Franciscan, and Mercenarios monks; a nunnery of Santa Clara, a college *de la campania*, and also the walls of another, which was begun on a magnificent scale, but was never finished, and is now falling to ruins.

" Immediately about Panama, east along the coast, and north-west from it, the land is low and flat; but west and north-east the mountains approach it closely; and from a hill, called Cerro Ancon, about a mile west from the city, and six hundred feet high, an excellent bird's-eye view is obtained of the whole adjoining country, including the city, the islands in the bay, the neighbouring plantations, the mountains of Veragua, the Pearl Islands, the flat country towards Chagres, the elevated chain between Porto Bello and Panama, the Rio Grande, the low land along the coast towards the Pacora and Chepo, Panama Vieja, &c. all which come successively under review, and together constitute a landscape beyond measure beautiful."

Panama is celebrated for its gold chains.

They are very well known for their beauty and peculiarly neat workmanship. One weighing about an ounce costs 4*l.* 8*s.* and silver chains of the same kind of manufacture are to be had very reasonably. The Panama hat, which is a favourite wear in the country, is brought from Guayaquil, and costs from two to twenty dollars. The little islands of Taboga, in the bay of Panama, distant about nine or ten miles, are the gardens of the town, and supply it plentifully with fruit and vegetables.

We have already seen that the river Chagres forms the principal route from the Atlantic side of the Isthmus to Panama. The river has been thus described by Mr. Lloyd: "The Chagres takes its rise a considerable distance east of Porto Bello, among the high mountains which approach the Bay of Mandingo; and after traversing a great tract of country, when nearly opposite Porto Bello, receives the Pequeni, which comes from the south-east, and is as large and broad as itself. The two thus form a very noble river; too rapid, however, to be easily navigable, and accordingly, though canoes ascend both branches in the dry season, even above the common point of junction, the pas-

sage is considered dangerous from the number of falls, or rapids, in some of which the stream runs with extraordinary velocity. In proportionate distances, as it approaches Cruces, its rate abates. At that town, which is twenty-three miles direct from the sea, forty-four as the river winds, it seldom exceeds three or three and a-half miles per hour, even in the rainy season. At Pena Blanca it runs two miles, at Gatun scarcely one, and at Brusa the current is in summer imperceptible.

"Few rivers of its size present more beautiful scenery on its banks than does the Chagres above Cruces. For miles together it is bounded by enormous abrupt masses of lime-stone, of the most curious and fantastic forms: in other parts savannahs extend to the very edge of the river, covered with a particularly fine grass called grammalotti; and the noble bongo-tree is seen studding the banks, something in the shape of a well-trimmed yew-tree, but growing to a much larger size.

"In most places the river is shaded from the sun's rays by a large tree called jigeron, which extends its branches across the river, its leaves being eagerly sought by the fish. The water

generally runs over a bed of various descriptions of pebbles, and is in summer most brilliantly clear. In many places, near its source, it is much wider than at its mouth, occasionally breaking into distinct channels and forming small islands; but in the rainy season these are all connected, and constitute one broad stream with strong sets and eddies, caused by the abrupt turns which render its navigation peculiarly perilous.

"Many years ago, from repeated and long-continued rains, the river rose until it arrived at the foundation of the church at Cruces, situate on a small rise about forty or fifty feet above the present level: the greater part of the town was submerged; and no intercourse could take place among the inhabitants for some weeks, unless by canoes. But towards its mouth, as far as the river Trinidad, it has never been known to rise more than six or eight feet, and this height the banks easily confine."

To the foregoing it may be added, that from Gorgona to Cruces the river is very shallow, and at Cruces it is very wide; but the mean breadth of the whole may be considered about a hundred feet. The banks of the river are much

beset by the branches of fallen trees, and others indeed grow into the very water. In the dry season, from December to May, the passage from Chagres to Cruces occupies three days; but in the wet season this passage, in consequence of the increased current, is not performed under twelve or fourteen days. But the passage down from Cruces to Chagres is generally made in twelve hours. A canoe, to perform the former passage, cannot be hired under twenty-four dollars, and for the latter eight dollars.

In ascending the Chagres, the first place of any importance is the village of Gorgona, seated on an eminence on the left bank. From here a road leads to Chorera, on the side of the Pacific. The village is on an eminence, and may contain about one hundred and fifty houses, or eight hundred inhabitants. It presents an interesting and pretty appearance from the river, as it is approached, the houses being remarkably clean. It is supposed to be the healthiest place in the whole isthmus, and is resorted to in the rainy season by the people of Panama.

Gorgona is twenty-eight miles from the mouth of the river, and about eight miles higher is the town of Cruces, pleasantly situated on a fine

open plain, also on the left or south bank of the river. This town is about eight hours ride from Panama. Above this town the river is not navigable. The inhabitants, like the rest of the people of the isthmus, appear to be given to no particular pursuit, excepting to that of cock-fighting.

Mr. Lloyd observes of Cruces, that "it is the place to which goods are always conveyed," and was a village of considerable extent when Mr. Lloyd first saw it, but was accidentally burnt down in 1828. When he left it, there were not more than one hundred and twenty houses, built of reeds, occasionally plastered, and neatly thatched.

The inhabitants of these places are nearly all owners of canoes or mules, or store-keepers for taking charge of goods, or bagas, that is, persons employed in working the canoes, which is done either by paddles or poles, according to the depth of water. Cruces and Gorgona are also resorted to as watering places in summer by the inhabitants of Panama, being considered very healthy; and the town of Chorera, on the river of that name, falling into the Pacific, has the same advantage.

Having now briefly treated on those parts of the isthmus which are chiefly connected with our future operations, it remains for me to complete the task I have undertaken by relating an occurrence which those scenes recall to my mind with feelings of pain and sorrow: an occurrence purely accidental in its nature; but in its effects one that, in a single moment, deprived science of one of her most promising and assiduous labourers, the Naval service of one of its brightest ornaments, and the officers and crew of the Chanticleer of a valued and respected commander.

CHAPTER X.

Return of Lieutenant Austin and his party.—Charm used by the country people.—Ganapatos and peoitos.—Sail for NavyBay.—Lieutenant Williams despatched with rockets.—Captain Foster leaves the Chanticleer for Panama to observe the rockets.—Return.—Narrative of Lieutenant Williams's proceedings.—Number of the party.—Encampment.—Difficulties and method of overcoming them.—Dangers of the Expedition.—Fatigue of the party.—Reach Mount Algoroba.—The rockets fired.—Return.—Illness of one of the party.—Rejoin the Chanticleer in Navy Bay.

LIEUTENANT AUSTIN and his party returned from their tedious and perilous journey, having crossed the isthmus by the route from Porto Bello as far as Panama. From the very nature of it they were obliged to prepare themselves for the worst, and had accordingly dressed themselves in blanket frocks carrying their provisions with them. In their route they had, as might have been expected, many rivers to cross,

and these they were obliged to ford at times up to their chins in water.

On considering the nature of the service required to be performed, and the means which were placed at this officer's disposal for the purpose, the tribute of admiration is justly due to him and his gallant little band of hardy fellows. A service was to be performed, one which was required by one of the principal objects of the expedition, and it was performed at all risks in a climate acknowledged by all who know it to be attended with the most fatal effects to Europeans. For twelve nights were Lieutenant Austin and his party exposed to the weather, sleeping beneath the trees in the woods, drenched with rain, and annoyed almost to desperation by reptiles.

The isthmus is well known to be infested with these and wild animals. Mr. Lloyd says, "the country people will seldom move after nightfall for fear of them, and always carry about their persons a 'contra' or remedy, or what they generally consider more efficacious, a 'charm,' against their bite. This charm is an alligator's tooth, stuffed with herbs compounded, and muttered over by some old woman. It is

worn round the neck. The 'contra' is said to be very efficacious, being a bitter root called guavito, scraped down, and part of the powder taken inwardly, and part applied to the bite.

A great pest in the country are what are called ganapatos, or ticks, which in half an hour's walk in summer will completely cover the person, and are taken from their hold with some trouble. A smaller but even more insidious enemy, is the peoito (*pulga*) de la Savaña, or Savannah flea, not larger than a grain of sand, of a deep vermilion colour, and very numerous. They attack the softer parts of the flesh, and occasion a very painful itching. Common fleas, mignas or chijos, and mosquitoes, are in the usual abundance. Fire-flies are common and very brilliant; with other insects, of which many, Mr. Lloyd believes, have not yet found a place in our entomological catalogues.

Exposed to all this, Lieutenant Austin and his party persevered in the object of their mission in the most undaunted manner, cutting their way through jungle, and crossing mountains as well as rivers, and protecting themselves to their best against exposure to the climate. Having visited Panama and ascertained

the best positions for the rocket stations, they found their way back to the Chanticleer at Porto Bello. Immediately on their return, Captain Foster, having completed the pendulum experiments, resolved on sailing for Navy Bay near Chagres, from whence it was his intention to proceed by that river to Cruces and Panama. We accordingly sailed from Porto Bello on the 13th of January, leaving Lieutenant Williams with the launch, with directions at a certain time to ascend the highest central ridge of hills between that place and Panama, from whence he was to fire rockets at certain appointed periods. Another party of observation was to remain at Porto Bello, and it was expected that Captain Foster himself would be at Panama for the purpose of observing them there. The Chanticleer being safely moored in Navy Bay, Captain Foster left us on Friday the 14th of January, taking a canoe at Chagres. He proceeded by way of Cruces to Panama, and returned again to the Chanticleer safely on the 25th of January.

The following rough notes have been supplied to me by Lieutenant Williams of his proceedings on this duty.

"On the morning of the 15th of January we left Navy Bay in the launch, with a party of seventeen men and three officers, for the purpose of firing a number of rockets from Cerro Algoroba, from the height and position of which it was hoped that they would be visible both on the Atlantic and Pacific side of the isthmus. We were supplied with twelve days' provisions for our journey, and arrived the same day at Porto Bello harbour. A guide was obtained for us, and it was arranged that at the completion of the journey he was to receive the sum of seven Spanish dollars.

"On the 17th, after an early breakfast, we proceeded on our route, our party consisting of twelve men, three officers, the guide, and eight days' provisions, twelve rockets and poles, three musquets, two cutlasses, ammunition, barometer, hygrometer, three axes, and each man a blanket, average weight of every load being thirty-one pounds.

"On passing over the Mount Zinchera, which lies at the back of Porto Bello, we left one officer and two men for the purpose of having the woods sufficiently cleared from a south-east to a south-west direction, so as to give a dis-

tinct view of the mountains between those particular bearings. After stopping a short time, we proceeded on our route, passing over some land, apparently cleared away for plantations, till we arrived at the foot of the Guanche Mountain, which we then began to ascend, and we were rather annoyed by the sarsaparilla which we found plentiful in some parts of it. When on the top, we were obliged to stop a short time to rest ourselves.

"After passing over the mountain we felt so much fatigued from the heat of the valleys that at half past ten we stopped at a hut and determined to remain there till after dinner. We again buckled on our loads, and began to walk up the mountain Nyuara, on the top of which we saw a small animal something like a hare, but had no opportunity of getting a shot at him. After descending, we found at the base a small running stream, and most of the people being more or less fatigued, we determined on taking up our quarters for the night.

"We immediately got rid of our loads; a fire was then prepared, while some were cutting down rafters and the rest variously employed

stripping the palms of their long leaves, as well as cutting up and collecting sufficient wood to last for the night. We soon built a commodious shed and roofed it with the palmetto, so as to keep out the wet. When finished, a fire was made inside of it, the heat and smoke of which would clear it of all unwelcome visiters, and we each then spread our blanket and placed our knapsacks in the berth we should occupy for the night.

"Next morning we found we had no cause to regret the extra care that we had taken in building our shed, as during the night some heavy rain had fallen, and we experienced the satisfaction of having had a dry spot to sleep in. After breakfast we crossed the stream, and began ascending the Mount Piedra, when several of the men from fatigue began to get tired of each other's company. As it was necessary to check any discontent immediately, I deliberated on the best means of putting a stop to it without proceeding to severe measures, in order that the peculiar service on which we were employed might be performed with that cheerfulness which it became necessary for all parties to possess. To effect this I hit upon the fol-

lowing plan, which answered admirably: we happened to be very short of rum, as one of the calibashes in which it was carried had been unfortunately broken by the man falling who had the charge of it. Collecting them together, I told them that by the unfortunate accident that had happened it would be impossible to give more than a very small quantity daily, and that they had better agree among themselves that, if any one was found growling, his rum should go to the general stock. The plan succeeded and they all appeared delighted with the arrangement, and from that day forth a man, if he felt dissatisfied, dared scarcely complain, for the first question to him was, "Do you grumble?" and the laugh was so decidedly against the poor fellow that, under all circumstances, he would endeavour to screw his face up to a smile, and answer "No!" Nor do I remember one case where we had occasion to put the regulation in force.

"Mount Piedra we found much steeper than the former, and covered with loose moderate-sized stones: there were fewer trees on it. We had to wade through several small streams, at one of which we stopped for a short time, as a man of

our party was seized with a giddiness. Being too unwell to carry his load, it was distributed among the rest of the party, and we commenced the ascent of another hill with a very steep and narrow ridge, there being scarcely room on it for a single person to walk with safety. We however found it more difficult to descend on account of the path being made so slippery by the rain, and the prickly bushes which surrounded the trees prevented our gaining any assistance from them. Several of the men had some serious falls, but received no material injury from them.

"After quitting these narrow and dangerous ridges, we had to pass through a quantity of very high grass and brushwood, through which the guide urged us to walk fast, and appeared very anxious to keep us together; and, as far as we could understand from him, it was generally supposed to be a resort for tigers. At three we arrived at the Rio Piedra. This river is broad, deep, and full of holes, and large rocks, and near where we approached it we found a pretty little cascade. We forded this river a little below the fall, and found the stream running with great rapidity. Without a guide

it would no doubt be very dangerous to pass. Having gained the left bank, we pitched our camp for the night, and were more fatigued than usual with our day's journey, having been besides exposed all day to heavy rain.

" Next morning we began ascending a very high mountain called Lollalla, and the weather being very dull and rainy threw a gloom over the party, but our spirits were soon relieved from the awfull stillness which seemed to surround us by the print of a tiger's foot being pointed out in one of the valleys by our guide. We were cheered by the sight of a macaw and several small birds, the finest we had seen since we left Porto Bello. Our shoes began to show symptoms of rough treatment, and another of the seamen was taken ill, so that we were obliged to divide his load among the rest to allow him to proceed.

" We now came to a small fall of water, the clearest and most delicious I had ever tasted. This was no doubt from comparison, as the generality of small runs of water were infested with insects, and full of dead leaves, where we had occasionally stopped before. After

crossing some deep ravines we arrived at the river Gatun Grande. This we found a considerable stream of water, gliding over a light gravelly bottom. In the rainy season it must become entirely impassable.

"We halted on its bank for half-an-hour, to enjoy a piece of biscuit with some of its delicious water. After crossing several ravines the party became so fatigued that it was with difficulty we arrived at the foot of the mountain, from which we were to fire the rockets.

"At eight o'clock next morning we left two men at our camp in charge of the baggage and provision, with orders to spread the rockets out to dry should the weather prove at all favourable; and the rest of us ascended the mountain, provided with axes, to clear the top of trees in the direction of Panama, Porto Bello, and Chagres. We accordingly set to work, but found the wood of some of the trees so hard that it almost resisted the axe; we, however, succeeded in clearing the top entirely, and built a tent for the following night. In the course of the day, two natives passed over the mountain with a

mule heavily laden. In answer to our enquiry where they were from, they told us from Cruces bound to Porto Bello.

"By observations with the barometer, we made the height of Algoroba 1·341 feet. On the following morning we again got the rockets out to dry and lashed to the sticks ready for letting off, provided the night should prove clear. The party repairing their shoes with thongs brought for the purpose for our return journey.

"After dinner, we ascended the mountain, taking with us the rockets, port-fires, rocket-guns and tarpaulins, ready for the evening. At six, we made a fire on the mountain, in hopes the light might be seen by Captain Foster at Panama, and Mr. Fox at Porto Bello. We were most anxiously wishing that the night would prove fine, as our orders were to wait for a clear night. About dark, it became a little cloudy, and we began to look at one another rather woefully, but at a quarter before seven it began to clear up, and became remarkably fine. We proceeded therefore to fire our rockets at the intervals previously determined on. Three out of the twelve burst, but I am happy to say did no damage. During our stay on the hill, it was

clearer than I think I ever observed it on this part of the coast, as there was not a cloud to be seen.

"Having directed Mr. Fox to fire a rocket from the hill he was looking out upon, provided ours were visible, we looked anxiously for it, but in vain; and I had no doubt but that the experiment had failed. We descended the mountain and arrived at our tent at a quarter past eleven. We began now to be terribly troubled by a species of insects, called by the natives ganapatos; they are nothing more or less than the sheep-tick, but so numerous that we got quite covered with them; and the only means we had of ridding ourselves of them was by steeping a quantity of tobacco in water, and rubbing our bodies with it.

"The next morning we commenced packing up for our homeward journey. We had now scarcely any shoes left, and the people from the exposure they had undergone began to look ill. The weight each had to carry was now fortunately reduced to twenty pounds each, which made a great difference in our ascending the mountains. We crossed the Gatun Grande, and arrived at the mountain Lollalla, and regained

our old habitation on the banks of the Rio Piedra at three o'clock.

"On the following morning, our loads becoming daily lightened, we proceeded at a brisk pace, and at twelve arrived at our old residence near the mountain Liguara; and at eleven minutes past twelve, crossed the Guanche Grande river, and arrived at a shed, the residence of a man and boy in charge of some horses and pigs. It was our intention to stop here for the night, but as the guide was very anxious to proceed, and wishing to regain as soon as possible His Majesty's sloop Chanticleer, we began to ascend the Guanche Grande mountain: when nearly at the top, one of the party, a very stout man, was taken ill with severe palpitation of the heart, and fainted three times. We were then two miles from the bottom of the hill, and could get no water. All that we could do was to wait till he recovered, and with the assistance of two men he managed to walk. Having crossed the last ridge, most joyfully we were joined by Mr. Fox and party, and arrived at sunset at Porto Bello. Next morning, after the party had cleared themselves of the ganapatos and insects which they had found on their

journey, we made sail from Porto Bello in the launch at 2h. 30m, P. M., and arrived at Navy Bay at sunset, where we enjoyed a bed on board the Chanticleer, for the first time since our departure."

CHAPTER XI.

The rockets not seen.—Another rocket party despatched under Lieutenant Williams.—Captain Foster again sets out for Panama.—Lieutenant Williams's notes.—Proceed up the Chagres.—Arrive at Gorgona.—Females of Gorgona.—Some account of Gorgona.—The rockets fired.—Return to Cruces.—Remarks on the people.—Ordered to Panama.—Arrival there.—The Pacific Ocean.—Remarks on Panama.—Return to Gorgona.—The rockets observed.—The Chanticleer under way.—Captain Foster leaves Cruces in a canoe.—Pleasing contemplations.—Captain Foster accidentally falls into the water and disappears.—Consternation of his party.—Futile efforts to save him.—The intelligence conveyed to Lieutenant Austin in the Chanticleer.—The corpse found and buried by Lieutenant Williams.

THE observations for the difference of longitude by the chronometers had been made; but the rockets fired by Lieutenant Williams from mount Algoroba, although the weather had been in every way favourable, had not been seen. It was however most important that

they should be observed, and Captain Foster determined on crossing the isthmus again, and in order to make sure of seeing them, to station a party at Cruces. Things being thus arranged, Captain Foster left the Chanticleer on Friday the 28th a second time, and took a canoe on the 28th of January, and proceeded as before direct for Panama.

Captain Foster on leaving the Chanticleer was cheerful and gay; but gave me his keys, ordered me to pay his debts, and bequeathed various articles, which he most valued, to his friends. "It is quite right to make preparations like these," he said. Then, half recanting, his conversation became jocose.

In the morning the officers breakfasted with him, and all was enthusiasm and glee. He had made particular preparations for going up the river in his gig, entertaining a strong aversion to the "rascally" canoe-men; but on his arrival at Chagres altered his determination, and took a canoe. Lieutenant Williams was again despatched with rockets to Gorgona, a village on the river Chagres, and as his notes contain information and are connected with the melan-

choly event which ensue, I have again availed myself of them.

"On the 28th of January 1831, three officers and four men were despatched to proceed up the Chagres river to mount Caravella, lying at the back of the village Gorgona, while Captain Foster and one man continued on to Panama. We left Navy Bay in the ship's launch, and arrived at Chagres, where we procured a canoe and three natives, after a little delay, for twenty-four Spanish dollars, and started at three P.M from Chagres. We arrived at Gatun at 7h. 45m. where was a small Indian village on the banks of the river. We started again from Gatun at ten, and arrived at Palanquilla an hour after midnight.

"Captain Foster being anxious to arrive at a certain time at Panama, decided on hiring a small canoe. The boat was easy to be procured, but no men could be found to go. He therefore determined on taking the two natives out of the large canoe, and leave us to pole up the best way we could with our own men and the (Padron) steersman. We succeeded after a very laborious poling in reaching San Pueblo; but from the sulkiness of the steers

man, on account of his men being taken away, and by our ignorance of the river, we were driven back three or four times in passing one of the rapids. We therefore determined on remaining for the night, and considered it was probable a good sleep might put the Padron in something of a more pleasant humour. We made a mess of a fowl and some rice, and offered him some, which he refused, pulling out his own provisions. After supper we rolled ourselves up in our blankets before the fire for the night.

"In the morning we commenced poling against a very rapid stream, and in many places large stumps of trees were just showing above the surface of the water, which rendered the canoe very liable to be upset and stove. Some parts of the river were so shallow that we had to get out to lighten the canoe. Our passage was, however, enlivened by birds of a variety of plumage, and occasionally alligators were seen basking in the sun on the banks of the river. At half-past nine we got up to Guanche Grande, and in an hour after arrived at Gorgona.

"Here we found the canoe that had taken Captain Foster to Cruces just arrived. I re-

ceived a note mentioning the arrangements he had made, and proceeded to the house of Signor ———, which was to be our abode during our stay at Gorgona. He was a black fellow, and of some consequence in the village, being a kind of deputy clergyman, having an image of some saint in a box, which the inhabitants used to give a few vintins to come and pray to. His establishment, however, was none of the best, although everything was done that lay in his power, and that of his better half, to oblige us.

"We fixed the barometer, to get a peep at which soon introduced us to all the beauty and fashion of the village. The dresses of the ladies are generally white frocks with flounces at the bottom, a tippet with three rows of the same and short sleeves and short waists, and a small Panama hat with a black ribbon, among the young women coquettishly placed on one side of the head, to display their jetty ringlets. The hair is parted behind and plaited, hanging down on each side of the shoulders. They wear also gold chains generally on their necks, but no shoes. In fact, some of them might be called

pretty. Their eyes are mostly jet black, and their teeth beautifully white.

"Next morning we determined on taking a good survey of the village. The mornings are generally foggy, with a range of temperature during the twenty-four hours of 9°, which made us sensibly feel the morning air. The town consists of about one hundred and fifty houses, constructed of reeds, plastered with mud and clay, and thatched with a species of palm. It is divided by about four principal streets running in a south-east and north-west direction. The town stands on an eminence of about fifty or sixty feet above the bed of the river. It has a church, alcalde, and a serjeant in charge of the local militia, which consists of all the male inhabitants of the village. The population, by our estimation, was between seven and eight hundred, the majority being females. Gorgona is generally considered one of the most healthy places on the isthmus. The children are strong in appearance, and not afflicted with any of those diseases so prevalent at Porto Bello. The current prices were, during our residence there, for a fine bullock twenty-five Spanish dollars;

hides, each, one Spanish dollar; grease per arroba three Spanish dollars; fowls and ducks, six rials each.

"During the afternoon we ascended the Caravelli mountain, and after firing off the rockets, in the evening we returned to our habitation. We were obliged to go to Cruces next morning; but the general coming from Panama to muster the men, we found it impossible to obtain a canoe.

"After going to the alcalde and obtaining a passport, we determined to go by land, and succeeded in getting a boy as a guide. The path to Cruces is, generally speaking, good, excepting the unpleasant circumstance of having to ford the river Chagres in two places, which to a stranger is not very agreeable, on account of the number of alligators in it. We, however, completed the journey in forty minutes, without being in the least annoyed further than by the heat, which was during the day 85°. On our arrival at Cruces, we received no tidings of Captain Foster, and therefore returned to Gorgona.

"In the evening a messenger arrived from Captain Foster, with a letter. On the 2nd, we started in a canoe, and arrived at Cruces at ten

A. M. Shortly after, Commodore Farquhar arrived from Panama, and left at four P. M. for Chagres. During the day, a number of cargo mules arrived, after them a party of six mules, with men, women, and children. They have no side-saddles, and the ladies generally ride on a mule seated behind a man. The price of a mule from Cruces to Panama and back, is sixteen Spanish dollars. The population of Cruces, according to the Commandante des Ames, is 1600; but they are generally in the habit of exaggerating the numerical quantity of those things, as they think it adds to their consequence.

"The inhabitants are similar to those at Gorgona. During the time of the rainy season the town is frequently flooded, and the houses are occasionally washed away. Canoes are from ten to fifteen days getting up from Chagres in the wet season. It is, however, excessively healthy, having little or no fever. They do not manufacture the cane into sugar, although there are several plantations about. The young and old are continually sucking the cane with the greatest satisfaction. They make, however, of the juice a kind of sweatmeat well known to

children. The usual food of the poorer class is dried plantains, cassava, bananas, yams and rice, with grated cocoa-nut. After a bullock is killed, the hide is stretched out with pegs, and left for the Turkey buzzards and pigs to clean for sale. The people appear rather litigious and fond of argument. Pigs, poultry, oxen, and cows are fine and plentiful. They do not use the meat fresh, but put a small quantity of salt, and cut it up in yards, and eat it grilled or roasted.

" Cruces possesses a church, a rude building of slight construction, with a tiled roof, but no walls. On the 4th, Captain Foster arrived at one o'clock from Panama, having seen the whole of the rockets from Cerro Ancon. From him I received orders to go to Panama. A mule and guide were hired, and I started the next morning before daylight, the guide singing some most melancholy ditty without any tune, more like a scream than any pretension to music.

" The road appears to have been once good, and must have been made with an immense deal of labour, being formed of large round

stones, but now is entirely neglected, being cut up by the heavy rains. There is no interest whatever in the journey; the riding is tedious in the extreme: we met several mules going to Panama with casks of grain, the drivers all armed, and generally two together. There are a few houses on the road where may be obtained fowls, oranges, eggs, plantains, and bananas.

"Arrived at Panama at noon, and proceeded to a house opposite the church, where I procured a lodging. The woman has a slave that speaks English, and I can get supplied with everything. I waited on the Consul, by whom I was received most courteously.

"The view of the Pacific from the battery is imposing, and the delightful sea-breeze the town receives is most refreshing; but there is a kind of melancholy stillness, only two Columbian schooners, of one hundred tons each, and several canoes lying in such a superb bay. In fact, all appears the remains of former splendour, people and all, which of all things to a casual observer is most miserable.

"There are at present one French and two

English resident merchants residing at Panama. I also met with an American, who told me he had brought over an apparatus for distilling a spirit from Indian corn. The people were making what they consider active preparations for war, as a descent is expected on the Atlantic side from the Carthaginian state. A mule from Panama to Cruces is seven Spanish dollars; but a delay of three or four hours takes place before one can be obtained, from the naturally dilatory state of the inhabitants. The Panama hats, originally so called from every article made in the different parts being obliged to go from the port of Panama, are all made at Guayaquil, and sold from two Spanish dollars upwards. In the dry season, I have been informed, the road from Gorgona is preferable to that of Cruces. They have no exports of any note.

"The India-rubber tree is to be found in the country, but they do not make any use of it. It is advisable for every traveller to carry his hammock with him, as there is a difficulty of being supplied with a bed, and you are generally greatly annoyed with ganapatos (sheep-ticks).

"On the 6th of February I started from Panama, and found the road as miserably tedious as before; arrived at Cruces at two P. M. At the entrance of the Panama road there is a large anchor, which had escaped my notice in going, as we passed the place in the dark; but for what purpose it got such a position I could not find out, as it is between twenty and thirty miles from the Pacific, and between forty or fifty from Chagres. Hired a canoe, and arrived at Gorgona, where I found one of the men who had arrived from the ship with a farther supply of rockets; he had met Captain Foster in the river, and brought me a note from him.

"On this occasion, as far as the observations were concerned, things went more prosperously; the rockets were seen, and everything being satisfactorily concluded, Captain Foster left Panama, and shortly reached Cruces. As nothing further would detain the Chanticleer at the isthmus, a place which all most ardently desired to quit, Lieut. Austin was desired to have her under sail off the mouth of the river ready to receive the party, and to depart immediately to complete the few remaining objects of the expedition.

On the 5th of February, the day that was to close the mortal career of our unfortunate commander, with a party consisting of Mr. Fox and Mr. Kay, two young officers of the Chanticleer, attended by his servant, Peter Veitch, he embarked in a canoe at Cruces to descend the Chagres. The party embarked about nine in the morning, and proceeded down the river; their thoughts and conversation, as they passed the different reaches enjoying the scenery around them, being turned principally on the speedy termination of the voyage, and on returning soon to those friends they had left at home. Such was the pleasing occupation of their minds as the canoe glided down the river, Captain Foster having, besides, the additional satisfaction of knowing that he had secured the object of their visit.

About five in the afternoon, the canoe having just passed a rapid, Captain Foster suddenly rose up from the party saying he would go and see what the man abaft was about. They were reclining beneath the awning of the canoe in conversation as Captain Foster crept out at the after part of it. Being outside of it with his

feet resting on the gunwale, he incautiously seated himself on the awning, which had no sooner received his weight than it gave way, and he was precipitated into the river. The noise of his fall was heard, and Mr. Fox and his coxswain, Peter Veitch, instantly plunged after him. But their noble efforts were of no avail. The current swept the canoe rapidly away from the spot where the accident had occurred, and before she could be turned round to regain it, Captain Foster was seen sinking with uplifted hands, to rise no more! Thus perished our unfortunate commander.

The persons who had endeavoured to save Captain Foster by plunging after him had considerable difficulty in regaining the canoe. There, where cheerfulness and gaiety had prevailed but a few short moments before, all was now consternation and horror. It was one of those momentary events the very suddeness of which produces a disbelief of its fatal effects, and those who witness them on recovering sufficiently from their first surprize, naturally ask themselves can this be? But the sad reality was before them, and two hours were mourn-

fully employed in a diligent but fruitless search after the body. Night having closed in upon them it was considered best to continue on to Chagres, where having arrived they awaited daylight to carry off the intelligence to the Chanticleer.

Lieut. Austin had passed the night under sail in the brig off the mouth of the Chagres, expecting to be joined the evening before by the party. At daybreak the gig was discovered coming off to the vessel, with Mr. Fox and Mr. J. H. Kay,* who shortly made known the disaster that had befallen their late unfortunate commander. Immediately boats were despatched to search for the body, and it was not until the eighth that intelligence was received that it had been seen floating in the river.

Lieut. Austin, on whom the command of the Chanticleer had devolved, was on shore making some necessary observations when this intelligence was brought to him. A canoe was dis-

* This young gentleman, who was of much service to Captain Foster in his scientific operations, is spoken of in high terms by Captain Sir John Franklin, with whom he has since served in His Majesty's ship Rainbow.

patched by him immediately with one of his seamen for the recovery of it, followed by the gig. Soon after midnight Lieutenant Williams arrived on board, having succeeded in finding it.

The particulars attending the recovery of the corpse are thus related by him:

"On the 7th of February we were preparing to start for the Mount Carravelle when the Captain's coxswain made his appearance. I felt rather astonished at seeing him, when he gave me a letter from Lieut. Austin, with a black seal; but as all kinds of wax are the same to sailors in a hurry, I thought nothing of it till the man said 'I have bad news, sir; Captain Foster is drowned.' I was for a moment perfectly astonished, having received his note only the day before.

"When I had collected myself, I read Lieut. Austin's note, which contained an order to leave Gorgona immediately with my people, and assist Mr. Collinson, who had come up the river in the gig to look for the body. The circumstance was known in the village directly, and the people came flocking in numbers to the house to hear the particulars from our host. I wished to

settle my bill with him, but he said it was against his religion to receive money after hearing of a death. However, his wife was not as rigid in her ideas, and I accordingly gave her the money. The people wished us all good by'e most affectionately, and appeared, now we became in some way associated with them, to feel some regret at our parting, most likely for ever. There must always be something in that feeling even among the greatest stoics.

"We were obliged to stop during the night, as the canoe-men were unwilling to go down the river by dark. At daylight we proceeded down the river till I met Mr. Collinson in the gig, who was then sweeping for the body. After we had swept for about two hours we observed two canoes paddling rapidly along; one passed without taking any particular notice of us, but another man in the canoe, that was following, came up, shouting to us in English.

"As he approached us nearer, he said in Spanish something about Captain Foster; I immediately caught at it, and asked him where (supposing that as it was now three days since he had fallen overboard that the body had floated); he replied at a place called Palamatio

Nueva. We immediately got down the awning, and the men stretched out with all their force. However, we had not proceeded above half a mile when the bow-man called out 'Good God, sir, there is the Captain.' We immediately laid in our oars, and approached the spot where the body lay. There was an old tree that had fallen in the river, and the body of Captain Foster was lying between the branches surrounded by Turkey buzzards.

"When we examined it, we found that one of the shoes was off, and that a fillet of wicker-work was made fast to the left-leg; and there appeared no doubt but that some canoe had had it in tow. I immediately desired the coxswain to feel for the chronometers; we found, however, that the right-hand pocket, in which Captain Foster carried his own watch, had been cut off; the other was left. We then felt his other pockets, and found his observation-book and purse gone. He had, however, nothing in it that could in the least benefit them, as he had but two or three dollars when he left me at Cruces, and a government bill. It was the wish of Lieutenant Austin, if possible, that the body should be towed to the ship; but, on con-

sulting together, we considered it in such a decayed state, that it might possibly be the means of bringing a fever into the ship, particularly as the men had lately been so much harassed and exposed. We therefore towed the body across to the opposite bank, and having left the ship in a hurry, we were obliged to dig the grave with the loose thwart and an axe. When everything was prepared, we placed it in the grave, and covered it over with the union-jack.

"Having no prayer-book, we were unable to read the burial-service, but we reflected on the event and considered it as a warning to us all that, but a few days before he was among us in health and spirits, laying out plans and arrangements for his future guidance. Alas! how futile becomes all our anticipations; for how truly may we say, 'in the midst of life we are in death.' His grave was quickly filled up, and wattled over so as effectually to prevent any beast of prey from being able to get at the body. The spot lies nearly half-way between Palamatio Viejo and Palamatio Nueva. There is one lone tree, close to the spot, on which is nailed a board with this inscription cut out with a knife: 'Com-

mander H. Foster, His Majesty's ship Chanticleer, drowned in Chagres river, February 5th, 1831.' We left the spot as soon as possible, and started for the ship, which we succeeded in reaching at two that morning."

CHAPTER XII.

Official Report of the foregoing event from Acting Commander Austin to the Hydrographer of the Admiralty.—Services of Captain Foster.—The Voyage concluded.

SUCH are the particulars of this melancholy event, but as the official report of it by Acting Commander Austin is an important record of it, I consider it right to insert it here. It is as follows:

"H. M. Sloop Chanticleer, 9th Feb. 1831.

"Sir,

"The length of time that Captain Foster and I have been personally acquainted, and more especially having been selected by him as his senior lieutenant on this unfortunate voyage, will sufficiently account to you for the knowledge I possess of his sentiments. Such being the case, I consider it my duty on the present occasion, to give you the earliest intimation of our ever-to-be-lamented loss.

" On our arrival at Porto Bello, on the 22nd of December, Captain Foster immediately began the pendulum experiments, and despatched me to Panama to ascertain the practicability of measuring across the isthmus by rockets in pursuance of his orders. The journey across being performed wholly on foot, I did not return to the ship until the 12th of January, when I found Captain Foster had finished his experiments, and was anxiously awaiting my arrival. Indeed, he was so solicitous to prosecute with all possible dispatch and fidelity the admeasurement of the isthmus, that he had determined on sailing to Navy Bay on the 13th, had I not arrived. In my report, I represented to him, the extreme difficulty and impracticability of measuring by chronometers, *viâ* Porto Bello. We accordingly sailed for Navy Bay on the 13th; and Captain Foster left the ship in his gig for Chagres, at daybreak on the 4th instant, taking with him two chronometers, and the requisite instruments. He intended to have proceeded up the river in his gig, but on his arrival at Chagres, he preferred taking one of the country canoes as far as Cruces, and thence to travel overland to Panama.

"To co-operate with him, and to ascertain positively whether the experiments could be performed agreeably to his instructions, the second lieutenant, Williams, with a strong party, was sent to Porto Bello in the launch, with orders to proceed to an elevated and central station, recommended by me as the most eligible for the purpose. The rockets were fired from this place at the appointed times; but were not seen either by Captain Foster at Panama, or by the officer stationed on the hill contiguous to Porto Bello. Captain Foster returned to the ship in Navy Bay on the 25th in good health and spirits, as well as the whole rocket party from Porto Bello. The captain remained but two days to get the error of his watch, and started again on the 28th, accompanied by the second lieutenant and a small party for firing rockets at Cruces, his object then being to measure the meridian distance between Panama and Chagres.

"Everything had been done at Panama, the experiments were concluded, and the Captain embarked in a canoe at Cruces, on Saturday morning the 5th of February, to return down the river, exulting in the success of his obser-

vations. In the dusk of the evening the canoe having passed down a rapid, some extraordinary sensation was excited in his mind, and he rose to see that all was right. He got out at the after part of the canoe, and was seating himself on the top of the thatched awning or covering, with his feet on the gunwale, when the awning gave way and he was precipitated into the river. The awning was nothing more than a frail texture of dried reeds. At the same moment an enterprising young officer, Mr. Fox, and the captain's trusty coxswain, Peter Veitch, jumped overboard, and exerted themselves in the most noble manner, but in vain! Our unfortunate but highly talented chief was seen to their horror sinking in the water, and in a very few moments he disappeared and was lost to us for ever! Those who jumped overboard so promptly were quickly obliged to regain the canoe; but they remained two hours on the spot searching unsuccessfully for the body. They proceeded to Chagres that night in great distress, and early on Sunday morning brought the melancholy account to the ship, which was under way off Chagres, waiting the arrival of Captain Foster.

" Such was our dismay at the disastrous intelligence, that I have not words to express our feelings, for though but a humble admirer of science, my zeal and patriotism have often called forth prayers that our talented chief might be preserved to the completion of his mission.

" I immediately despatched the gig under the direction of the master, with five day's provision, to search diligently for the body; and at the same time offered a reward of twenty dollars to any of the natives who should procure his remains, in order that they might be interred. And it is some gratification to be enabled to add that we were fortunate enough to obtain the body on the following Tuesday. Lieutenant Williams, who had been left at Cruces to superintend the rockets, on becoming acquainted with the distressing accident, immediately came down in a canoe, and joined the party I had sent up in the gig. They found the body floating a few miles below the place where the accident had occurred. The dreadful state in which it was, made it impossible to bring it down the river; it was therefore deemed advisable to inter it on the spot. A grave four

feet deep was dug, and, shrouded in the colours of our country, it was buried with every attention that circumstances would permit. The grave was banked, well staked, and decently wattled. A board was carved by Lieutenant Williams, with his name, the date, and manner of his death, and conspicuously affixed to a lofty tree immediately over the grave, so that it may be easily seen by any one passing the place.

"To Lieut. Williams's exertions and kindness on the occasion, I cannot bear sufficient testimony, and it is a great loss to this gentleman that I have not the pen of Captain Foster to detail to you his able services and scientific attainments, for he was always associated with Captain Foster in his labours and observations. With his assistance I look forward to be enabled to give you satisfaction in the hydrographical department.

"It is necessary to inform you that Captain Foster's body had been plundered by some of the canoe-men of his valued private chronometer, together with his note-book, containing all his observations since leaving Porto Bello; but the government watch was found in a breast pocket on the left side, and escaped de-

tection; I presume from the unusual circumstance of a person carrying two watches.

"Having obtained permission from the governor to erect a tablet to his memory in any place I might think fit, I have accordingly done so in the port of St. Lorenzo at Chagres: it is a large piece of very hard and durable wood, cut in the usual form of a grave-stone, bearing a copper-plate with the following inscription neatly engraved thereon:—

"'This tablet is erected by the senior lieutenant and officers of his Britannic Majesty's sloop Chanticleer, to perpetuate the memory of their late commander, Henry Foster, F.R.S. who was drowned in the river Chagres on the 5th of February 1831, while measuring the difference of longitude between Panama and Chagres. This talented and distinguished officer was employed in nautical and astronomical science, having nearly completed his mission of three years' duration. He fell at his post, ripe in honours but young in years, ætat 36.'

"Afterwards was placed beneath the former.

"'His remains were found on Tuesday the 8th, floating in the river a little below Palamatio and buried on the spot.'"

Lieut. Austin continues:—

"I have sent by the same conveyance as this, an official statement of the event for the information of my Lords Commissioners of the Admiralty.

"Thus I believe and hope that everything has been done with propriety, and that I have entered into all the details that a letter admits of. Permit me to apologise for the length of the communication, and the trouble I have given.

With every sentiment of respect
I have the honour to be, Sir,
Your obedient humble servant,
(Signed) H. F. AUSTIN.

To Capt. F. Beaufort, R. N.
&c. &c. &c.

Commander Henry Foster was the eldest son of the Reverend Henry Foster of Woodplumpton, near Preston, in Lancashire. He was born in August 1796, and was educated under Mr. Saul, at Green Row, in the county of Cumberland. He was originally intended for the church; but adopted a profession more congenial to his taste. He entered the naval service of his country as a volunteer in 1812, under

Captain Morton, in his Majesty's ship York. His course of servitude as a midshipman was as follows:—

In 1815 on board the Vengeur, Captain Alexander.
1817 . . . the Eridanus, Captain King.
1817 . . the Blossom, Captain Hickey.
1819 . . . the Creole, Commodore Bowles.
1820 . . the Conway, Captain Basil Hall.
1823 . . . the Griper, Captain Clavering.

At the time that the Blossom visited the Columbia river, with the Commissioners to establish the boundary line between Great Britain and the United States, he commenced his scientific operations by surveying the mouth of that river. When in the Creole afterwards with Commodore Bowles, he made a survey of the north shore of the La Plata, which was of material service in constructing the present chart of that river. But it was not until serving in the Conway, under Captain Basil Hall, that his scientific qualities were fully evinced. In addition to the employment of surveying, he was then entrusted with the use of a collection of astronomical instruments, which had been supplied to Captain Hall by the Board of Longitude. With these he made some excellent observations, which, with pendulum expe-

riments, the first he ever undertook, obtained him admission into the Royal Society. His next appointment was to the Griper, Captain Clavering, on her voyage with Captain Sabine to the coasts of Greenland and Norway, and on the return of this ship in 1824 he received his lieutenant's rank. In the unsuccessful voyage of Sir Edward Parry, in which the Fury was lost in Prince Regent Inlet, Lieut. Foster had accompanied him as astronomer to the expedition. Here he employed the leisure afforded by an arctic winter in making some exceedingly interesting experiments on magnetism, refraction, and the velocity of sound, besides those connected with determining latitude and longitude. For these observations, which are printed in the Philosophical Transactions for 1826, on the return of the last unsuccessful attempt by Sir Edward Parry to reach the North Pole from Spitzbergen, Lieutenant Foster received the Copley medal of the Royal Society, and in half an hour afterwards, his Commander's rank. His appointment to the Chanticleer took place a few days afterwards.

As the Chanticleer's voyage was designed expressly for the employment of Captain Foster,

so it ended with his death. Having paid the last duties to her late commander, the Chanticleer sailed from Chagres on the 11th of February for Porto Bello, for the purpose of getting observations for the chronometers. From this place she finally sailed on the 13th following, and after getting the same observations off the east end of Jamaica, Cuba, Crooked Island, Bermuda, and St. Michaels, arrived at Falmouth on the 17th of May 1831, and was paid off at Sheerness on the 9th of June following.

A voyage of more than three years was thus completed with no other loss than that just related. After having traversed the most boisterous seas, and sojourned in every clime from the equator to the pole, some the most deleterious on the face of the globe, without losing a man by sickness, it behoves me to reflect with grateful feelings on the event, and to record my gratitude to a Divine Providence for so many and great mercies.

APPENDIX.

THE principal and perhaps the most important object of the voyage having been the pendulum operations, and next to them the determinations of longitude by means of the chronometers, a statement of the results of these, together with other remarks of a nature interesting to the navigator, naturally belong to the present work. For the details of the former the reader is referred to the seventh volume of the Memoirs of the Royal Astronomical Society recently published. At the request of the Council of that society, a report on the pendulum experiments of Captain Foster was drawn up by Francis Baily, Esq., President of the Astronomical and Vice-president of the Royal Society of London, which report was printed at the public expense by order of the Lords Commissioners of the Admiralty. Mr. Baily's report, besides being a work of vast pains and labour, presents the most complete history of this kind of experiment that has yet been published, on which account alone it is highly valuable. Respecting the nature of this experiment, the object of

which is to ascertain the true figure of the earth, a few remarks were made in the commencement of these volumes, and the following extracts on the subject, sufficient to convey to the reader the general result, are taken from Mr. Baily's report.

The observations for the difference of longitude between the meridians of the various places visited by the Chanticleer have been discussed in all their extensive details by Dr. Tiarks, a gentleman whose experience in this branch of science rendered him peculiarly well qualified to perform so important and delicate a task. The report of Dr. Tiarks on a subject of so much interest to the scientific navigator, and from which he may obtain so much useful information on one of the most valuable branches of his professional knowledge, is given without any abridgement whatever.

The remaining papers of the Appendix consist of various particulars of a hydrographical nature, that cannot be otherwise than useful to navigators who may visit those places of which they treat. Like those which precede them, they are the results of Captain Foster's observations, and they would no doubt have been more numerous and complete had he been spared to superintend their publication.

RESULT OF THE PENDULUM EXPERIMENTS.

(Extracted from Mr. Baily's Report.)

Captain Foster had not sufficient leisure, during his voyage, to deduce any results from his experiments. The only progress which he made in the computations was the determination of the mean interval for each experiment: but this could not give him much insight into the final result, since all the corrections were afterwards to be computed and applied. On this subject he expresses himself very properly, and almost *prophetically*, in a letter to Captain Beaufort, dated November 6, 1830, wherein he says, " I shall be very curious to see what sort of results my labours will give in pendulums, for I assure you I have laboured hard with them, and in a manner and with the feelings also of doing justice to the subject rather than of merely gaining fame, and without bias to one notion or another. *All the observations are fairly recorded and honestly obtained; so that I am indifferent about whose hands they may fall into to compute, should it please God to render such auxiliary necessary.* By the way, what think you of such a procedure under any circumstances? Would it not be more satisfactory to all parties?" The hint which is here thrown out by Captain Foster might doubtless in many cases be followed up with good effect; but it is also evident that we frequently require the assistance of the experimentalist himself to clear up and explain trifling discordances which are occasionally discovered in the final investigations, and which can only be removed (if at all) by those who have been actually engaged in making the experiments.

Places at which the Pendulums were swung.

The number of places at which Captain Foster swung the pendulums amounted in the whole to fourteen, extending

from London in the northern hemisphere to South Shetland in the southern hemisphere. At all these places each of the brass invariable pendulums, No. 10 and No. 11, was swung; at six places the iron convertible pendulum was swung on both knife-edges, and at eight places the copper convertible pendulum was swung on both knife-edges. And here it may be proper to remark, that as the iron and copper convertible pendulums were each furnished with two knife-edges, marked A and B, Captain Foster may be considered as having taken out *six* independent and invariable pendulums, each of which furnishes a distinct result, comparable with the rest; and by this means we are enabled to detect anomalies that otherwise would have escaped notice. In fact, no voyager ought to take out less than three independent pendulums; for, in the case of a discordance between any two of them, a third is requisite to clear up the difficulty.

The total number of experiments made with these pendulums was 1017 sets, out of which (if we except some of those made at South Shetland, of which I shall speak more particularly in the sequel) I have found it requisite to reject only three; namely, one at Cape Horn, one at the Island of Ascension, and one at Para, all of which were marked as doubtful at the time by Captain Foster.* And, as each of the various sets made during the voyage consisted, on an average, of nearly twenty coincidences, the total number of coincidences taken by Captain Foster at the fourteen stations was about 20,000, and occupying about 2710 hours. To which should be added the several sets which I have myself made on these pendulums since their return to this country, occupying upwards of 470 hours more. So that the total time occupied in experimenting on these pendulums has been upwards of 3180 hours; thus furnishing a

* The rejection, however, of these does not materially affect the results in either case.

series more extensive and varied than any ever before attempted by any individual, and which must have its due weight in all discussions relative to this important inquiry.*

The following table exhibits a list of the places where the pendulums were swung by Captain Foster in the order in which they were visited by him, together with the pendulums employed at the several stations, and the number of hours occupied by the experiments at each place. The three places which are marked with an asterisk are those which were visited by Captain Sabine in his voyage of experiment in the years 1822 and 1823.

* The total time occupied by Captain Sabine in making the pendulum experiments at the thirteen different stations which he visited during his two voyages in the northern and southern hemisphere was only 598 hours, which period includes the 62 hours employed in determining the rate of expansion from the pendulum experiments. The total time occupied by Captain Freycinet, at the nine different stations which he visited, was only 367 hours; and the total time occupied by Captain Duperrey, at the six different stations that he visited, was only 256 hours. So that Captain Foster's experiments are five times more extensive than Captain Sabine's, and full 2½ times more extensive than *the whole of the above experiments united*, and they have also the advantage of having been made with a greater variety of pendulums. These remarks are not made for the purpose of making any invidious distinction, but to show the comparative value of Captain Foster's labours.

No.	Stations.	Brass.		Iron.		Copper.		Total Hours.
		No. 10.	No. 11.	A	B	A	B	
1	London, before the voyage	23·74	21·82	. .	. .	. .	. .	45·56
2	Greenwich	25·08	22·95	. .	. .	. .	. .	48·03
3	*Monte* Video	64·83	41·63	. .	. .	. .	. .	106·46
4	Staten Island	120·50	69·83	28·64	31·40	43·05	43·11	336·53
5	South Shetland	59·91	173·34	41·34	42·86	25·72	28·49	371·66
6	Cape Horn	72·97	71·85	. .	. .	. .	. .	144·82
7	Cape of Good Hope	70·96	52·78	63·76	65·47	57·34	58·96	369·27
8	St. Helena	59·13	72·18	. .	. .	27·18	36·24	194·73
9	Ascension Island	107·84	76·66	26·04	23·83	36·67	35·57	306·61
10	Fernando de Noronha	52·41	46·27	. .	. .	. .	. .	98·68
11	Maranham	48·75	41·73	. .	. .	41·94	32·05	164·47
12	Para	45·53	57·17	30·70	33·24	36·78	36·07	239·49
13	Trinidad	50·21	43·13	22·89	23·30	31·05	29·90	200·48
14	Porto Bello	47·15	35·73	. .	. .	. .	. .	82·88
	London, after the voyage	43·15	40·27	77·36	90·60	115·60	107·01	479·99
	Total number of hours	892·96	867·34	290·73	310·70	415·33	407·40	3183·66

I shall now proceed to state the results obtained with these pendulums at the several places in succession, together with such other circumstances connected therewith as may tend to elucidate and explain the principal object in view, which is to determine the figure of the earth from the variation in the force of gravity, as indicated by the difference in the number of vibrations made in a mean solar day by the different pendulums at the various stations. The geological features of the country around the several pendulum stations are taken from the official reports thereon made to Captain Foster by Mr. Webster, the surgeon of the Chanticleer.

The following table will show the *observed* value at each station, (corrected, where requisite, for any deviation from the standard temperature of 62°, or from the true correction for the buoyancy of the atmosphere, and afterwards reduced to a comparison with Captain Foster's mean pendulum, assumed as making 86,400 vibrations in a mean solar day at London,) together with the *computed* value according to the data here deduced. In a collateral column are given the differences arising either from local attraction or from errors of observation, to which are annexed the names of the observers. In this last column, where the mark (N. P.) is attached to Captain Foster's name, it implies that the stations are those at which he swung the pendulum on the occasion of his voyage to the North Pole; and where the marks (Alt.) (Gr.) and (Paris) are attached to Captain Sabine's name, it implies that the stations are those at which he swung the pendulum on the three separate journeys which he made to Altona, Greenwich, and Paris, for the express purpose of determining the difference in the number of vibrations between London and those places respectively. It is necessary to make this distinction in the cases, lest they should be confounded with the stations in the more extensive voyages of these two observers. Where two or more observers have visited the same stations, the results obtained by each are kept separate and distinct for the purpose of comparison; and, as I have not in all cases been able to ascertain the precise spot at which the pendulum has been swung, I have uniformly preserved the latitude as given by each observer, however minute the difference may be.

No.	Station.	Latitude.	Vibrations.		Difference.	Observer.
			Observed.	Computed.		
		deg. mi. sec.				
1	Rawak . . .	0 1 34 S.	86261·46	86264·86	—3·40	Freycinet.
2	Pulo Gaunsah Lout	0 1 49 N.	86266·64	86264·86	+1·78	Goldingham.
3	St. Thomas . .	0 24 41—	86268·84	86264·87	+3·97	Sabine.
4	Galapagos . .	0 32 19—	86264·56	86264·88	—0·32	Hall.
5	Para	1 27 0 S.	86260·61	86265·00	—4·39	Foster.
6	Maranham . .	2 31 35—	86258·74	86265·30	—6·56	Foster.
7	Ditto . . .	2 31 43—	86259·19	86265·30	—6·11	Sabine.
8	Fernando de Noronha	3 49 59—	86271·20	86265·86	+5·34	Foster.
9	Ualan . . .	5 21 16 N.	86275·44	86266·78	+8·66	Leutke.
10	Ascension . .	7 55 23 S.	86272·26	86269·06	+3·20	Foster.
11	Ditto . . .	7 55 48—	86272·06	86269·08	+2·98	Duperrey.
12	Ditto . . .	7 55 48—	86272·56	86269·08	+3·48	Sabine.
13	Sierra Leone . .	8 29 28 N.	86267·54	86269·70	—2·16	Sabine.
14	Porto Bello . .	9 32 30—	86272·01	86270·96	+1·05	Foster.
15	Trinidad . . .	10 38 55—	86267·24	86272·42	—5·18	Foster.
16	Ditto . . .	10 38 56—	86266·78	86272·42	—5·64	Sabine.
17	Bahia	12 59 21 S.	[illegible]72·38	86276·07	—3·69	Sabine.
18	Madras . . .	13 4 9 N.	[illegible]72·36	86276·19	—3·83	Goldingham.
19	Guam	13 26 21—	[illegible]80·64	86276·84	+3·80	Leutke.
20	Ditto . . .	13 27 51—	[illegible]82·98	86276·90	+6·08	Freycinet.
21	St. Helena . .	15 54 59 S.	[illegible]88·29	86281·54	+6·75	Leutke.
22	Ditto . . .	15 56 7—	[illegible]88·29	86281·54	+6·75	Foster.
23	Jamaica . . .	17 56 7 N.	[illegible]84·66	86285·90	—1·24	Sabine.
24	Isle of France .	20 9 23 S.	[illegible]97·60	86291·20	+6·40	Duperrey.
25	Ditto . . .	20 9 56—	[illegible]98·08	86291·23	+6·85	Freycinet.

26	Mowi	20 52 7 N.	86297·52	86293·00	+4·52	Freycinet.
27	St. Blas	21 32 24—	86288·80	86294·77	—5·97	Hall.
28	Rio Janeiro	22 55 13 S.	86293·48	86298·52	—5·04	Freycinet.
29	Ditto	22 55 22—	86294·90	86298·52	—3·62	Hall.
30	Bonin Island	27 4 12 N.	86322·06	86310·81	+11·25	Leutke.
31	Valparaiso	33 2 30 S.	[illegible]28·16	86330·82	—2·66	Leutke.
32	Paramatta	33 48 43—	[illegible]31·48	86333·55	—2·07	Brisbane.
33	Port Jackson	33 51 34—	[illegible]34·06	86333·68	+0·38	Freycinet.
34	Ditto	33 51 40—	[illegible]32·94	86333·68	—0·74	Duperrey.
35	Cape of Good Hope	33 54 37—	[illegible]31·33	86333·90	—2·57	Foster.
36	Ditto	33 55 15—	[illegible]31·58	86333·95	—2·37	Freycinet.
37	Ditto	33 55 56—	[illegible]32·56	86333·98	—1.42	Fallows.
38	Monte Video	34 54 26—	[illegible]34·36	86337·42	—3·12	Foster.
39	New York	40 42 43 N.	[illegible]38·06	86359·22	—1·16	Sabine.
40	Toulon	43 7 20—	[illegible]37·16	86368·48	—1·32	Duperrey.
41	Paris	48 50 14 N.	[illegible]38·01	86390·54	—2·53	Freycinet.
42	Ditto	48 50 14—	[illegible]38·30	86390·54	—2·24	Sabine (Paris).
43	Ditto	48 50 14—	[illegible]38·56	86390·54	—1·98	Duperrey.
44	Shanklin Farm	50 37 24—	86396·40	86397·32	—0·92	Kater.
45	Greenwich	51 28 40—	86398·90	86400·58	—1·68	Foster.
46	Ditto	51 28 40—	86399·24	86400.58	—1·34	Leutke.
47	Ditto	51 28 40—	86399·46	86400·58	—1·12	Foster (N. P.)
48	Ditto	51 28 40—	86400·67	86400·58	+0·09	Sabine (Gr.)
49	Ditto	51 28 40—	86400·72	86400·58	+0·14	Sabine (Alt.)
50	London	51 31 8—	86399·76	86400·74	—0·98	Fallows.
51	Ditto	51 31 8—	86399·90	86400·74	—0·84	Foster (N. P.)
52	Ditto	51 31 8—	86399·72	86400·74	—1·03	Sabine.
53	Ditto	51 31 8—	86400·00	86400·74	—0·74	Kater.
54	Ditto	51 31 8—	86400·00	86400·74	—0·74	Goldingham.
55	Ditto	51 31 8—	86400·00	86400·74	—0·74	Hall.

No.	Station.	Latitude.	Vibrations.		Difference.	Observer.
			Observed.	Computed.		
		deg. mi. sec.				
56	London	51 31 8—	86400·00	86400·74	—0·74	Brisbane.
57	Ditto	51 31 8—	86400·00	86400·74	—0·74	Sabine (Paris).
58	Ditto	51 31 8—	86400·00	86400·74	—0·74	Sabine (Gr.)
59	Ditto	51 31 8—	86400·00	86400·74	—0·74	Sabine (Alt.)
60	Ditto	51 31 17—	86400·00	86400·75	—0·75	Foster.
61	Falkland Island	51 31 44 S.	86399·84	86400·78	—0·94	Duperrey.
62	Ditto	51 35 18—	86396·74	86400·99	—4·25	Freycinet.
63	Arbury Hill	52 12 55 N.	86403·68	86403·35	+0·33	Kater.
64	Petropaulouski	53 0 53—	86408·90	86406·34	+2·56	Leutke.
65	Clifton	53 27 43—	86407·46	86407·99	—0·51	Kater.
66	Altona	53 32 45—	86408·98	86408·28	+0·70	Sabine (Alt.)
67	Staten Island	54 46 23 S.	86415·22	86412·80	+2·42	Foster.
68	Cape Horn	55 51 20—	86417·98	86416·72	+1·26	Foster.
69	Leith Fort	55 58 41 N.	86418·02	86417·16	+0·86	Kater.
70	Sitka	57 2 58—	86420·54	86420·96	—0·42	Leutke.
71	Portsoy	57 40 59—	86424·70	86423·21	+1·49	Kater.
72	Petersburg	59 56 31—	86432·20	86430·94	+1·26	Leutke.
73	Unst	60 45 28—	86435·40	86433·64	+1·76	Kater.
74	South Shetland	62 56 11 S.	86444·52	86440·65	+3·87	Foster.
75	Drontheim	63 25 54 N.	86438·64	86442·20	—3·56	Sabine.
76	Hammerfest	70 40 5—	86461·14	86462·23	—1·09	Sabine.
77	Port Bowen	73 13 39—	86470·48	86468·06	+2·42	Foster (N. P.)
78	Greenland	74 32 19—	86470·72	86470·75	—0·03	Sabine.
79	Spitzbergen	79 49 58—	86483·28	86479·58	+3·70	Sabine.

The results in this table prove most incontestably the powerful effect of local attraction on the pendulum, since the differences are in many cases much greater than any which would arise from error of observation, and are moreover confirmed, in several instances, by different voyagers. Thus, at Maranham, Ascension, and Trinidad, the errors or differences, as found by Captain Sabine and Captain Foster, are almost identical, and those at Ascension are further confirmed by Captain Duperrey. The difference at St. Helena, deduced from Captain Foster's experiments, is confirmed by those of Captain Leutke. At the Isle of France the results of the experiments of Captain Freycinet and Captain Duperrey very nearly accord. At Guam there is indeed a difference in the results between Captain Freycinet and Captain Leutke, but they both indicate an increase of gravity at that place, though differing in degree: it should be noted, however, that Captain Freycinet himself had some doubts about the accuracy of the results at Guam; and I think it will appear, from a comparison of the values given by him in page 22 of his *Voyage autour du Monde*, that the pendulum No. 1 exhibits at Guam a much greater value than it ought to do, as compared with the other two pendulums. At Rio Janeiro there is a difference in the results between Captain Hall and Captain Freycinet, but they both indicate a diminution of gravity at that place. At the Cape of Good Hope, also, we find that all the three observers, Foster, Freycinet, and Fallows, agree in a diminution of gravity, although there is a slight difference in the amount of that diminution. On the other hand, it must be confessed that we find discordances between different observers which cannot at present be satisfactorily explained. Thus, at Paramatta and Port Jackson (which, for the purposes of this comparison, may be considered as one station) the results do not accord so well as might be wished; and at the Falkland (or Malouine) Islands there is a discordancy between the results of Cap-

tain Freycinet and Captain Duperrey that is quite inexplicable. It should be remarked, however, that Captain Freycinet made only one experiment, and with only one of the pendulums, at that place; and moreover it will be seen that there is a difference of upwards of three minutes and a half in the latitude of the stations; so that it is possible that the local attraction might not be the same at each place.*

On a review of the whole, I think it must be conceded that the differences between the observed and computed values in many cases far exceed the probable errors of observation; and, being in several instances confirmed either by the experiments of various persons or by various pendulums swung by the same persons, show most clearly that there is some local influence on the pendulum at such stations with the exact nature of which we are at present unacquainted, and which baffles all our efforts to deduce the true figure of the earth from pendulum experiments made at a few places only. For, as I have already observed, the results deduced from such experiments will vary according to the selection which we make of the stations, which ought not to occur, if there were no local influence exerted on the pendulum. And I will here take leave to repeat the remark which I have made in a former part of this report, that the force of gravity seems to be greater in islands situate at a distance from the main land than it is on continents. Such

* Captain Freycinet fixed his observatory at the Falkland (or Malouine) Islands, in the *Isle of Conti* situate in the *Baie Française*, now called Berkeley Sound. See his *Voyage autour du Monde*, page 98. But Captain Duperrey fixed his observatory amidst the ruins of the ancient settlement of *Saint Louis*, at the bottom of the same bay, and states that the difference in the latitude of the two stations is 3′ 32″, and in longitude 3′ 43″, the Isle of Conti being situate to the southward and eastward.—See *Con. des Tems* for 1830, page 183. I cannot find any island designated by this name in any of the maps of Berkeley Sound. It is probably the same as that which is called *Long Island* in the map of the Geographical Society.

islands are for the most part of volcanic origin, and consequently formed of dense materials; yet it might be supposed that the circumambient sea would destroy the effect of this superior force exerted on the pendulum.

Either the materials of which such islands are composed are more dense than is generally imagined, or the influence of the substratum on the pendulum is confined within very narrow limits. For the elucidation of this point I would suggest that, in case of another scientific expedition towards the north, experiments should be made not only on the main land, but also *at sea*, on a *field of ice*, beyond the reach of any peculiar local attraction. Another experiment, bearing also on this point, might be made nearer home and without much expense. Let a vast mass of cannon-balls be piled together at one of the dock-yards or arsenals, (Woolwich for instance,) and then let a pendulum be swung at the top of this pile, and at some other station within the yard, beyond the influence of this mass. If any experiments of this kind should be attempted, and indeed in all experimental inquiries of this nature, I should recommend that *two* pendulums at least be employed; and moreover that, in the case of the pile of balls, the pendulums be swung in the plane of the magnetic meridian, and also perpendicular thereto, in order to ascertain whether any electro-magnetic effect would be produced by such a change of position.

In the present state, however, of our knowledge on this subject, it is evident that in deducing the figure of the earth from pendulum experiments, we ought not to reject the results at certain stations merely because they present a slight anomaly, or do not accord with our preconceived notions respecting the compression. Those experiments only can be legitimately excluded which on the face of them exhibit evident marks of a derangement of the apparatus, or some gross error in the observations.

The most remarkable difference in the general table above

given is that which occurs at the Bonin Islands, which amounts to $11\frac{1}{2}$ vibrations.* Captain Beechey, in his account of these islands, states that Peel Island, one of the cluster, "is entirely volcanic, and there is every appearance of the others to the northward being of the same formation. They have *deep water all around them.*" * * * "We noticed basaltic columns in several parts of Port Lloyd; and in one place Mr. Collie observed them divided into short lengths, as at the Giant's Causeway." * * * "Many of the rocks consisted of tuffaceous basalt of a greyish or greenish hue, frequently traversed by veins of petrosilex"—(page 233, octavo edition.) If substances of this kind (whose specific gravity probably does not amount to 3·0, and the effect of whose influence must be considerably diminished by the inferior density of the surrounding sea) exert such a powerful influence on the pendulum, how are we to estimate the results of experiments made on large continents, and where are we to look for a zero point of comparison for such experiments undisturbed by any local influence?

The general results of all the experiments above detailed indicate the impropriety of fixing on the length of the seconds pendulum, in the present state of our knowledge of that instrument, as a standard measure for any nation or country, unless the precise spot where it is swung for such purpose be well defined and always accessible. We see, from Captain Foster's experiments at Maranham and Fernando de Noronha, two stations nearly in the same latitude, and not more than 800 miles apart, that the results differ 11·90 vibrations from each other after the correction is applied for the slight difference of latitude; so that the length

* By Captain Leutke's equations, the difference is only 6·46 vibrations; but he considers even this to be so great a discordance as to warrant the rejection of the result. This, however, is not a legitimate mode of proceeding, more especially as he acknowledges that the experiments at this place and at Valparaiso were the most satisfactory of the whole.

of a seconds pendulum deduced from experiments at either of these places would differ from the length of a similar pendulum deduced from experiments at the other place by more than one hundredth of an inch, a quantity far too great to be tolerated in measures of this kind.

It will be evident, from what has been here stated, that we cannot deduce the true figure of the earth from any experiments, however accurate, made at a *few* places only; but that we must combine the results of numerous stations in various parts of the globe, in order to obtain a correct mean. It has necessarily happened that hitherto all the experiments, with the exception of some of Captain Kater's, have been made on or near the *sea coast;* and what now seems most desirable, in order to perfect the general theory, would be the acquisition of good experiments made at various places in the *interior of large continents.* Out of the fifty-one stations enumerated in the list in pages 8—10, there are forty-six that are contiguous to the sea-coast; and out of these forty-six there are at least one-third situate on islands lying at a considerable distance from the main land. At most of these insular stations the force of gravity (as I have elsewhere remarked) appears to be considerably increased; and it would therefore be desirable to know how far this effect may be modified by the result of experiments at a distance from the ocean.

If we examine the separate results of the five several voyages, viz. Foster, Sabine, Freycinet, Duperrey, and Leutke, we shall find a marked difference between them, inasmuch as the two English voyagers make the compression of the earth about $\frac{1}{289}$, whilst the three foreign voyagers make it about $\frac{1}{267}$. This, however, will appear more clear from the following short table, showing the value of v (=the number of vibrations at the equator,) g, (=the increase of

gravity,) and c, (=the reciprocal of the compression,) deduced from the results of the experiments of each voyager. To which I have added the combined result of the whole of these and other experiments deduced by myself in the preceding pages; and likewise the general result deduced by Professor Airy in his excellent and interesting paper, *On the Figure of the Earth*, inserted in the *Cyclopedia Metropolitana*. I would here observe, however, that Professor Airy could not of course include the results of the experiments of Captain Foster and Captain Leutke; but he has retained those made by MM. Biot, Bessel, Borda, and Rumker, with a *variable* pendulum, which, for the reasons already stated, I have omitted.

Names.	v	g	c	
Leutke .	86272·86	·0049150	267·70	}
Duperrey	86269·60	·0048973	266·40	} =267·23
Freycinet	86267·36	·0049131	267·60	}
Sabine .	86263·46	·0051807	288·40	}
Foster .	86264·16	·0051960	289·48	} =288·94
Baily .	86264·86	·0051449	285·26	}
Airy . .	86264·44	·0051330	282·90	} =284·08

RESULTS OF THE CHRONOMETER OBSERVATIONS.

DR. TIARKS'S REPORT ON CAPTAIN FOSTER'S CHRONOMETRICAL OBSERVATIONS IN H. M. S. CHANTICLEER, TO CAPTAIN F. BEAUFORT, R.N. HYDROGRAPHER TO THE ADMIRALTY.

SIR,

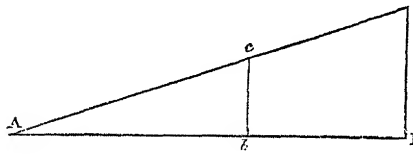
I HAVE carefully looked over the observations and calculations of the late Captain Foster and the officers of H. M. S. Chanticleer, and have endeavoured to find the most probable results for the different arcs of longitude which have been chronometrically determined by the expedition commanded by Captain Foster, and, after his lamentable death, by Captain Austen. The calculations had already been performed by Captain Foster for the parts executed by him, and he would no doubt, had his life been spared, have carefully re-examined them; they are, however, as far as I have seen, as free from errors as we can expect calculations of such an extent to be. The near agreement of all the single results of Captain Foster's equal altitudes shows his great skill in observations of this kind, and the advanced state and correctness of the calculations afford unequivocal proof of his indefatigable industry.

I have recalculated a considerable number of his equal altitudes, and have not found any error of consequence in them. The only errors of consequence which I have detected in the other calculations are the two following: Captain Foster applied the correction for the change of rate

of the chronometers, from Funchal to Fernando Noronha, to the longitude of Teneriffe, which is east of Funchal, with the same sign which he correctly uses for the places west of that place, and by thus applying the corrections with the wrong sign, has more or less vitiated all his numbers. Secondly, Captain Foster has by mistake reckoned the interval elapsed between his observations on Staten Island and St. Martin's Cove, Tierra del Fuego, too great by a whole day, which forced him altogether to reject the results of five chronometers after an interval of only eight days and a half. I have besides corrected some smaller errors. The chronometers do not seem to have retained their rates for any length of time, but some of them have repeatedly altered them to a considerable amount in very short intervals. As these chronometers were all considered to be very excellent ones, I am inclined to believe that Captain Owen is right in finding fault with the manner in which the chronometers were suspended from the deck of the Chanticleer. My own experience, as far as it goes, likewise proves that a suspension from the upper deck of a vessel is not favourable to the regular going of timepieces.

Whenever a change of rates has taken place, the only course that can be adopted is, to suppose that the chronometer has *uniformly* altered its rate during the intervening time. For the whole interval, this supposition at once leads to the adoption of the mean of the two rates, determined at the beginning and at the end of the interval; but, as it is often required to find the state of the chronometers for an intermediate time, (between the two moments for which the rates have been determined,) it becomes necessary to investigate the allowance to be made for the change of rate for such shorter periods. Let us suppose that the mean daily rate of a chronometer during a certain number of days (d) has been found=a, and that after a certain number of days (t), the mean daily rate is again determined for a number of

days (d'), and that the rate is then found to be$=a+b$. We suppose, consequently, that the chronometer has uniformly accelerated or retarded, according as a is a positive or negative quantity. On this supposition, then, it is required to find the whole change of the chronometer, owing to the alteration b, after a number of days (τ), which are supposed to be less than t. The former rate (a) strictly belongs to the middle of the interval (d), and the latter rate ($a+b$), in like manner, to the middle of the interval d'. The change of rate may therefore be supposed to have taken place during the whole interval $t+\frac{1}{2}(d+d')$. Now it is clear, that if AB represent the interval $t+\frac{1}{2}(d+d')$, and BC the change of rate b, the area of the right-angled triangle ABC will represent the accumulation arising from the uniform change of rate. If AC is therefore expressed in days, and BC is the change of the daily rate, the whole accumulation will be$=\frac{\text{AB. BC}}{2}=\frac{b(t+\frac{1}{2}(d+d')}{2}$. In like manner, the triangle Abc will represent the accumulation answering to the time Ab, which let be $\tau+\frac{1}{2}d$, if the days τ are reckoned to begin after the interval d. As the areas of the two triangles ABC and Abc are to one another as the squares of the sides AB and Ab, we shall have for the area of the triangle Abc this value: $\frac{\frac{b}{2}(\tau+\frac{1}{2}d)^2}{t+\frac{1}{2}(d+d')}$ This is, therefore, the change accruing from the alteration of the rate from the middle of the interval d. But as the change since the beginning of the days τ is only required, (it being assumed that the time has been determined at that moment,) we must deduct from it that part which belongs to the days $\frac{1}{2}d$, which, by making $\tau=o$, we find$=\frac{\frac{1}{2}b.\ (\frac{1}{2}d)^2}{t+\frac{1}{2}(d+d')}$ We have, therefore, for the quan-



tity required this: $\frac{\frac{1}{2}b[(\tau+\frac{1}{2}d)^2-(\frac{1}{2}d)^2]}{t+\frac{1}{2}(d+d')}=\frac{b(\tau+d)\tau}{2t+d+d'}$ (1).

On the supposition that the acceleration did not begin until the chronometer's first rate had been determined, viz. at the beginning of the interval t, and that the rate did not further change after that interval, we find the quantity (making d and $d'=o$)$=\frac{b.\,\tau^2}{2t}$ (2). This formula differs a little from the one given by the late Captain Flinders and by Captain Owen, and used by Captains King and Foster, as well as others; but it is evident that the one here deduced is more correct and rather more simple. In order to show the application of (1), I subjoin the following example, taken from Captain Foster's observations. Captain Foster ascertained the mean rate of his chronometers during five days at Funchal. After having touched at Santa Cruz, Teneriffe, and San Antonio Island, and having passed Pennado de San Pedro, (St. Paul's Rock,) he arrived at Fernando Noronha thirty-six days after leaving Funchal, and determined the rates of his chronometers during the next four days. These rates proved to be very different for most of the chronometers from those obtained at Funchal. The preceding formula (1) will give the corrections to be applied to the results of the Funchal rates at the places visited during the thirty-six days. We have accordingly $d=5$, $d'=4$, $t=36{,}043$, (taking into account the difference of longitude,) and therefore the accumulation in the interval τ will be$=\frac{b.\,(\tau+5)\tau.}{81.086}$

The values of τ are as follows: for

Santa Cruz . .	$\tau=3.9981$	& theref. log. $\frac{(\tau+5\tau)}{81.086}$	$=9.64705$
San Antonio .	$\tau=12.0234$		$=0.40216$
Pennado de S. Pedro	$\tau=30.8406$		$=1.13455$
Fernando Noronha	$\tau=36.043$		$=1.26111$

These factors, multiplied by the change of rate of each chronometer, will therefore give the quantities by which the

results obtained by the rates a must be respectively corrected. Example:

The rate of M'Cabe's chronometer (167) at Funchal was	2.80″
The rate of the same at Fernando Noronha was found .	4.14
Hence the change of daily rate (=b) . . .	1.34

The calculations for Pennado de San Pedro is consequently thus:

Log. 2.80″ .	0.44716	Log. 1″.34 . . .	0.12710
Log. 30.84 .	1.48911	Const. log. for Pennado. S. Pedro	1.13455
	1.93627		1.26165
Number 86.35=1′ 26″.35			Number 18″·27

By Funchal rates . .	1′ 26″.35
Correction for change of rate	0 18. 27
	1 44. 62 which is the loss of the chronometer [in 30.84 days.

Captain Foster has determined no rates at Falmouth, probably believing that as the longitude of Falmouth was sufficiently known, the deviation from the mean time of Falmouth, compared to that from Greenwich mean time, originally given him, would determine the rates of the chronometers during the interval. But when it is considered how much the chronometers have subsequently altered their rates, that they have been removed during that interval from the observatory to the vessel, and that the interval amounts to thirty-six days, it becomes doubtful whether rates so determined can be safely employed. For this reason I have adopted the longitude of Madeira resulting from the Madeira rates only, which give the longitude a little greater; it will be seen besides, that there is reason to suppose that the longitude of the Island of Fernando Noronha, of which that of Funchal forms a part, is too small.

The longitude of Fernando Noronha is of great consequence in deducing the results of Captain Foster's chronometrical measurements, and it is to be lamented that the difference of meridians between Funchal and Noronha is one

of the least satisfactory determinations. Captain Foster first visited this island in 1828, and after having been at various parts of South America, New South Shetland, the Cape of Good Hope, St. Helena, and Ascension, he returned to it, and proceeded from it again to the coast of America: the longitude of Noronha enters, therefore, into almost all longitudes from Greenwich that can be deduced from Captain Foster's chronometrical measurements.

Before we compare the determinations of Captain Foster with those of other observers, it will be proper to investigate how far they agree among themselves. We have three comparisons of this kind.

1. The difference of longitude between St. Martin's Cove, Tierra del Fuego, and Deception Island. New South Shetland was twice determined, Captain Foster having sailed from St. Martin's Cove to Deception Island, and thence returned again to St. Martin's Cove. We have:

	min.	sec.
Deception Island, east of Port Cook, Staten Island	13	50.09
St. Martin's Cove, west of Staten Island . .	14	5.95
	27	56.04
Deception Island, east of St. Martin's Cove (direct)	27	54.91
Difference .		1.13

The smallness of this difference proves that the results are most likely very accurate; I have, however, exclusively adopted the former value, because the return voyage to St. Martin's Cove was long and unfavourable.

2. By summing up the differences of meridians west of Noronha as far as St. Martin's Cove, and east as far as Mossel Bay, we obtain the difference of longitude between St. Martin's Cove and Mossel Bay, which is likewise determined directly by the Chanticleer's voyage from the former place to the latter in May and June 1829. The comparison stands thus:

	hrs.	min.	sec.
Rio Janeiro west of Fernando Noronha	0	42	59.70
Monte Video west of Rio Janeiro	0	42	18.07
Staten Island west of Monte Video	0	31	13.70
St. Martin's Cove west of Staten Island	0	14	5.95
St. Martin's Cove west of Fernando Noronha	2	20	37.42
Next, Ascension east of Fernando Noronha	1	11	57.02
Lemon Valley, St. Helena, east of Ascension	0	34	41.44
James Town, St. Helena, east of Lemon Valley	0	0	6.92
Amsterdam Battery, Ca. of Good Hope, e. of James Town	1	36	33.00
Mossel Bay, Cape Colony east of Amsterdam Battery	0	14	49.97
Mossel Bay east of Fernando Noronha	3	38	8.35
St. Martin's Cove west of Noronha	2	20	37.42
Differ. of longit. between Noronha and St. Martin's Cove	5	58	45.77
The same difference was determined directly	5	58	52.86
Difference	0	0	7.09

This difference is very small, especially considering that the latter difference is on account of the length of the interval imperfectly determined; but it is most likely so small on account of the mutual destruction of the errors in the parts of which the sum is made up.

3. Captain Foster determined the difference of longitude between Noronha and Porto Bello, and the officers of the Chanticleer subsequently that between Porto Bello and Falmouth. We may therefore deduce the longitude of Fernando Noronha from these determinations, and compare it with the more direct determination formerly obtained, thus:

	hrs.	min.	sec.
Maranham west of Fernando Noronha	0	47	33.90
Para west of Maranham	0	16	45.80
Fort St. David's, Trinidad, west of Para	0	52	0.80
La Guayra west of Fort St. David's	0	21	40.27
Porto Bello west of La Guayra	0	50	53.17
Porto Bello west of Fernando Noronha (Foster)	3	8	53.95

	hrs.	min.	sec.
Porto Bello west of Fernando Noronha (Foster)	3	8	53.95
Chagre west of Porto Bello (Austen) . .	0	1	22.94
Chagre west of Fernando Noronha . .	3	10	16.89
Barracoa east of Chagre . . .	0	22	0.43
Bermuda east of Barracoa . .	0	39	18.34
St. Michael's east of Bermuda . .	2	35	58.01
Falmouth east of St. Michael's . .	1	22	39.30
Greenwich east of Falmouth . . .	0	20	10.85
Chagre west of Greenwich . .	5	20	6.93
Chagre west of Fernando Noronha . .	3	10	16.89
Noronha west of Greenwich . .	2	9	50.04
By the former determination . . .	2	9	23.06
Difference	0	0	26.98

Here we have a difference of 27″, a considerable part of which, indeed, may be referred to the difference of the meridians of Bermuda and St. Michael's, which is evidently less accurate than the others. It will be seen from the table of longitude given at the end that I have not attempted to apply partial corrections in order to remove this disagreement, but have deduced all the longitudes of places visited, from Noronha to Bermuda, from the longitude of Noronha, as directly determined, and that of St. Michael's from Falmouth; so that the disagreement falls entirely on the difference of longitude between Bermuda and St. Michael's, which is by that table 27″ less than it was actually determined. As the partial arcs are all given, the more accurate determination of any one of the places will prove where the errors are most likely to be found. The numerous astronomical observations which Captain Foster has made at Chagre will at once prove whether the longitude deduced from Noronha or the one which would result from the Chanticleer's return to Falmouth is more correct, and all the other longitudes will thereby likewise be confirmed or corrected.

Comparison of Captain Foster's results with other determinations of longitude.

The mean of all the observations hitherto made by Mr. Fallows gives:

	hr.	min.	sec.	
The long. of the observatory at the Cape of Good Hope	1	13	53.18	E.
The observatory is, by Captain Foster's sketch east of Amsterdam Battery	0	0	12.66	
The long. of Amster. Battery according to Mr. Fallows	1	13	40.52	

By Captain Foster's chronometrical measurements we have the following differences of longitude:

	hrs.	min.	sec.
Noronha west of Ascension	1	11	57.02
Ascension west of Lemon Valley, St. Helena .	0	34	41.44
Lemon Valley west of James Town, St. Helena . .	0	0	6.92
James Town west of Amsterdam Battery . .	1	36	33.00
Noronha west of Amsterdam Battery . . .	3	23	18.38
Longitude of Amsterdam Battery by Mr. Fallows .	1	13	40.52
Longitude of Noronha from Mr. Fallows' longitude of the observatory at the Cape . . .	2	9	37.86
The same by Captain Foster's Chronometers .	2	9	23.06
Difference . .	0	0	14.80

Captain Sabine has determined the longitude of the Barrack Square at Ascension by lunar distances, which determination Captain Foster states agrees with his own astronomical observations at the Cape.

	hrs.	min.	sec.
The long. of the Barrack Square, Ascension, by Capt. Sabine is	0	57	34.33
Captain Foster finds Noronha west of Ascension . .	1	11	57.02
Long. of Noronha from Captain Sabine's long. of Ascension	2	9	31.35
The same by Captain Foster	2	9	23.06
Difference .	0	0	8.29

The difference of longitude between Funchal and Rio Janeiro was determined by Captain King through the intermediate station of Porto Praya, while Captain Foster chose Fernando Noronha. The difference of longitude is found as follows:

	Capt. King.	Capt. Foster.
Longitude of Funchal . . .	1 7 37.81	1 7 38.94
Longitude of Rio Janeiro . .	2 52 20.20	2 52 22.76
Difference of long., Funchal—Rio Janeiro	1 44 42.39	1 44 43.82
		42.39
	Difference	0 0 1.43

We may deduce the longitude of Noronha from Captain King's longitude of Rio Janeirc and Captain Foster's meridian difference between Fernando Noronha and Rio Janeiro.

	hrs. min. sec.
Captain King's longitude of Rio Janeiro . . .	2 52 20.20
Rio Janeiro west of Noronha, by Captain Foster .	0 42 59.70
Longitude of Noronha by Captain King's long. of Rio Janeiro	2 9 20.50
The same, by Captain Foster	2 9 23.06
Difference .	0 0 2.56

Captain Owen found the difference of longitude between Rio Janeiro and the pyramid or peak at Fernando Noronha .	0 43 3.00
The same as determined by Captain Foster . .	0 42 57.50
Difference .	0 0 5.50

Captain Owen states that Captain Beechey found this difference of longitude 44′, which would appear very singular.

	hrs. min. sec.
The longitude of Rio Janeiro is, according to Captain Owen	2 53 0.00
Rio Janeiro west of Noronha, by Captain Owen . .	0 42 57.50
Longitude of Fernando Noronha according to Captain Owen	2 10 2.50

	hrs.	min.	sec.
Longitude of Fernando Noronha according to Captain Owen	2	10	2.50
Reduction to Captain Foster's station . . .	0	0	2.20
Captain Owen's Longitude of Foster's station at Noronha .	2	10	0.30
The same, by Captain Foster	2	9	23.06
Difference .	0	0	37.24

We have, therefore, the following values for the longitude of Noronha:

	hrs.	min.	sec.
By Captain Foster's chronometers . . .	2	9	23.06
By Capt. Foster and the officers of the Chanticleer on her return	2	9	50.04
By Captain Sabine's longitude of Ascension, and Foster's Noronha-Ascension	2	9	31.35
By Mr. Fallows' long. of the Cape, and Foster's Noronha-Cape	2	9	37.86
By Capt. King's long. of Rio, and Foster's Noronha-Rio .	2	9	20.50
By Captain Owen's Rio Janeiro and his Rio-Noronha .	2	10	0.00

It appears, therefore, that, with the exception of Captain King's, all other determinations of the longitude of Noronha place this island farther westward than Captain Foster's measurement. But having taken his greatest value for the longitude of Funchal, and having rejected several chronometers that give the difference of longitude between Funchal and Noronha smaller than the others, I do not feel warranted in increasing that difference and the longitude of Noronha any more. That Captain Foster's longitude of Noronha can be wrong 37″, or, as the longitude of Funchal can be uncertain only by a small quantity, that his difference of meridians of Funchal and Noronha can be wrong 37″, appears quite impossible. The difference from Captain Sabine is no more than may be easily accounted for by admitting such errors as the methods employed are liable to; the only difficulty that remains is the longitude of the Cape observatory by Mr. Fallows. The difference of meridians Cape-Noronha consists, indeed, of four results, three of

which may be a little wrong; but one would hardly suppose that the sum of the errors would amount to 15″. This difficulty can only be removed by further observations of Mr. Fallows, or perhaps by Captain Foster's own astronomical observations at the Cape, which, by his own admission, differ from the chronometrical results so as to favour Mr. Fallows's longitude of the Cape observatory.

There is a great agreement between the results obtained by Captains King and Foster, which cannot but give confidence in their accuracy. The following longitudes will prove this:

Differences of Longitude.

	Capt. King.			Capt. Foster.		
Longitude of Funchal .	1	7	37.81	1	7	38.94
Funchal-Teneriffe .	0	2	40.40	0	2	40.58
Funchal-Rio Janeiro .	1	44	42.34	1	44	43.82
Rio Janeiro-Monte Video	0	52	17.80	0	52	18.07
Monte Video-St. Martin's Cove	0	45	18.20	0	45	19.65
Rio Janeiro-Fort St. Catherine	0	21	38.53	0	21	39.77

It appears that all the longitudes of Captain King are a little short of Captain Foster's.

In the detailed list of the results of every chronometer, I have given the dates of the observations on which the determinations depend, as also the rates which have been employed in the calculation. The results placed in brackets have been excluded from those that give the mean of all results, and the mean of those marked with a * has been counted as one result only.

With a view to examine the correctness of Captain Foster's calculations, and at the same time to see whether more accordant results could be adduced, I have tried other rates, generally those nearest to the observations on which the longitudes depend. In some cases the results are better; but it would appear that the small errors in the determination of time, and likewise, perhaps, the irregularities in the

going of the chronometers, have too great an influence on rates derived from short intervals. I have therefore generally retained the results derived from the rates originally adopted by Captain Foster, and which are the means of all the rates, deduced from all the combinations of any two days on which the time has been determined at the same place. These results are contained in the first column; those which I have deduced from other rates in the second column. The table exhibiting all the longitudes deduced from the operations of Captain Foster and the other officers of the Chanticleer contains, first, the single differences of longitude that have been determined, and next the longitudes reckoned from Greenwich which have been deduced from them. It will appear, from this arrangement, upon what partial arcs the longitudes depend, so that, in case of a more accurate determination of any difference of longitude, the necessary corrections may be easily applied to those which depend upon that element.

Description of the Stations at which Captain Foster observed.

Falmouth.—The flagstaff of Pendennis Castle.

Madeira.—The garden of the British Consul at Funchal.

Teneriffe.—Santa Cruz. The British Consul's house, 240 feet north, 20° west, from Fort San Pedro. The latitude of this spot was found by observations of Polaris and Antares with a repeating circle 28° 28′ 0·85″ north.

The island of *San Antonio.*—The station on the beach near the west point of the island, and at the base of the highest mountain on the island, in latitude 17° 1′ 4″·4 by circummeridional altitudes of the sun taken with a sextant. The bearing of the south point of the island from the station was south 9° 4′ east. The summit of the highest mountain bore north 77° east, distant about two miles and a half as determined by the angle of elevation 26°, and the height 7400 above the level of the sea assigned to it by Captain

Horsburgh. The summit of the mountain is, therefore, 3″·37 north, and 10″·18 (time) east of the station.

St. Paul's Rock; or, *Pennado de San Pedro.*—The rock bore from the Chanticleer at sea north 80° east, the estimated distance being about twelve miles. The latitude as deduced from the noon observation was 0° 56′ 00 north. The rock was, therefore, about 2′ 4″ north, and 27″·28 in time east of the place of observation.

The Island of *Fernando Noronha.*—The governor's house, whose latitude was found by several observations of the sun and stars 3° 49′ 59″·47 south. The peak, or pyramid, bore from the place of observation south 71° 50′ west, distant 3540 feet, and is, therefore, 10″·93 south, and 2″·22, in time, west of the place of observation.

Cape Frio.—Latitude of the place of observation 22° 58′ 39″·63 south by circummeridional altitudes taken with a sextant. Cape Frio bore from the place of observation south 25° 46′ east, distant about three-quarters of a geographical mile, and is, therefore, about 40″·52 south, and 1″·42, in time, east of the place of observation. The variation of the compass was observed on shore 1° 7′ east.

Rio Janeiro.—The station was on the Island of Villegagnon, from which the Sugar-loaf bore south 2° 50′ east, near the well in the middle of the island. The latitude of the place of observation was found by altitudes of the sun, taken with a sextant, to be=22° 54′ 31″·07 south.

The Island of Santa Catherina.—Fort Santa Cruz d'Anhatomirim, near the flagstaff of the fort. Latitude 27° 25′ 29″.8, which is the mean of the results of eleven meridian observations made by Captains Foster, Roussin, and Stokes.

Monte Video.—Station on Rat Island, near the south-east angle of the fort. The latitude was found to be 34° 54′ 25″·7 by thirty-two observations of the sun and stars taken with a repeating circle.

Staten Island—At the head of Port Cook, where there is

a low flat isthmus over which boats can be transported to the opposite side of the island. The place of observation lies at the foot of the high land on the western side of the isthmus, not many feet above high-water mark (spring tides).

St. Martin's Cove.—Tierra del Fuego, near Cape Horn. From the place of observation the north end of Chanticleer Island was just visible to the westward of a projecting point inside of the Cove, near South Head and the southern part of Jerdan Island, a little open of North Head, and it is about thirty yards above high water-mark. Its latitude was found by circummeridional altitudes of the sun taken with a sextant, 55° 51′ 19″·83.

Deception Island.—Pendulum Cove, or its eastern side, about 4000 feet from the summit of Mount Pond, which bore north 20° east. The latitude was ascertained by observations of the sun on different days with a sextant and reflecting circle, and found to be=62° 56′ 11″·4 south.

St. Martin's Cove.—Tierra del Fuego. The second station bore from the former south 84° east, distant 580 feet; the difference of longitude between the two stations was, therefore, only 0″·01.

Mossel Bay.—Seal Island bore from the station north 22° 31′, west, distant 8096 feet. The latitude of the station was found by altitudes taken with a sextant=34° 10′ 17″. The variation of the needle was 35° 16′ westerly.

Table Bay.—South-east bastion of Amsterdam Battery. The true bearing of the Devil's Peak from the place of observation in the battery was south 20° 31′ east, and its distance 16,600 feet. The latitude of the station was determined by a sextant=33° 54′ 36″·6 south, which gives the latitude of the Devil's Peak=33° 57′ 10″·2.

St. Helena.—First station, the castle or governor's house, James Town. The second station was at the western extremity of the fort in Lemon Valley. The latitude of the

fort was determined with an altitude and azimuth circle, and found to be 15° 56′ 7″.15 south, and the variation of the needle was found to be 24° 37′ westerly.

Ascension Island.—Barrack Square. The latitude was determined by forty circummeridional observations taken with an altitude and azimuth circle, and is=7° 55′ 23″·4 south; the variation of the compass 20° 10′ westerly. The time of high-water at Ascension on full and change days is 5ʰ 35′ P. M.; the greatest rise is two feet, which occurs at new moon; but one foot eight inches at the full, the highest tide being the third after the full and the second after the change.

Fernando Noronha.—The station was the same as before, viz. the governor's house.

Maranham.—Point San Francisco. The place of observation was from the consul's house south 15° 29′ 40″ east, 425 feet; from the cathedral south 24° 20′ 40″ east, distant 4928 feet. Dip of the needle 22° 20′·9 north; variation 31′ west.

Para.—Fort San Pedro de Lasca, station in the fort. Dip of the needle, 23° 27′.4 north; variation of the needle 1° 14′ east.

The *Island of Trinidad.*—Fort St. David's, or Sea Fort, Port d'Espagne. Dip of the needle, 38° 59′.5 north.

La Guayra.—The fort near the wooden jetty.

Porto Bello.—Fort Jeronymo. Dip of the needle, 32° 42′.3 north; latitude 9° 32′ 30″ north.

Chagre.—Near the eastern angle of the Castle of St. Lorenzo, situated on the north-eastern bank at the mouth of the river Chagre. Latitude, by circummeridional altitudes of the sun and stars, 9° 18′ 38″ north; variation of the compass, 6° 27′ 50″ east.

Porto Bello.—The same station as before.

The *Island of Jamaica.*—Point Morant, on the eastern end of the island. The latitude=17° 55′ 26″, determined

by circummeridional altitudes of the sun; variation of the needle, 5° 13′ east.

Barracoa.—On the eastern part of the island of *Cuba.* Forte del Punta de Barlovento, harbour of Barracoa, near the flagstaff of the fort on the weather-point of the harbour of Barracoa. Latitude 20° 21′ 36″; variation of the needle 3° 17′ east; dip of the needle 50° 6·9′.

Bermuda.—Fort St. Catherine, St. Catherine Point, St. George's Island. Latitude 32° 23′ 13″ north, determined by circummeridional altitudes of the sun and stars; variation of the needle 6° 59′ east; dip of the needle 65° 18·1′ north.

Cape Maize.—Eastern end of the island of Cuba. Latitude 20° 4′ 28″; variation of the needle 2° 27′ east.

Crooked Islands.—Passage Islands, the southern extreme of Castle Island. Latitude 22° 7′ 26″ north; variation of the magnetic needle 4° 27′.

Island of St. Michael's.—The flagstaff of the castle of St. Braz, at the city of Delgada. The latitude was determined by circummeridional observations of the sun=37° 43′ 58″; variation of the magnetic needle 24° 31′·½ west; dip of the needle 67° 34′·1 north.

Falmouth.—Flagstaff of Pendennis Castle as before; variation of the magnetic needle 25° 25′ west; the dip of the needle=68° 5′·74.

Note.—All the bearings have been corrected for the variation of the needle, and refer to the true north.

I am, Sir,

Your most obedient servant,

I. L. TIARKS.

Captain F. Beaufort, R.N.

List of the Chronometers that have been employed, and which are referred to by their Numbers.

Maker's name.	No.	Maker's name.	No.
M'Cabe . . .	167	Murray . .	555
Ditto . . .	187	Ditto . .	620
Ditto	543	Dent . .	2
Parkinson and Frodsham	699	Young . .	78
Ditto . .	799	Arnold . .	578
Ditto . . .	838	French . .	4214
Ditto . .	902	Wedenham . .	929
Ditto . . .	1095	Earnshaw .	1024
Ditto . .	1204		

Longitudes determined by Captain Foster and the other Officers of H. M. S. Chanticleer.

Names of Places.	Differences of Longitude.	Longitudes from Greenwich.
		West.
	hr. mi. sec.	hr. mi. sec.
Funchal, Madeira, west of Falmouth	0 47 28·09	1 7 38·94
Santa Cruz, Teneriffe, east of Funchal	0 2 40·58	1 4 58·36
The Island of San Antonio, west of Funchal	0 33 42·34	1 41 21·28
Pennado San Pedro, St. Paul's Rock, west of Funchal	0 49 28·89	1 57 7·83
Fernando Noronha, west of Funchal	1 1 44·12	2 9 23·06
Cape Frio, west of Fernando Noronha	0 38 16·75	2 47 39·81
Rio Janeiro, west of Fernando Noronha	0 42 59·70	2 52 22·76
The Island of St. Catherine, west of Rio Janeiro	0 21 39·77	3 14 2·53
Monte Video, west of Rio Janeiro	0 52 18·07	3 44 40·83
Port Cook, Staten Island, west of Monte Video	0 31 13·70	4 15 54·53
St. Martin's Cove, Tierra del Fuego, west of Port Cook	0 14 5·95	4 30 0·48
Deception Island, east of Port Cook, Staten Island	0 13 50·09	4 2 4·44
Ascension Island, east of Fernando Noronha	1 11 57·02	0 57 26·04
Lemon Valley, St. Helena, east of Ascension Island	0 34 41·44	0 22 44·60
James Town, St. Helena, east of Lemon Valley	0 0 6·92	0 22 37·68
		East.
Amsterdam Battery, Cape of Good Hope, east of James Town	1 36 33·00	1 13 55·32
Mossel Bay, east of Amsterdam Battery, Cape of Good Hope	0 14 49·97	1 28 46·59
		West.
Maranham, west of Fernando Noronha	0 47 33·91	2 56 56·97
Para, west of Maranham	0 16 45·80	3 13 42·77
Fort St. David's, Trinidad, west of Para	0 52 0·80	4 5 43·57
La Guayra, west of Fort St. David's, Trinidad	0 21 40·27	4 27 23·84
Porto Bello, west of La Guayra	0 50 53·17	5 18 17·90
Chagre, west of Porto Bello	0 1 22·94	5 19 39·95
Point Morant, Jamaica, east of Chagre	0 15 15·20	5 4 24·75
Barracoa, Cuba, east of Chagre	0 22 0·43	4 57 39·52
St. George's Island, Bermuda, east of Barracoa	0 39 18·34	4 18 21·18
Cape Maize, eastern end of Cuba, east of Barracoa	0 1 27·65	4 56 11·87
Castle Island, Crooked Islands, east of Barracoa	0 0 40·65	4 56 58·87
Castle St. Braz, St. Michael's, west of Falmouth	1 22 39·30	1 42 50·15

Chronometers.	Funchal, Island of Madeira, west of Falmouth.		The Island of Fernando Noronha, west of Funchal.		Santa Cruz, Island of Teneriffe, west of Funchal.		The Island of San Antonio, west of Funchal.	
	hr. mi. sec.		hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
167	0 47 30·95	—	1 1 43·46	1 1 43·76	0 2 41·20	0 2 40.60	0 33 41·54	0 33 42·11
187	29·43	—	37·34	37.17	42·66	42·54	39·18	39·35
543	24·53	—	49 21	49·73	41·86	39·43	44·52	45·89
699	(33·27)	—	54·98	55·92	42·12	40·63	41·22	42·67
799	(10·29)	—	(19·97)	(20·61)	37·98	37·05	46·25	47·16
838	(8·07)	—	(25·10)	(25·73)	39·67	38·44	40·51	41·69
902	16·75	—	39·54	38·20	39·86	42·13	(34 3·41	39·19
1095	21·57	—	44·30	43·82	39·68	40·62	33 44·20	43·30
1204	29·46	—	48·10	48·43	40·50	40·21	43·99	44·29
555	32·38	—	36·71	36·79	40·48	39·88	40·97	41·33
620	(48 51·99)	—	(0 58 89)	(3·69)	(42·76)	(32·97	(55·30)	(34 5·89)
2	47 28·68	—	(1 19·09)	(18.57)	41·61	42·27	35·88	33 35·24
78	27·40	—	34·70	31·49	40·68	39·62	42·41	43·10
578	35·59	—	52·87	53·19	39·20	38·58	47·42	48·01
4214	32·30	—						
Means .	0 47 28·09		1 1 44·12	1 1 43·85	0 2 40·58	0 2 40·15	0 33 42·34	0 33 42·56
	Observations. At Falmouth, 1828, May 1, 5. Funchal May 12. *Rates at Funchal.* May 12 to May 17. *Rates employed.* Funchal rates.		*Observations.* At Funchal, May 17. Noronha June 22. *Rates at Noronha.* June 22 to June 26. *Rates employed.* Mean of Funchal and Noronha rates. / Funchal and Noronha rates from May 14, 5 to June 24.		*Observations.* At Funchal, May 17. Santa Cruz, May 21. *Rates employed.* Funchal and Noronha rates, from May 17 to June 22. / from May 14,5 to June 24.		*Observations.* At Funchal, May 17. San Antonio, May 29. *Rates employed.* The same as at Santa Cruz.	

Chronometers.	Pennado de San Pedro, west of Funchal.		Cape Frio, west of Fernando Noronha.		Rio Janeiro, west of Fernando Noronha.		The Island of Santa Catharina, west of Rio Janeiro.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
167	0 50 20·04	0 50 20·33	0 38 19·78	0 38 20·88	0 43 2·07	0 43 3·89	0 21 38·20	0 21 37·47
187	15·13	15·02	13·62	15·13	42 55·45	42 57·48	39·45	38·73
543	25·49	26·18	18·76	18·84	43 0·83	43 0·97	38·13	38·71
699	27·26	28·13	(58·50)	(39 0·62)	(43·61)	(46·56)	48·57	48·42
799	49 59·91	0·48	9·39	38 11.20	42 49·11	42 51·57	37·36	38·00
838	50 3·03	3·62	26·27	29·07	43 5·16	43 8·96	36·48	37·00
902	16·48	15·26	25·30	27·66	7 06	10·26	40·63	40·77
1095	21·15	20·70	17·53	18·85	42 59·67	1·44	41·42	41·53
1204	25·28	25·56	16·96	17·71	58·52	42 59·52	39·08	39·38
555	12·54	12·66	(37 53·30)	(37 56·56)	(35·47)	(39·87)	48·18	47·94
620	(49 44·92)	49 54·02	38 18·74	38 20·51	43 0·26	43 2·79	39·62	40·16
2	59·13	58·68	15·45	17·85	42 57·88	0·83	39·63	40·18
78	50 19·42	50 17.14	13·64	14·16	55·85	42 56·56	37·11	37·48
578	27·71	27·98	22·79	23·73	43 4·52	43 5·8	34·67	34·98
4214							38·06	37·99
Means .	0 50 16·35	0 50 16·29	0 38 18·17	0 38 19·63	0 42 59·70	0 43 0·84	0 21 39·77	0 21 39·98
	Observations. At Funchal, May 17. Near Pennado, June 16, 84. *Rates employed.* The same as at Santa Cruz.		*Observations.* At Fernando Noronha, June 26. Near Cape Frio, July 14. *Rates employed.* Noronha and Rio Janeiro rates.	Noronha, June 24—26. Rio Janeiro, July 16—19.	*Observations.* At Fernando Noronha, June 26. At Rio Janeiro, July 16. *Rates at Rio Janeiro.* July 16 to July 27. *Rates employed.* The same as at Cape Frio.		*Observations.* At Rio Janeiro, July 27. Sta. Catharina, Aug. 5, 14. *Rates employed.* Rio Janeiro and Monte Video rates.	Rio Janeiro, July 22—27. Monte Video, Aug. 19—23.

Chronometers.	Monte Video, west of Rio Janeiro.		Port Cook, Staten Island, west of Monte Video.		St. Martin's Cove, Tierra del Fuego, west of Staten Island.		Deception Island, west of Staten Island.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
167	0 52 13·13	0 52 14·32	0 31 28·20	0 31 26·83	0 14 6·30	0 14 5·48	0 13 43·30	0 13 44·73
187	13·27	14·54	10·68	14·16	6·85	5·59	49·19	53·82
543	21·07	20·19	5·91	3·05	8·75	8·27	45·56	49·05
699	46·57*	45.81*	30 42·19	3·95	2·74	1·35	59·25	14 12·99
799	6·14*	9.87*	(52·26)	2·19	13 55·58	0·19	14 48·94	34·58
838	4·63*	6·98*	31 13·78	18·45	14 2·99	2·32	13 52·23	13 52·48
902	25·84	26·53	11·83	10·91	5·47	5·19	52·53	51·70
1095	23·72	24·72	9·98	9·58	7·72	6·85	43·70	48·45
1204	15·87	16·30	5·34	1·03	9·72	7·55	43·21	49·70
555	39·49*	38·43*	29.33	27·62	9·83	9·06	57·54	52·41
620	16·87	18·82	19·74	19·21	5·22	6·12	53·71	51·19
2	14·88	17·35	16·76	16·38	3·82	2·76	56·47	57·72
78	12·16	13.79	24·52	23·32	3·.2	2·59	52·37	54·12
578	8·61*	10·00*	26·60	26·88	3·56	2·54	43·36	44·98
4214	20·88	20·64	6·87	12·12	6·92	7·86	43·59	51·21
Means .	0 52 18·07	0 52 19·04	0 31 13·70	0 31 14·38	0 14 5·95	0 14 4·91	0 13 50.09	0 13 50·89
	Observations. At Rio Janeiro, July 27. Monte Video, Aug. 19. *Rates at Monte Video.* Aug. 19—23; Sept. 17—Oct. 4, 5. *Rates employed.* Mean of Rio Janeiro and first Monte Video rates. | Rio Janeiro, July 22—27. Monte Video, Aug. 19—23.		*Observations.* At Monte Video, Oct. 4, 5. Port Cook, Oct. 31. *Rates at Port Cook.* Oct. 28—Nov. 9; December 7—20. *Rates employed.* Mean of second Monte Video and first Staten Island rates. | Monte Video, Sept. 28—Oct. 4, 5. Staten Island, Oct. 28—31.		*Observations.* At Port Cook, Dec. 20, 5. St. Martin's Cove, Dec. 29. *Rates employed.* Second Staten Island and first Deception Island rates. | Staten Island, Dec. 14—20, 5. Deception Island, 1829, Jan. 14, 5—17.		*Observations.* At Port Cook, Dec. 20, 5. Deception Island, 1829, Jan. 14, 5. *Rates at Deception Island.* Jan. 14—26; Feb. 15—28. *Rates employed.* Mean of second Staten Island and first Deception Island rates. | Staten Island, Dec. 14—20, 5. Deception Island, Jan. 14—20, 5.

Chronometers.	St. Martin's Cove, west of Deception Island.		Mossel Bay, Cape of Good Hope, east of St. Martin's Cove.		Table Bay, Cape of Good Hope, west of Mossel Bay.		James Town, St. Helena, west of Table Bay.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
167	0 27 46·77	0 28 0·90	5 58 0·00	5 58 0·00	0 14 0·00	0 14 0·00	1 36(57·65)	1 36(58·58)
187	28 4·03	0·94	46·07	47·52	50·43	48·30	41·05	35·30
543	7·10	0·12	41·87	50·28	51·40	50·37	36·31	34·75
699	27 40·53	1·74	58·83	56·77	50 67	46·70	33·47	31·45
799	(26 44·74)	(27 19·53)	23·85*	18·81*	49·51	53·57	(47·40)	(48·73)
838	27 31·27	43·72	59 18·34*	59 19·10*	42·92	42·21	(25·36)	36·48
902	48·46	44·79	58 53·35	58 59·01	48·02	50·89	33·06	32·61
1095	59·47	57 14	46 83	52·38	51·32	50·32	35·79	33·49
1204	28 2·96	28 52·34	43·85	52·73	47·51	47·22	34·46	28·81
555	27 53·78	28 5·17	59 29·19*	59 37·14*	53·89	46·82	(37 11·43)	(37 0·53)
620	28 1·86	0·06	58 50·63	58 52·91	48·58	46·66	36 30·76	36 31·65
2	27 54·35	27 54·42	59·13	54·32	48·33	45·34	30·35	30·24
78	28 6·89	28 13·60	59 7·24	59 4·75	50·79	47·06	29·92	29·29
578	27 48·89	2·95	2·93	58 56·54	48·08	46·61	32·08	32·28
4214	28 2·35	27 46·46	58 11·60*	14·03*	57·79	51·81	39·98	45·64
929							24·12	27·04
Means .	0 27 54·91	0 27 57·45	5 58 52·86	5 58 54·50	0 14 49·97	0 14 48·81	1 36 34·30	1 36 33·00
	Observations. At Deception Island, Feb. 28. At St. Martin's Cove, April 3—April 8. *Rates at St. Martin's Cove.* April 3—19; May 4, 5—22. *Rates employed.* Second Deception Island, and first St. Martin's Cove rates.	At Deception Island, Feb. 22—28. At St. Martin's Cove, April 3—8.	*Observations.* At St. Martin's Cove, May 22, 5. Mossel Bay, June 28. *Rates at Mossel Bay.* June 28—July 4. *Rates employed.* Mean of St. Martin's Cove and Mossel Bay rates.	At St. Martin's Cove, May 14—22. At Mossel Bay, June 28—30.	*Observations.* At Mossel Bay, July 4. Amsterdam Battery, July 17. *Rates at Amsterdam Battery.* July 17—26; Dec. 1—13. *Rates employed.* Mean of Mossel Bay and Table Bay rates.	At Mossel Bay, July 2—4. At Amsterdam Battery, July 17—21.	*Observations.* At Amsterdam Battery, Dec. 13. At James Town, St. Helena, Dec. 27. *Rates at St. Helena.* 1829, Dec. 27—1830, Jan. 10. *Rates employed.* Mean of second rates at Table Bay and St. Helena rates.	At Amsterdam Battery, Dec. 10—13. At St. Helena, Dec. 27—Jan. 1, 1830.

Chronometers.	Lemon Valley, west of Castle, James Town.	Castle, James Town, east of Lemon Valley, St. Helena.	Barrack Square, Ascension, west of Lemon Valley, St. Helena.		Fernando Noronha, west of Barrack Square, Ascension.		Point St. Francis, Maranham, west of Fernando Noronha.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
167	0 0 6·57	0 0 7·56	0 34 45.87	0 34 49.09	1 11 0·00	1 11 0·00	0 47 0.00	0 47 0·00
187	8·17	7·02	44·36	44.29	58·16	57·74	33·22	31·77
543	7·38	6·94	40·67	40.24	58·79	59·31	36.50	34.41
699	6·85	7·15	42·34	44·13	57·14	55·80	30·35	31·16
799	6·08	6·18	37·92	39·07				
838	6.25	6·27	38·96	38·25	53·88	53·63	30.45	28·53
902	7·09	7·54	42·40	42·27	58·85	58·57	36·73	36·07
1095	7·16	6·92	42·42	41·65	59·50	57·91	34·76	33·44
1204	6.83	6·36	35·78	35·12	55·68	57·55	32·47	31·40
555	6.87	6·66	44·61	46·67	51·05	53·44	36·13	34·02
620	7·10	6·74	41·99	39·94	58·32	59·45	31·16	29·56
929	7.40	7·18	39·04	39.63	58·62	56·79	32·32	32·57
2	6·91	6.58	41·20	41·74	54·95	56·47		
78	6·51	6·56	41·37	41·14	57.56	57·46	33·94	32·27
578	7·57	7·22	41·47	40·64	56·15	57·35	32·32	33·10
4214	6·75	6·91	42·56	42·54	53·98	54·55	36·48	35·16
1024					12 2·60	12 1·68	36·75	35·78
Means .	0 0 6·97	0 0 6·87	0 34 41·44	0 34 41·65	1 11 57·02	1 11 57·18	0 47 33·91	0 47 32·80
	Observations. At James Town, Dec. 27. At Lemon Valley, Dec. 29.	*Observations.* At Lemon Valley, Dec. 31. At James Town, Jan. 1, 1830. *Rates at Lemon Valley.* Feb. 3—8, 5.	*Observations.* At Lemon Valley, St. Helena, Feb. 8, 5. At Barrack Square, Ascension, Feb. 15. *Rates at Ascension.* Feb. 15—23; May 23—June 5, 5. *Rates employed.* Mean of the rates at St. Helena and at Ascension. St. Helena, Feb. 6—8, 5. Ascension, Feb. 15—19.		*Observations.* At Barrack Square, Ascension, June 5, 5. At Fernando Noronha, June 12, 5. *Rates at Noronha.* June 12, 5—18; July 11—17. *Rates employed.* Means of Ascension and first Noronha rates. Ascension, June 1—5. Noronha, June 12, 5—15.		*Observations.* At Fernando Noronha, July 17. At Point St. Francis, Maranham, July 25. *Rates at Maranham.* July 25—Aug. 1; Aug. 27—Sept. 4. *Rates employed.* Mean of second Noronha and first Maranham rates. Noronha, July 13—17. Maranham, July 25—28.

Chronometers.	Fort San Pedro du Lasco Para, west of Point St. Francisco, Maranham.		Fort St. David's, Trinidad, west of Fort San Pedro du Lasco Para.		Fort at La Guayra, west of Fort St. David's, Trinidad.		Fort St. Jeronymo, Porto Bello, west of the Fort at La Guayra.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
187	0 16 46·15	0 16 45·72	0 52 2·43	0 52 1·00	0 21 39·16	0 21 39·19	0 50 54·05	0 50 53·80
543	45·90	45·90	0·06	51 59·50	41·07	40·56	53·49	53·19
699	39·91	41·67	0·89	59·16	37·83	37·86	51·36	51·36
838	44·52	44·95	51 53·83	54·70	41·95	41·42	58·83	53·33
902	46·72	46·78	52 2·75	52 1·97	37·68	37·20	49·36	49·51
1095	46·57	46·02	12·20	12·47	40·37	40·08	54·39	54·11
1204	48·11	47·70	0·35	51 56·45	39·18	38·59	55·11	54·92
555	47·51	45·61	8·19	52 4·95				
620	45·60	44·24	1·71	51 59·07	44·51	41·60	50·64	50·80
78	45·26	45·05	51 58·26	56·24	40·35	39·67	52·83	52·75
578	45·04	46·50	57·46	56·71	39·38	40·51	52·31	52·61
4214	49·90	46·93	58·83	50·80	39·11	38·75	53·12	52·44
929	44·91	45·27	54·04	50·42	41·88	44·45	51·66	51·62
1024	45·13	49·09	52 0·15	52 0·60	40·23	40·23	54·00	53·83
Means .	0 16 45·80	0 16 45·82	0 52 0·80	0 51 58·86	0 21 40·27	0 21 40·01	0 50 53·17	0 50 52·66

Observations.
At Maranham, Sept. 4.
Fort San Pedro, Para, Sept. 9.

Rates at Para.
Sept. 9—13; Oct. 3—10.

Rates employed.
Mean of the second rates at Maranham and first rates at Para. — Maranham, Sept. 1—4. Para, Sept. 9—11.

Observations.
At Fort San Pedro, Para, Oct. 10.
At Fort St. David's, Trinidad, Oct. 29.

Rates at Trinidad.
Oct. 29—Nov. 2; Nov. 28—Dec. 5.

Rates employed.
Mean of the second rates at Para and first at Trinidad. — Para, Oct. 6—10. Trinidad, Oct. 29—Nov. 2.

Observations.
At Fort St. David's, Trinidad, Dec. 7.
At the Fort at La Guayra, Dec. 13, 5.

Rates at La Guayra.
Dec. 13, 5—15, 5.

Rates employed.
Mean of the second rates at Trinidad and the rates at La Guayra. — Trinidad, Dec. 2—5. La Guayra, Dec. 13, 5—15, 5.

Observations.
At the Fort at La Guayra, Dec. 15, 5.
At Fort St. Jeronymo, Porto Bello, Dec. 23.

Rates at Porto Bello.
Dec. 23—30.

Rates employed.
Mean of the rates at Trinidad and La Guayra. — La Guayra, Dec. 13, 5—15, 5. Porto Bello, Dec. 23—27.

Chronometers.	Punta de Barlovento, Barracoa, east of Castle St. Lorenzo, Chagre.		Porto Bello, east of Castle St. Lorenzo, Chagre.		Point Morant, Jamaica, east of Castle St. Lorenzo, Chagre.		St. George's Island, Bermuda, east of Punta de Barlovento.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
187	0 21 57·17	0 21 54·38	0 1 22·99	0 1 23·01	0 15 11·12	0 15 10·17	0 39 16·72	0 39 17·35
838	(22 16·60)	22 0·28	22·77	22·76	22·20	14·81	(46·44)	(54·79)
902	1·35	21 58·95	24·44	24·42	15·51	15·09	17·59	17·36
1095	21 59·48	22 3·42	22·36	22·55	14·72	16·97	17·25	17·87
1204	22 5·02	4·10	22·62	22·63	16·57	16·50	16·53	15·68
620	(14·78)	9·82	24·13	24·16	24·17	22·10	23·83	25·66
78	21 58·10	21 58·09	25·91	25·91	15·62	15·62	2·98	2·51
578	58·69	59·77	20·43	20·44	9·86	11·20	21·61	20·79
4214	22 3·20	22 0·50	23·57	23·57	17·69	16·70	19·16	19·16
929	5·81	4·24	22·99	22·98	12·91	15·62	21·87	21·67
1024	21 55·08	21 55·16	20·08	20·09	6·86	7·25	25·88	26·20
Means .	0 22 0·43	0 22 0·79	0 1 22·94	0 1 22·96	0 15 15·20	0 15 14·73	0 39 18·34	0 39 18·43
	Observations. At Chagre, 1831, Feb. 11. Barracoa, March 5. *Rates at Chagre.* Feb. 7—11. *Rates at Barracoa.* March 5—13. *Rates employed.* Means of the above two rates at Chagre and Barracoa.	Chagre, Feb. 9—11. Barracoa, March 5—8.	*Observations.* At Chagre, Feb. 11. Porto Bello, Feb. 12, 5. *Rates employed.* The rates at Chagre and Barracoa.	Chagre, Feb. 9—11. Barracoa, March 5—8.	*Observations.* At Chagre, Feb. 11. Point Morant, Feb. 25. *Rates employed.* The same as at Porto Bello.		*Observations.* At Barracoa, March 13. St. George's Island, March 28. *Rates at Bermuda.* March 28—April 1. *Rates employed.* Mean of the rates at Barracoa and at Bermuda.	Barracoa, March 8—13. Bermuda, March 28—30.

Chronometers.	Cape Maize, Cuba, east of Punta de Barlovento, Cuba.		Castle Island, Crooked Islands, east of Barracoa, Cuba.		Castle St. Braz, St. Michael's, east of Fort St. Catharine, Bermuda.		Pendennis Castle, Falmouth, east of Castle St. Braz, St. Michael's.	
	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.	hr. mi. sec.
187	0 1 26·82	0 1 26·98	0 0 38·30	0 0 38·65	2 36 3·87	2 36 6·06	1 22 46·55	1 22 45·90
838	29·34	(33·40)	42·06	(53·94)	(30·22)	(32·62)	45·87	45·02
902	27·10	27·05	40·23	40·16	35 57·15	35 57·75	40·49	40·89
1095	28·65	28·60	41·22	41·11	36 2·83	36 10·24	36·70	34·89
1204	27·39	27·33	39·13	38·95	10·98	12·02	45·83	46·44
620	27·94	28·36	41·39	42·30	3·86	8·02	35·41	35·85
78	26·39	26·43	39·28	39·10	35 34·51	35 37·86	27·12	28·02
578	27·82	27·87	41·30	41·33	54·02	57·36	25·26	25·56
4214	26·75	27·91	38·57	38·90	36 11·30	36 10·47	43·04	42·48
929	27·53	27·64	41·09	41·32	35 15·17	35 31·13	56·11	49·68
1024	28·44	28·70	44·60	45·15	43·58	3 52·77	41·13	38·58
Means .	0 1 27·65	0 1 27·69	0 0 40·65	0 0 40·70	2 35 58·01	2 35 59·37	1 22 40·32	1 22 39·39
	Observations. At Barracoa, March 13. Cape Maize, Cuba, March 15. *Rates employed.* Rates at Barracoa and Bermuda. / The same as before.		*Observations.* At Barracoa, March 13. Castle Island, March 18. *Rates employed.* The same as for Cape Maize. / The same as before.		*Observations.* At Bermuda, April 1. Castle St. Braz, April 22. *Rates at St. Braz.* April 22—28. *Rates employed.* Mean of the rates at Bermuda and at Fort St. Braz. / Bermuda, March 28—April 1. St. Braz, April 22—24.		*Observations.* At Castle St. Braz, April 28. Pendennis Castle, May 8. *Rates at Pendennis.* May 8—12. *Rates employed.* Mean of the rates at Fort St. Braz and at Pendennis. / St. Braz, April 25—28. Pendennis, May 8—11.	

Postcript, July 13, 1834.

Mr. Henderson informs me that his latest determination of the longitude of the Cape observatory is $1^h\ 13^m\ 55^s{\cdot}0$ east of Greenwich, and that Amsterdam battery is, according to Captain Owen's Chart, 15^s west of the observatory. According to these data, Amsterdam battery is, consequently, in longitude $1^h\ 13^m\ 40^s$ east of Greenwich. Mr. Henderson likewise informs me, that Captain Foster's station in James Town, St. Helena, is, by his estimation, 3^s east of the observatory, the longitude of which Lieut. Johnson has found to be $22^m\ 50^s$ west of Greenwich. The longitude of Captain Foster's station would therefore be $22^m\ 47^s$ west of Greenwich. The difference of longitude between Amsterdam battery and Capt. Foster's station in James Town, which Capt. Foster's chronometers make $1^h\ 36^m\ 33^s$ would, according to these determinations, be only $1^h\ 36^m\ 27^s$. Assuming the longitude of the station in James Town, derived from the longitude of the observatory at that place, as determined by Lieut. Johnson, to be correct, and adding to it the difference of longitude between this station and that of Fernando Noronha resulting from Capt. Foster's chronometers, we shall find the longitude of the latter station $2^h\ 9^m\ 32\ 38^s$ which would nearly agree with the longitude derived from Capt. Sabine's longitude of the island of Ascension, and would prove that the difference of longitude between Funchal and Fernando Noronha has been determined too small by $9^s{\cdot}32$. The great difference of 27^s between the two determinations of the difference of longitude between St. George's island, Bermuda, and Castle St. Braz, St. Michael's would, by adopting this longitude of Fernando Noronha, be reduced to 18^s. The above correction of $9{\cdot}32^s$ if adopted, would fully affect almost all the longitudes,

most of them depending on that of Fernando Noronha; those, however, determined between Funchal and Fernando Noronha, would have to be corrected by the product of this quantity into the ratio of the squares of the times elapsed between the observations at Funchal and those of the places in question, and Fernando Noronha respectively. The longitudes of Mossel Bay and Amsterdam battery must, of course, depend on the longitude of the Cape observatory. In this manner we should obtain the following list of longitudes.

Places.	Longitude from Greenwich.		
	West.		
	hrs.	min.	sec.
Funchal, Madeira	1	7	38·94
Santa Cruz, Teneriffe	1	4	58·37
The Island of San Antonio	1	41	22·08
Pennado de San Pedro, St. Paul's Rock	1	57	13·10
Fernando Noronha	2	9	32·38
Cape Frio	2	47	49·13
Rio Janeiro	2	52	32·08
The Island of St. Catherine	3	14	11·85
Monte Video	3	44	50·15
Port Cook, Staten Island	4	16	3·85
St. Martin's Cove, Tierra del Fuego	4	30	9·80
Deception Island	4	2	13·76
Ascension Island	0	57	35·36
Lemon Valley, St. Helena	0	22	53·92
James Town, St. Helena	0	22	47·00
	East.		
Amsterdam Battery, Cape of Good Hope	1	13	40
Mossel Bay, Cape of Good Hope	1	28	29·97
	West.		
Maranham	2	57	6·29
Para	3	13	52·09
Fort St. David's, Trinidad	4	5	52·89
La Guayra	4	27	33·16
Porto Bello	5	18	26·33
Chagre	5	19	49·27
Point Morant, Island of Jamaica	5	4	34·07
Barracoa, Island of Cuba	4	57	48·84
St George's Island, Bermuda	4	18	30·50
Cape Maize, eastern end of Cuba	4	56	21·19
Castle Island, Crooked Islands	4	57	8·19
Castle St. Braz, S. Michael's	1	42	50·15

I. L. TIARKS.

HYDROGRAPHY.

MEMOIR ON STATEN ISLAND.

BY LIEUT. E. N. KENDALL, R.N.

Staten Island is rendered remarkable by its position off the south-east extreme of the South American continent by the peculiarity of its shape (it being so deeply indented by bays as to form nearly four different islands), and by the circumstance of its offering a good departure to ships bound into the Pacific, as well as a landfall returning from thence. It is composed of an accumulation of lofty hills of clay slate, whose peaked summits retain through most of the year the snowy covering amassed on them during the long and dreary winter. They preserve for the most part a direction nearly north and south, inclining, however, in many cases, a little to the eastward. The harbours are merely the valleys between them, they consequently all preserve nearly the same direction, and are surrounded almost on every side by high land, the water in them deepening rapidly towards the centre. The coast consists everywhere of rocky cliffs elevated from two to five hundred feet, and the water is of great depth, having generally from fifteen to twenty fathoms close to their bases. The velocity of the tides is very great, and as they meet with constant obstacles from the manner in which the headlands jut out at right angles to their direction, there is produced, when the wind is strong and contrary, a rough cross breaking sea that is impassable by a boat, and even dangerous to a ship of considerable size.

There is also reason to believe that the meeting of the flood tides coming round Cape Horn, and through the various channels of "Terra del Fuego," contributes to occasion the unusual agitation of the sea in the vicinity of Staten Island. The flood comes from the eastward along the northern shores of the island, and continues its course southward through the Strait of Le Maire, varying in velocity

from five to seven or eight knots. To the southward of the island but little amount of tide is perceptible; there is, however, a remarkable undertow, which renders it dangerous for boats to stretch across the mouths of the deep bays, as it is difficult to close again with the land, for which reason the sealers invariably follow the circuitous route of the shores. The times of high water at full and change at Cape St. Bartholomew and Cape Horn are 3h. 50m. and 5h. 30m. respectively, showing that the great tide wave of flood comes from the south-west. This seems to point out that Staten Island, standing with its extreme length about east-north-east, or nearly at right angles to its direction, receives upon its southern shore the whole force of the flood, which having passed Cape St. John, follows the direction of the coast to the westward, where it meets the flood coming down the eastern side of the South American continent, and also that proceeding from the Straits of Magellhaens, together with those that find their passage between the islands of Terra del Fuego. This heaping together of the tides in one place from such a variety of directions, would be quite sufficient to account for the constant state of agitation exhibited by the surrounding sea of Staten Island, even in moderate weather, without taking into account the prevalence of westerly gales of the most violent character.

The harbours of Staten Island are with one exception confined to its northern side; they are St. John's Harbour, Port Cook, New Year's Harbour, Basil Hall Harbour, Port Parry. Port Hoppner, and Port Vancouver. There are also two or three small bays in the Straits of Le Maire, but they are rendered unsafe by their exposure to the prevalent westerly winds. All these anchorages, though well protected when once gained, are more or less difficult of access from the force with which the tides set across the mouths of the inlets, the depth of water, and variableness of the wind, which in every instance, except that of blowing immediately lengthways of

the port, finds its way down the ravines of the mountains in various directions, according to the peculiarity of their form.

The New Year Islands afford a sort of protection from westerly winds, and there is anchorage under the north-easternmost in seventeen fathoms; but it cannot be recommended, being open to the influence of all winds between north and east-south-east, the bottom rocky, and the tides running with great velocity, whilst the eddies are so uncertain in their distance from the island, that it is by no means easy to keep a ship clear of her anchors.

St. John's Harbour.

This is the easternmost in the island, and may be easily recognized at a distance by the Mount Richardson, at whose base it is situated. On nearing it, a remarkable cliff, like a painter's muller, appears on the eastern shore, which is high and steep. Allowance must be made in steering for the harbour for the set of the tide, which at all times runs rapidly across its mouth; it is, however, less sensible when within the headlands, forming the north-west bay, in which, in case of necessity, or to await the turn of the tide, an anchor may be dropped in from twenty to thirty fathoms. The mouth of the harbour is wide, having twenty-five fathoms in the centre, with a rock standing off at some distance from the western point, to which a berth must be given. The shores, with this exception, are bold, and immediately within the western point is a small bay, where anchorage may be had in ten fathoms. The most sheltered situation is at the head of the harbour, distant from the entrance three miles south-south-west, where a vessel may choose any depth between twenty and five fathoms, with sandy bottom, and moor with an open hawse to the south-west, from whence the gusts that come from the mountains are violent. The wind, anything to the westward of

west-north-west, or even north-west outside, will be found to draw out of the harbour on nearing its head, and if at all strong, it will be impossible to beat further, as it follows the direction imparted to it by every ravine in the hill as it passes; and therefore warping will be found the only means of advancement, taking care to have hands by a bower anchor ready to let go, and the cable stoppered at a short scope, in the event of the hawsers being carried away. A ship might readily heave down on a beach of sand at the head of the harbour. Wood and water are plentiful and easily procured; celery and wild fowl (race-horse or steamer ducks, kelp and upland geese,) may also be obtained, and in the proper season (October) a good supply of penguins' eggs may be insured by having men in attendance at a *rookery*, about a mile to the eastward of the harbour's mouth, whither they could walk along the eastern hills from the vicinity of the Painter's Muller, and remain to collect daily the eggs as they were deposited, and secure them until a favourable opportunity offered of embarking them from the foot of the cliff on which the rookery is established.

The shores of St. John's Harbour are lined with kelp, which is an excellent indication of its navigable part, the border of it being almost invariably in eight fathoms, and that close to the shore, the depth rapidly increasing towards the centre, until near the head of the harbour, where the depth gradually decreases to the beach.

Port Cook

Is decidedly, without exception, the harbour most eligible in Staten Island for a ship in want of shelter, from the considerations of its affording good anchorage at its entrance in not too deep water, the greater regularity of the prevailing winds, and the facility of communication with the south side of the island, by means of the low isthmus sepa-

rating it from Port Vancouver. Captain Foster having given a detailed account of the capabilities of this and New Year's Harbour, it would be superfluous for me to enter further into a description of them.

Basil Hall Harbour.

The head of this is separated by a narrow neck of elevated land from the head of New Year's Harbour, though their mouths are two miles and a quarter apart. This is a most convenient anchorage when once attained, and well sheltered from all winds, though the depth of water and contraction of its mouth by two detached rocks render it difficult of entrance without a commanding breeze and favourable tide. There are three rocky patches nearly in the middle of the space within the entrance, but all the danger is pointed out by the kelp and the tops of the rocks themselves, which show at half tide: they must be passed on the eastern side, where there is a space sufficiently wide to admit of beating in moderate weather. The best anchorage is between a small green island on the western shore, and a fine sandy beach to the northward of the island; it is from seven to ten fathoms, and the island may be passed on either side, taking care to avoid a rocky ledge that runs off its south-east extremity. Although the whirlwinds common to all the harbours of Staten Island are found to exist here, yet the comparative lowness of the south-western shore renders them less violent than in many of the others; and the New Year Islands afford some protection to the harbour from the sea, by stretching, though at a distance, across its mouth. Wood and water are abundant, and a fine sandy beach abreast of the anchorage affords facility for a small vessel in want of repair.

Fish of a large size were seen amongst the kelp, that might be caught by a hook and line, though the patches

of seaweed near the beach would prevent the use of the seine.

There is anchorage on the eastern side, in a bay just within the entrance, but it cannot be compared with that before mentioned, being exposed to the swell that rolls in from seaward, and open to the influence of westerly, the prevailing winds. The best directions for entering are, after having passed the rocks in the mouth of the harbour, to steer for a remarkable peaked hill, the easternmost of two near the head of the harbour, until another peaked hill on the western shore, which stands by itself, comes into view, after which the course may be shaped so as to pass the island on the northern side, where the best anchorage will be found.

Port Parry.

The entrance of this may easily be distinguished by its being the first opening to the westward of New Year Islands, and by Buckland Peak on its eastern side, whose quoin-shaped appearance renders it a very remarkable object. There are detached rocky islets off both the points of entrance, but they are bold and steep, and there is no danger to be apprehended from approaching them.

The harbour itself is divided into two parts by the near approach of its opposite shores, about two miles and a quarter from the entrance, after which they again expand, forming well-sheltered and secure anchorage.

The depth of water in the gorge of the inner harbour is eight fathoms, and the breadth about one hundred and fifty feet; and after having passed it, the eastern point of the outer entrance should be brought on with the eastern point of the inner, in order to lead clear of two rocky patches that lie one on either side within it, and are pointed out by the kelp growing on them.

There is good anchorage in nine or ten fathoms to the

southward of a small grassy island on the eastern shore of the inner harbour, with sandy bottom, after which the water again deepens to the head of the harbour, where a vessel may be moored with an open hawse to the south-south-west, opposite to a sandy beach—the place in which the observations were made.

The deepest water is on the western shore, more particularly abreast of a perpendicular cliff opposite to the small island before mentioned. In this harbour wood and water may be got on board with facility, and clams may be caught by a scissors-shaped rake to detach them from the sand at low water.

There is a rocky patch having four fathoms on it nearly in the centre of the outer expanse, and the water gradually shoaling all round it, a vessel might find a temporary anchorage. The depth of water in the western arm is an objection to it as a place of long continuance for a ship, but the bottom is good, and both wood and water may be procured, though the swell that rolls in on the rocks would be very destructive to the boats on landing; there is, however, a convenient place for the employment of a hose for watering.

The hawse should be open to the west in the event of mooring. After entering the outer harbour, there is no bottom with thirty fathoms of line, until near the contraction; and the western shore should be kept on board if the intention be to anchor in the western arm of the outer harbour. If bound into the inner harbour, the eastern shore should be hugged tolerably close until abreast of a white ravine situated on it. Unless with a leading wind, it would be impossible to sail through the contraction. If the wind was found to baffle on nearing it, the sail must be taken off the ship, and preparations made for towing or warping; indeed it would be perhaps better in all cases to adopt those precautions, as the height of the surrounding

land frequently causes flaws that might in so narrow a channel drive the ship on shore before the sails could be trimmed.

To this harbour the sealing vessels are accustomed to resort when in want of repairs, or of a place of shelter while their boats are absent in the pursuit of furs; in this respect it is, however, very inferior in point of convenience to Port Cook, for though the distance across to the southward of the island from the head of the harbour hardly exceeds the breadth of the isthmus at Port Cook, and there is a boat harbour nearly opposite, yet the elevation of the land is too great to admit of a communication by boats being kept up without two separate establishments.

From the height of the land also the squalls are frequent and violent, though not sufficient to cause apprehension to a ship well moored.

Port Hoppner.

The next opening to the eastward of Cape St. Anthony is divided from Port Parry by a point of land two miles broad from Point Isabella, the western point of Port Parry, to Point Austin, the easternmost of Port Hoppner. Abreast of the western arm of Port Parry, however, the distance across the neck of land does not exceed half a mile. This harbour is also divided into two, similarly to Port Parry; it has a high rocky island in its mouth, by which it is protected from north-westerly winds, and which affords anchorage for the space of half a mile within it, in from twenty to eight fathoms. To the south-east of this island, however, there is a continuation of rocky patches, and two pinnacled rocks peep above the water's edge, and are surrounded by abundance of kelp. Near the head of the outer harbour there is also anchorage close to the shore, which on the western side is high and precipitous. The contraction is not more than from twenty-five to thirty feet broad, with from two to four fathoms in it; yet the sealers sometimes

haul their small schooners through, and having gained the inner expanse, they are completely secure from all winds, in from twenty to six or seven fathoms, being moored by hawsers to the rocks. The tide rushes through the narrow opening with great velocity; it would be prudent therefore not to commence warping in until the last quarter flood.

A tolerably sized river falls into the head of the inner basin from the mountains, by which the whole of the harbour is surrounded. In the outer harbour there are no soundings in the centre with forty fathoms of line. Wood and water are here tolerably plentiful; but the harbour is by no means so convenient or so secure as either of those previously mentioned.

This is the westernmost harbour in the island. There is anchorage in the small coves on the eastern side of Flinder's Bay, and also in Crossley Bay; but as they are open to the prevalent winds, and unprotected from the sea that those winds produce, they can by no means be recommended.

To the southward of Staten Island, the only well-sheltered harbour is Port Vancouver, immediately opposite to Port Cook, from which it is separated by a low isthmus. In it a vessel may ride in security in sixteen or seventeen fathoms; sandy bottom, close to a rivulet, and near a convenient wooding place in the western arm. There is a rocky island on the eastern side of entrance which is always visible, and a reef extends some distance from the south point of the western arm, which may be avoided by not hauling in for the anchorage there until a remarkable white ravine on the south shore becomes visible; these are the only dangers, and in this harbour the same advantages of communication with other parts of the island, by means of the isthmus, are offered as in Port Cook, while it possesses the important one of affording a place of refuge during a south-west gale. It may easily be recognised from seaward by its being the first opening to the eastward of Dampiers' Islands, from the southernmost of which it is distant four

miles and a half. A ship must moor with an open hawse to west.

Back Harbour cannot be recommended, on account of the heavy rolling sea that sets into it with south-west winds, the scarcity of wood, and difficulty of procuring water, in consequence of the surf that breaks on the beach. The holding ground, however, is good, and small vessels have rode here occasionally in north-west winds.

The time of high water at full and change is very nearly the same in all parts of the island; the rise and fall amounts to from seven to nine feet.

G. N. KENDALL, 2nd Lieut.
Approved. HENRY FOSTER, Commander.

HYDROGRAPHICAL NOTICES BY COMMANDER HENRY FOSTER, R.N.

THE ISLANDS OFF CAPE HORN.

The whole of these islands are composed of greenstone, in which the hornblende and felspar are more or less conspicuous, and the presence of iron very apparent, as already stated. Their shores are bold; and the mountains are peaked, rising with a steep ascent to an elevation of from ten to seventeen hundred feet above the level of the sea; and being thickly clothed to within two or three hundred feet of their summits with different sorts of shrubs and evergreen trees, renders them difficult of access. These are, the fagus antarctica (semper virens), and (decidua), winterana aromatica, arbutus and holly-leafed berberis, which gives to this otherwise dreary place a cheerful appearance; and the change of colour that the leaf of the fagus antarctica decidua undergoes in autumn, adds much to the beauty of the scenery at this season of the year.

The names of the headlands and places in the accom-

panying plan have been taken from a manuscript chart, which was furnished me by Captain King, of the Adventure, on my departure from St. Martin's Cove; and I have to express my acknowledgments for his kind attentions in affixing the name of the vessel I command to an island off the entrance into St. Martin's Cove, and my own name to a mountain on Hermite Island, from the summit of which I had obtained some observations.

HENRY FOSTER, Commander.

MEMOIRS ON ST. MARTIN'S COVE, April 1829.

The entrance into this harbour bears from Cape Horn north-west-half-west true, from which it is distant about ten miles, and is further distinguishable by Chanticleer Island, that lies about a mile due east from South Head. In this direction there are no dangers but what show themselves, and the Cove is of easy access with north-east, east, or south-east winds; but with the westerly winds that prevail here it is quite the reverse, and ships then should anchor off the entrance in about twenty-two fathoms, and warp into the Cove, where there is a convenient berth in eighteen fathoms, sandy bottom, midway from either side, and about half a mile from the head of the Cove. This anchorage is safe, although the gust of winds in westerly gales (which are of frequent occurrence at all seasons of the year) rush down the sides of the mountains in various directions with impetuous violence, and may be very properly called *hurricane squalls*. They strike the ship from aloft, and have more the effect of heeling the vessel than of bringing a strain upon the anchors, which, when once imbedded in the sandy bottom, hold remarkably well, and will cost a heavy heave in weighing.

Wood and water are in abundance in every part of the Cove, but cannot always be procured from the steepness of the shores and the heavy swell that sometimes sets in.

The water is highly coloured by the vegetable matter through which it percolates, but we found no other inconvenience from its use than that of giving to our tea a deeper colour, and somewhat unpleasant taste. The wood was very much twisted and stunted in growth, and did not appear to us fit for any other purpose than fuel for shipping.

The shores are skirted with kelp, which serves to protect the boats in landing, and amongst which also fish are to be caught with a hook and line abreast of the rills of fresh water that discharge themselves into the sea. It was from the Indians that we obtained a knowledge of this most valuable supply, by observing them in the act of fishing, which is ingenious enough: they have a line, but of what material it consists I know not; to the end is fastened a limpet, (P. fissurella,) which the fish eagerly swallow, and not being able whilst in the water to disgorge it, are thereby drawn to the surface, and taken by the hand. In this manner they have been known to catch several dozen in the course of a few hours. Our people were immediately furnished with hooks and lines, and on favourable occasions (for it was found that with a swell setting into the Cove the fish did not so readily take the bait) would bring on board a sufficiency for the supply of three or four messes, consisting of five persons each mess; but this success was of rare occurrence, and we were never so fortunate after the Indians left us, which took place on the 1st of April; I am therefore induced to believe, that it is only in the summer months of these regions that supplies of so salutary a nature can be procured. The wild fowl that are most palatable consist of geese and race-horses, more aptly called steamers by the sealers (from their action in the water, for having but very small wings they cannot fly, and therefore they propel themselves from their pursuers with their feet and wings, which has precisely the appearance of a steam-boat in miniature on the water). Both these sort of birds are well tasted, and we found them

a very agreeable addition to our two-thirds' allowance; they were generally seen amongst the kelp in the Cove about daybreak, but soon afterwards would depart for their other places of resort in the day-time.

At the head of the Cove, and a few feet beyond the reach of high-water spring-tides, abundance of celery is to be found, as also in many other places in the Cove. During the whole time of our stay here, (viz.) two months, which was at the latter end of the autumnal season, a sufficiency was daily procured for the use of the ship's company, and although of not so luxuriant a growth as we found it in December, it was nevertheless considered wholesome.

The latitude of the observatory 55 deg. 51 min. 19 sec. 8 south.

Longitude west of Port Cook, Staten Island, 0 hr. 14 min. 4. sec. 78 or 67 deg. 28 min. 26 sec. west of Greenwich.

Variation of the compass 23 deg. 9 min. easterly.

TIDE.

Time of high water on full and change 3 hr. 50 min.

Perpendicular rise about 8 feet.

With respect to the rise and fall of tide, it did not appear to exceed eight feet; but the swell that set into the Cove at these periods of the moon's age, rendered the observations both on the times and on the rise and fall very uncertain. There was no very decided direction observed in the stream of either tide, which was also very slack; but it appeared that the flood came in from the southward amongst these islands. At the distance of three or four leagues to the southward of Cape Horn, however, there is a current running to the east-north-east, at the rate of about one mile per hour; but in what manner this current may influence the tides near the shore, or what changes may be produced in the direction and the strength of the current itself by the flood and ebb-tides, will require a very extensive suite of observations to ascertain.

HENRY FOSTER, Commander.

NOTICE ON THE EXISTENCE OF A CURRENT IN THE VICINITY OF CAPE HORN.

The circumstance of there being no well-authenticated account of the existence of a current to the southward of Cape Horn, has induced me to throw together the following observations bearing upon that subject, made during the passages of his Majesty's sloop Chanticleer, from *Staten Island* to *Cape Horn*, from *Cape Horn* to *South Shetland*, from *South Shetland* to *Cape Horn*, and from *Cape Horn* to *Staten Island*, during the summer and autumnal months of those regions.

The tables in which these observations are recorded require no particular explanation, but it may be necessary to state, that minute attention was paid to every circumstance which might introduce error in the deductions of the ship's place by the account; that the ship's way through the water was measured by a self-registering log of Mr. Massey's invention, and that the variation of the directing compass was ascertained by actual observation on the course steered, whenever the state of the weather would permit: this, however, was found to be an unnecessary precaution, as the local attraction of the Chanticleer in those latitudes where the dip of the needle is no more than about fifty-eight degrees south, did not exceed two degrees west in extreme cases.

The observed places of the ship are deduced from my own observations, and being made with the view to the ascertaining of the existence or non-existence of a current, renders it unnecessary to add that they were taken and completed with every possible care and attention.

The following tables comprise these observations.

Date.	Latitude south.	Longitude west.	Temperature Fahrenheit.		Apparent set of Current, or the difference between the D. R. and observed Place of the Ship.	Mean set, or Current deduced.
			Surface Water.	Air.		
		From Staten Island to Cape Horn.				
1828.	deg. min. sec.	deg. min. sec.			deg. mi. hr.	
22d December.	54 44 55	63 29 00	46·5	49·0		
24th ———	55 56 11	62 08 00	44·0	43·5	N. 20 E. 15 in 42	
25th ———	56 31 49	63 05 45	44·0	46·0	S. 63 E. 13 in 24	N. 80° E. 11·6′ in 24 h.
26th ———	56 51 30	66 17 12	44·0	45·0	S. 50 W. 8 in 24	
27th ———	56 12 42	66 51 38	50·0	56.5	N. 26 E. 18 in 16	
		From Cape Horn to South Shetland.				
29th December.	56 18 00	67 28 00	47·5	45·0		
31st ———	56 56 40	65 32 30	42·5	43·5	No current observed.	
1829.						
1st January.	57 39 43	64 58 12	41·5	44·0	N. 57 E. 41 in 24	
2d ——	59 35 43	65 16 18	38·5	41·5	S. 55 E. 15 in 24	S. 65° E. 11′ in 24 hs.
3d ——	60 26 57	65 28 00	36·0	39·0	S. 24 E. 7 in 24	
5th ——	62 58 00	63 01 30	34·5	38·0	N. 75 E. 13 in 48	

Date.	Latitude south.	Longitude west.	Temperature Fahrenheit.		Apparent set of Current, or the difference between the D. R. and observed Place of the Ship.	Mean set, or Current deduced.
			Surface Water.	Air.		
		From South Shetland to Cape Horn.				
1829.	deg. min. sec.	deg. min. sec.			deg. mi. hr.	
9th March.	62 30 38	62 31 00	34·5	39·0		
12th ——	61 47 38	64 22 00	36·0	37·5	N. 25 E. 37 in 72	
14th ——	58 53 42	62 29 30	38·0	39·5	N. 51 E. 54 in 48	
16th ——	58 37 54	64 36 00	41·5	43·0	N. 70 E. 14 in 48	
18th ——	56 55 30	63 57 30	42·0	43·0	North 69 in 48	
19th ——	56 21 14	63 57 42	44·0	45·5	N. 12 W. 6 in 24	N. 49° E. 21′ in 24 h.
20th ——	56 51 16	65 18 40	44·0	45·5	West 22 in 24	
22nd ——	57 21 00	65 27 30	43·5	46·0	S. 80 E. 52 in 48	
23rd ——	57 36 00	66 02 30	42·0	43·5	S. 70 E. 32 in 24	
24th ——	56 42 30	67 07 36	43·0	42·0	N. 71 E. 26 in 24	
25th ——	55 59 48	67 19 30	47·0	48·0	N. 72 E. 20 in 25	
		From Cape Horn to Staten Island.				
24th May.	55 59 30	67 14 00	45·0	44·0		
25th ——	54 48 47	63 18 00	41·5	42·0	N. 51 E. 54 in 23	N. 51° E. 54′ in 23 h.

The effect which these observations appear to point out, is that of an easterly motion of the sea, in the vicinity of *Cape Horn*, produced, no doubt, by the prevalence of north-west, west, and south-westerly winds; and although its direction is sometimes much to the north, as well as to the south of the east, this deviation, in all probability, arises from the prevalence or greater strength of the north-west or south-west winds over each other during the intervals between the observations, as it was generally remarked that the currents' deviation from the east, towards the north or south point of the compass, was in accordance with the prevalence of one of these winds over the other during the above interval.

The strength of this set appears also to be much influenced by that of the winds, for, during the voyage from *Cape Horn* to *South Shetland*, it was found, at the time of meeting with north-east winds in the parallel 60° south, the set to the eastward was diminished in its velocity to about half the amount we had previously experienced.

From these several irregularities, the individual observations do not admit of any very satisfactory conclusions being drawn; but taken collectively, they uniformly indicate an easterly or north-easterly set, as shown in the last column of the tables; on looking over which, it will be seen that in the voyage from *Staten Island* to *Cape Horn* a current setting to the north 80° east, at the rate of twelve miles in twenty-four hours, may be expected in the summer months, and that between *Cape Horn* and *South Shetland* a current setting to the south 65° east, of equal strength, was experienced during the same season of the year; whilst in the autumnal months this current was found to set to the north 49° east, with nearly twice the velocity; which seems to indicate that the winds from the south-western quarter, in autumn, are more violent and of longer duration than in the summer season: and indeed, on a review of the winds during the passages in the different seasons alluded to, it

was found that north-west, west, and south-west winds exceeded those from all other quarters put together, in the month of March, in the ratio of four to one; whilst in the summer months, and during an equal interval, these winds were found to exceed all others in the ratio of two to one only, which points out at once, apart from other circumstances, the most advantageous time of the year for rounding this noted promontory to be the summer months of those regions; and certainly, from the strength and frequency of the gales we experienced in the month of March, I am induced to recommend the summer season as the proper time for the navigation of those seas; particularly as at this season north-easterly winds may be expected in the parallel of 60° south, and which, in all probability, continue to blow in a high southern latitude throughout the summer, as we found the north-easterly winds to be the prevailing wind during our residence at *South Shetland*, in the months of January and February.

The next and most important conclusion that is to be drawn from these observations is, that of the set of the flood-tide round *Cape Horn*, which appears to come from the south-west; such, at least, seems to be the case from the observations made during the passage of the Chanticleer from *Cape Horn* to *Staten Island*, in May 1829; when, at the time of taking our departure from *Cape Horn*, it was ascertained to be nearly low water; and on our arrival off *Cape St. John* the flood tide had just made its mark. The passage from *Cape Horn* to *Staten Island* was performed in twenty-three hours, in which interval we had felt the whole influence of flood-tides, whilst that of one ebb only had been experienced; and on comparing the ship's place, ascertained in the most unexceptionable manner by bearing at the time of our departure from *Cape Horn* and on arrival off *Cape St. John* with the dead reckoning, made under very unfavourable circumstances, viz. fine weather, a free though

side wind, and the ship's way through the water measured with a self-registering log, a set to the north 51° east, at the rate of fifty-four miles in twenty-three hours, was experienced; from which, if twenty-four miles be deducted for the effect of the previously established current at this season, we have thirty miles for the set of the flood tide at *neaps*, or about three miles per hour, taking into consideration, that as we advance to the eastward the flood-tide is prolonged, and, on the contrary, the continuance of the ebb is thereby curtailed. How far the strength of these tides may have operated in producing some of the irregularities in the north-easterly set of the sea, deduced from the previous observations when near in shore, by having been influenced by either tide for a longer period in the interval between the observations, I have not ascertained; but, from some notes which were made at the time, I have every reason to believe that the tides caused part of the irregularities in question.

HENRY FOSTER.

MEMOIR ON SOUTH SHETLAND.

Remarks: The navigation of these islands is rendered hazardous by the presence of massive berg ice, and the prevalence of thick foggy weather. In our passage to South Shetland from Cape Horn, in the month of January 1829, we met with the first ice, being the fragment of a berg in latitude 59° 45′ south, and 15° 00′ west longitude; and then again in latitude 60° 15′ south, when upon the same meridian; after which we had always more or less in sight, and from the thick state of the weather we were occasionally so close to large masses of it, that it required the most active measures to avoid them; but in March no ice was seen after passing the parallel of Smith's Island to the northward, and, what is very remarkable, we did not observe, either at sea

or in the placid basin in Deception Island, any remains of field or floe-ice; although it is reputably stated that field ice extends from the shores of these islands in October to the distance of sixty or seventy miles.

The general character of these islands is lofty, peaked, and precipitous; they are surrounded by a deep sea, and entirely covered with snow to the water's edge, except in places where from the steepness of the cliff snow cannot be retained, and there the black coloured face of the rock appears, when close in shore, to be dappled with the miserable efforts of a red coloured lichen to vegetate, which, with the exception of a little sea-weed and some moss (another lichen of more luxuriant growth found on Deception Island) is the only vegetation this dreary region affords. The rock of Possession Cape, upon which I landed on the 7th of January, was composed of syenite disseminated with quartz rock, containing copper pyrites; and the whole of these islands, with the exception of those decidedly volcanic, such as Deception, Sail Rock, and probably the newly-discovered groups, appeared to possess the same geological character. The land called Trinity Land is, like Prince William's land, high, and covered with snow, having its shores indented with deep bays or inlets, and intersected by straits.

Deception Island may be considered as a volcano rising pyramidically out of the sea, and having the sides of its crater elevated at a mean height about 1000 feet above the level of the ocean. The form of this island externally is nearly circular, measuring from north to south about eight miles, and from east to west seven miles. The interior basin or crater, which communicates with the sea by a narrow opening on the south-east quarter, is about five miles long in a north and south direction, and three miles from east to west. The depth of water in the centre is ninety-seven fathoms, and its shores are indented with numerous coves, one of which afforded shelter for the Chanticleer. The shores in

several places are composed of ice intermixed with ashes, and present cliffs in which the alternate strata of these substances are much contorted; and as far as our researches went, it appeared that ice was a principal component of this island. At various places on the eastern side of the basin, or crater, the presence of hot-water streams are observable from the steam which arises at their junction with the sea. The first of these streams seen by us was at a bay immediately within the northern point of entrance, and on inserting a thermometer a few inches into the cinders, through which the water was running, it indicated a temperature of 136°. On the western side of the crater Lieutenant Kendall found a sulphur spring, from which he procured some specimens of alum; and every part of the island visited presented indubitable proofs of their volcanic formation, tuffa and ashes intermixed with ice, compact and vesicular lava, pumice-stone, and a brick-like substance, being all thrown together in the wildest order; and the circumstance of a few lichens adhering to the rock in some places, and the fresh appearance the rocks assumed in other parts of the island, at once assigns different periods for their respective formations.

Smith Island, which is the westernmost of the group, is very high and steep, without the least vestige of a beach, that we could see on passing to the westward of it. The highest part, which I have named Mount Beaufort in respect to Captain Beaufort, R. N., is about 6600 feet above the level of the sea, and is stated to have been seen at the distance of eighty-five miles, which is within two miles of the limit from whence it could be seen from considerations of curvature only, but with the aid of ordinary refraction it might have been visible at the distance of ninety-four miles.

The position of Mount Beaufort being tolerably well ascertained, may afford to those who, having met with adverse winds off Cape Horn, are compelled to pass its meridian to

a high southern latitude, the means of ascertaining their longitude with tolerable precision, either by its bearings when on a known parallel, or by bearings from two stations sufficiently apart for that purpose, and connected by means of a self-registering log; and thus may be obtained, in a climate where opportunities for making astronomical observations are of rare occurrence, the latitude and longitude of the ship so circumstanced, with a degree of certainty little inferior to that assigned to the island of Deception, upon the accuracy of which the situation of this mountain mainly depends.

There were a great many whales seen amongst the ice in Bransfield Strait, and some were sufficiently near us to admit of the fin upon their backs being seen, which clearly pointed out their species. These whales sent the spray, in the act of respiration, to a very considerable height, which was ascribed to the humid state of the atmosphere not being capable of holding the more attenuated parts of the spray in solution, thereby rendering it visible at a greater elevation than would otherwise have been the case. No seals were seen on the islands or places visited by us, nor were any met with at sea; and during the whole time of our stay at Deception, eight sea-leopards only were seen, the whole of which were killed and five preserved for specimens. The particulars of the measurement of one of these, communicated to me by Lieutenant Kendall, with a drawing, accompanies this notice.

At the base of the highest hill on the island the pendulum experiments were performed; and there also hot-water streams were found discharging themselves into the sea. The summit of the hill, or rather the earthy parts of it, were perforated with numberless small holes, through which steam issued with a loud hissing noise; and the surrounding ground was too hot to be touched by the naked hand with impunity. There was a vast quantity of ice on the

summit, so much so that the hill appeared from the observatory to be an entire iceberg, covered here and there with loose cinders and ashes. Subterranean sounds, as of mountain torrents, were frequently heard; and on one occasion were so loud as to create some apprehensions for the safety of the instruments, and accordingly the pendulums that had been experimented with were immediately taken on board.

Remarks on the Harbour of Deception.

From the account of those who have examined the various harbours the South Shetland Islands afford, the harbour formed in Deception Island is considered the best. This harbour His Majesty's sloop Chanticleer entered on the evening of the 9th of January, 1829. The entrance is on the south-east side of the island, in approaching which a perforated rock will point out more precisely its situation, as the rock itself stands a little to the northward of the entrance. The navigable width of the entrance is only seven hundred and twenty feet, in which the soundings are from fourteen to eighteen fathoms. The northern shore is steep, and presents a perpendicular cliff of from two to three feet high. The southern shore, on the contrary, is of very moderate elevation, and declines to the north-east; in which direction from it a rocky spit runs out nearly two-thirds of the way across the entrance, having from two to four fathoms near its extreme point. The depth of water in the fair channel rapidly increases to forty-five and fifty fathoms towards the inside, and soon afterwards there will be no bottom with sixty fathoms of line.

On the outside of the entrance there is anchorage in from seventeen to twenty-six fathoms; but it cannot be recommended for any other purpose than that of affording the means of warping a ship out through the entrance in moderate weather with the wind right in, or in the event of

a calm at the time of flood-tide. In the centre of the basin there are ninety-seven fathoms of water, and the shores are everywhere too bold for anchoring, at a suitable distance from the beach; besides which the bottom, being composed of either loose mud or cinders, affords no hold for the anchors. On the eastern side, however, and at the foot of the highest hill on the island, which is crested with ice in a very remarkable manner, there is a cove, lying in a north and south direction, in which three or four vessels might be secured by placing, as was done in the Chanticleer, a bower anchor on each side of its opposite shores, and having another under foot in fourteen fathoms water, at the distance of about half a cable from either side. This mode of securing a ship will be found absolutely necessary for her safety at this place, and even then the topmasts should be struck and the anchors well backed, as the gales of wind from the north-east are not only of frequent occurrence in the summer months (January and February), but are of the most severe character, from the lowness of the temperature, 33° to 29°, and the sleet with which they are usually attended. Off the entrance into this cove there is anchorage in twenty-two fathoms, but from the badness of the holding ground it will be necessary to have both bowers down with the wind from the eastward, to prevent being blown off into deep water; and with westerly winds the situation of the vessel would then be extremely hazardous, being upon a dead lee-shore, and exposed to the fetch of the sea over the widest part of the basin. Water may be procured from a variety of places in the cove; but it will be found necessary, from its muddy condition, to sink wells in the beds of the different streams that discharge themselves into the sea, in which a sufficiency may be collected clear enough for use. From the Report of Lieutenant Kendall, who surveyed the island, it appears that the only secure place now afforded for shipping is this small cove; and there is reason to believe that this

cove is not the one spoken of by the sealers, as neither its situation, form, or character of the soundings in it, accord with their descriptions; but that the place which once afforded anchorage for ships is now rendered inaccessible, except for boats, by the observable changes which the face of nature on this island daily undergoes. At all events, there is a snug-looking place a little to the northward of this anchorage, and where several articles useful to sealers were found, and the dilapidated remains of places built for the purpose of boiling the blubber of seals for oils. There was also the shank of a large merchant-vessel's anchor, which, together with other articles, gave us reason to suppose that they must have been landed directly from the vessel to which they might have belonged when inside of the cove, as the distance they were from the outer shores would have made the labour of transporting them to the places where they were found excessive. Near the same spot, too, there were the remains of a seaman, who had ended his days on this inhospitable island; and from all these circumstances, I am induced to believe that the cove in question is the one which is stated as capable of affording anchorage for five or six vessels in four or five fathoms water over a bottom of good clay, the entrance into which is now nearly blocked up by a spit that has extended itself right across the entrance, and in some places is dry at low water. In the event of this island being hereafter visited by persons furnished with proper instruments for surveying, it would be highly interesting to ascertain to what extent the present form of this island may have changed by the active agency of rivulets, or the more powerful action of volcanic eruptions, for which purpose the careful survey made by Lieutenant Kendall will prove very valuable. And with the view of obtaining a knowledge of the extremes of temperature during the year, in these regions, there was deposited, on the 1st of March 1829, a self-registering thermometer,

of Six's construction, on the western side of the cove, at a rocky eminence near its northern extremity, with a request, written in English, that its indices might be carefully registered, and a notice thereof sent along with the instrument to the Secretary of the Admiralty.

HENRY FOSTER, Commander.

OBSERVATIONS ON THE NATURAL PRODUCTIONS OF THE PLACES VISITED BY THE CHANTICLEER, BY W. H. WEBSTER, SURGEON, R.N.

Island St. Catherine.

AMID the luxuriant beauty of vegetation at St. Catherine's, we perceived the loss of the coco-nut and many of the palm tribe, which had so much delighted us in the tropics. The woods, however, produced still a few species, and one of the coco-tribe happened to be in full flower; and it was an object of attraction and admiration to us all, from its grand and majestic appearance, standing aloof in character and aspect from the surrounding vegetation. From the summit of its head hung pendent immense clusters of small yellow flowers, forming dense bunches of more than a yard in length, and containing several hundred flowers. Over each elegantly drooping spadix stood an erect and stately spathe, arched and vaulted, and of three feet in length. When we consider that several of these gigantic bunches were appended to the same tree, it will readily be conceived that they formed a conspicuous feature in the scenery; and the effect was heightened by hives of bees humming round and clustering on every flower. The fruit is a small sweet and pulpy drupe, about the size of a plum, each bunch of flowers yielding about a bushel of fruit. The erect spathe, which we have spoken of, is strong, woody, and boat-shaped; and is used as a cradle for infants and as a cart to drag little children in. The tree itself yields a gummy

matter, and the kernel of the nut a fine oil. Those who visit the tropics cannot fail to notice the many immediate uses of the various products of the palm, and none more striking, perhaps, than the ready-made cloth they yield—a peculiar characteristic of this noble tribe. In some cases, as from the base of the frons of the coco-nut tree, it may be stripped off in considerable lengths, so as to afford no mean or despicable wrapper; for which purpose, indeed, it is used by the natives in the Brazils, &c.

The analogy to cloth is very great, for it has a warp and weft. Other palms yield it of a softer and closer texture, and the spathe of one is so perfect as to form small sacks, caps, and filtering bags. And this cloth-like texture affords the best illustration of the vegetable tissue, and exemplifies in a simple and obvious manner the arrangement of the fibres in the general structure of plants. The formation of wood and bark is on the same principle, varying only in consolidation; and the maceration of the bark of trees developes the truth of the assertion.

Another feature of the vegetation of these realms is their fecundity, and the struggle for existence. All is full, even to superabundance and excess: some are climbing up the loftiest trees, and pushing through every aperture to gain the light; others are sending down long stems to take root in the earth—having begun their existence at the summit, and obtained the eminence from birth, are in danger of being starved in their aerial station; some are engrafted on the branches, and bloom and die thereon—garlands of parasitic flowers adorn the trees—parasitic ferns encumber the stem; yet, amid all the bloom and fragrance they emit, there is a deceitfulness about them — they destroy their supporting friend by their smiles.

The agave vivipara, or viviparous agave, was particularly abundant at St. Catherine's; and the ground around them was studded with the younger plants. The larger ones

were loaded with bulbous buds ready to vegetate, and they were dropping from the stem with every breeze. The roots of this agave are gathered and frequently sold as sarsaparilla; the fibres of the leaves form a strong and useful cordage, but not so durable as hemp in water.

It is somewhat remarkable, that most of the plants whose leaves furnish fibres for cordage, belong to the same class as the agave, and are hexandrous, as the celebrated phormium tenax, or New Zealand flax, and several of the bromelias, which yield excellent cordage. And there is another property belonging, in an especial manner, to some of the hexandrous plants — that of being bulbiferous. Not only have we the extraordinary agave vivipara, but the allium bulbifera, the lilium bulbiferum, the large bulb bearing crenum, the ornithogalum bulbiferum, and the surprising bulbs, or air potatoes, as they are called, of the dioscorea bulbiferum, or the bulb-bearing yam. Other instances might be adduced of this tendency to bear live or bulbous buds on their stems, and thus supplying the place of seed; for which, however, no obvious reason can be assigned.

The ferns were very numerous and beautiful at St. Catherine's; in fact, I had never gathered so rich a harvest of them before — I collected fifty specimens of them in a day. I tended them with care, and put them by when I thought they were sufficiently dry. About five weeks afterwards, I had occasion to look at them, and found to my surprise the papers excessively mildewed; but the plants themselves appeared particularly fresh, and there appeared an evident motion in the dust, or mildew upon the papers: thinking it might proceed from some animalcule, I took a glass and found the motion to proceed from the bursting of the capsules and the ejection of the seeds.

I stood for some time witnessing the exhibition, and I now perceived that what I had originally mistaken for damp and mildew was only the exquisitely minute atomical seeds of

the ferns; nay not the seeds, but the impalpable capsules, which contained myriads of seeds. How wonderfully minute! The colours were various, some being bright yellow, others deep brown, and many sooty coloured.

Monte Video.

At Monte Video, we had good cheer and substantial living. There was a respectable ordinary kept by Mr. Caulfield, at which most of the English and American merchants boarded. The following list of articles, with their prices, is the best illustration of their markets and produce:

Sept. 1828.

Beef, of the very best and finest quality,	1d. per lb.
Mutton, small and poor	8d. lb.
Pork, large and gross	9d. lb.
Bullocks' tongues, each	10d.
Suet	8d. lb.
Bread, sour and bad	18d. quart.loaf.
Eggs, per dozen	1s.
Fowls, the couple	7s.
A turkey	10s.
Irish butter	2s. lb.
Dutch cheese	1s. lb.
Good tea	8 to 10s. lb.
Moist sugar, Havannah	6d. lb.
Brandy	8s. per gallon.
Wines, reasonable and good. Champagne	4s. 6d. per bottle.
Candles, bad	8d. lb.
Potatoes	8s. per bushel.
Wild ducks	1s. the couple.
Partridges	5d. each.
Fish, a good supply and reasonable.	
Excellent chocolate	1s. lb.
Milk	5d. per pint.

Washing is 6s. per dozen; it is dear, on account of the price of fuel and labour, though it is generally washed in cold water. House rent is very dear, and with the scarcity of fuel, is a counterbalance to the cheapness of the beef. Slave-labour is very expensive, for each slave confines himself to the particular line of his vocation! which multiplies the number of servants required in a family.

Spring had scarce begun to send forth its flowers. The cactus mammillaris was common on the rocks about the mount. The pappophorum, or tufted reed, is very handsome, and like a plume of feathers; it is used to decorate the ball-rooms. Anemones, lobelias, guliums were in bloom.

The gardens produce celery, lettuce, pompions, onions, endive, spinach, beans. The mani, or ground-nut, arachis hypogea is very much cultivated, and used as food by the lower orders; a piece of bread and some of these nuts roasted is oftentimes their dinner. I did not dislike them. The artichoke is a great favourite. The peach is the most abundant of their fruits; but the quince is perhaps the best. They have apples, pears, figs, grapes, plums, strawberries, almonds, melons, apricots, and a few olives.

Monte Video is moderately supplied with fish. The smelts are from four to twenty inches in length—they are semi-transparent, and are most delicious eating; they are very abundant, and easily caught by the hook. Mullet, skate, bream, soles, conger-eels, and young sharks; the bull-head and corvino are the general fish in the market. The beaches are destitute of shells or sea-weed. I found several curious eggs of a species of murex floating on the water, and occasionally on the beaches; it was a membranous egg, rather larger than a hen's, with a strong elastic bladder-like coat, transparent, closed, nearly filled with an aqueous fluid, and with many little shells in various stages of their growth. The shells were quite loose, and unconnected with the blad-

der egg. The shells were about one-tenth of an inch in length, very strong, of a pale brown colour, and semi-pellucid; the bladder, I presume, bursts to let them out, or they destroy it. I did not procure the shell and its inhabitants which produced these large eggs.

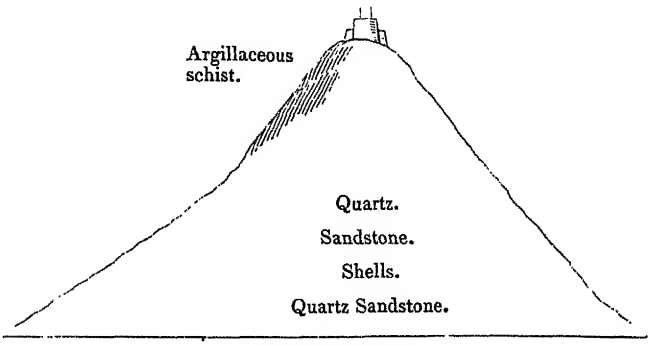
The country is level and without rocks, except on the shore, and then only a few feet elevation. In the immediate vicinity of the town they are micaceous schist and quartose sand-stone, with particles of mica; being, in fact, a loose crumbly binary granite, sometimes of a closer and more compact nature. The rocks about the town of Monte Video are entirely of this; while Rat Island is a greenish sand-stone, with spangles of auriferous pyrites. Talcose schist is not uncommon about the south-east part of the town. There is quartz rock embedding masses of talc; veins of quartz traverse the mica schist in every direction. They have no stones adapted for building; nor any limestone. The soil is composed of deep beds of clay, of which good bricks are made, occasionally embedding nodules of septaria. There are no minerals, or precious stones.

The Mount, though well covered with soil, presents the outcropping of the rocks near the top, while the fissures disclose the sides. The base of the mountain is a quartz sand-stone of large grain. The principal mass of the mount is of the same; but towards the summit there is an argillaceous schist in vertical layer. There is no regular stratification in any part.

Near the base of the mount is a bed of shells, considerably above the bed of the river. I found muscles, limpets, oysters, and conchs of a different and much larger kind than any now found on the banks of the river. Shells are found in digging the foundations; sometime the shells are thin, and apparently of fresh-water formation. Those near the base of the mount are very numerous indeed.

On the pampas there is a reddish marl, and efflorescen ces of salt in some parts to the southward.

The Light-house, 450 feet above the level of the sea.



The River La Plata.

Staten Island.

The seal, the otter, the rat, and the mouse are the only quadrupeds on Staten Island. Birds are more numerous, and comprise three species of penguins, gulls, albatrosses, shags, of which the pelecanus crestatus, or crested shag, form extensive groups, building their nests in the loftiest trees on the hills. The black oyster catcher, the Johnny rook, the mountain hawk, high in the beetling cliff his aëry builds, a small owl, a few thrushes, two species of linnets, the humming bird, as a stray and occasional bird, I presume, and three species of geese, form the ornithological catalogue of the island. The anas cinerea, or loggerheaded duck, the racer of old voyagers but the steamer of the moderns, is the finest bird for the table in these regions. He might with propriety be called the impennis, or wingless duck; the utmost spread of the two wings is not two feet, for a bird of 14lbs in weight. The wing is about six inches in length, strong, thick, and fleshy; the quill feathers extremely small, strong, hard, and rigid. The colour of the

bird is a dull grey brown—the coating of down and feathers is extremely thick. The bird is very broad chested, or in nautical phraseology broad about the bows, and very flat bottomed for skimming over the surface of the water—as a butcher's tray, the thigh immensely thick and strong, and a broad web foot. When on the water, which is its natural element, it propels itself along with great rapidity by the very powerful stroke of its broad web feet, aided in a great degree by the stroke of its wings on the surface of the water. Whenever we saw one of these birds flapping on the water, it was a common observation that he had got his steam up.

The geological structure of Staten Island is chiefly of quartz-rock, greywacke, clay-slate, and micaceous schist. The greywacke and quartz rock are intermixed and alternate, forming the principal mountain hills of the island—they are unstratified. The quartz in many parts is disposed in vertical veins.

The greywacke is of a grey earthy colour, containing quartz in grains, dispersed through the mass. In some parts it is of a fine compact crystalline texture, while other portions approach more to the nature of a sand-stone. In the ridges of greywacke many vertical veins of quartz are found, and large masses of beautiful rock crystal are often attached to the face of the rock, or imbedded in the fissures. We gathered many splendid specimens of rock crystal pure and untinged.

The quartz rock is compact, or imperfectly granular, splitting into, or disposed in, tables with vertical fracture. The quartz rock forms many extensive ridges, in various parts of the island, and alternates occasionally with the greywacke. From the cleavage and disposition of this rock, it assumes a bastion-like form in some parts, and the eastern cliffs of South Port Hatchett resemble some rude castle cast in giant mould. The quartz is frequently coated with a pellicle

of oxide of iron, resulting from the decomposition of the minute portion of pyrites which it contains. In the lower part of the ravines the quartz is split into sharp angular fragments, resembling silicious schist, and the smaller fragments being washed down by the torrents, have the appearance of beds of coarse gravel, from the red tinge of the oxide of iron. In these situations are occasionally some large breccia, or silicious conglomerates. Small veins of bright red and yellow ochre are imbedded in the quartz. The rocks and cliffs, on various parts of the coast, assume a white appearance, and resemble chalk cliffs at a distance. It is produced by a white silicio-argillaceous crust, arising from the decomposition of the felspar of the weathered surface of the quartz rock. The quartz rock varies very much in its nature, in different parts of the island. Where it contains felspar in small quantities, it produces a white enamel; with iron, a rusty red surface; and on the lofty hills it lies in large masses of pure milk quartz, of so delicate a white as generally to be taken for a patch of mountain snow.

The micaceous schist is associated with the quartz rock, and forms some of the sublimest peaks of the island. It contains some minute garnets. The mica schist passes into and alternates with the quartz rock. The lofty peak on the western side of South-port Hatchet is of mica schist.

The clay slate prevails very extensively throughout the island, and is a subordinate formation. Deadman's Island is entirely of clay slate, and also East Harbour. The base of the ridges on the western side of the mouth of North Port Hatchet is composed chiefly of clay slate; and the overhanging ledges of the caves, formed by the washing of the sea, are picturesquely veined with milk-white quartz, alternating with beds of graphite, or fine black-lead of a jet-black lustre, soft and delicate, and apparently of a very pure and good quality. Large quantities of black-lead are very con-

spicuous along this part of the coast. The clay slate of the island generally contains cubical crystals and spangles of golden pyrites.

There are a great variety of slates found in different parts of the island, of which I more particularly noticed the following, viz. whetstone slate; coarse dense slate, in tabular masses; white satin slate, of a greasy unctuous feel; elegantly veined slates, susceptible of a high polish. Claystone was found at Cape St. John.

Although I did not find any metal, I cannot divest my mind of the idea but that some metals are contained within the rocky masses of this island. It is a rough and rugged casket; and Nature secures her treasures in the strongest chests, and he that would obtain the prize must force the bolts and break the box. The geological products of the island, as far as we have enumerated them, are, 1. Greywacke. 2. Quartz rock. 3. Micaceous schist. 4. Clay slate. 5. Graphite, or black-lead. 6. Rock crystal. 7. Garnets. 8. Ochre. 9. Pyrites, or fire-stone. 10. Numerous varieties of elegant and useful slates. 11. Abundance of peat.

Vegetation of Staten Island and Cape Horn.

With the most boisterous and humid climate on the globe, and with a low but eminently uniform temperature, vegetation flourishes with a surprising beauty and luxuriance. And the rugged aspect which the island appears to wear at a distance, is changed into perpetual and unbroken verdure. Every spot is clothed with plants, the hills are crowned with evergreens; and every season finds them much the same. And it would appear, that the assigned law of diminution of temperature from elevation, does not follow the assigned ratio at this place and at Cape Horn; for the character of vegetation on some of the mountain hills did not vary in the least from that of the lowland plains.

Although the hills alluded to were not above twelve hundred feet, yet in a climate of an almost uniformly low temperature, the permanent reduction of four or five degrees would bring the thermometer nearly to the freezing point. But, waiving this consideration, I am convinced, from repeated observation at Cape Horn, that from the temperature at the level of the sea, and the known altitude of the hills, snow should be capping the summits and sides thereof when not a particle has been there. In fact, the hills about Cape Horn are very rarely mantled over with snow. How adverse is this to popular belief! The Fuegians are naked: and flowers linger on the trees through the dull and dreary winter of Cape Horn.

The fagus antarctica, or antarctic beech, is the common and prevailing tree. The name is neither appropriate nor distinctive, as there is another beech of these regions. As the antarctic beech is an elegant evergreen, might it not be called the fagus sempervirens? The tree, in its young state, is handsome and elegant. It grows to the height of thirty or forty feet, with a girt of from three to five feet; and sometimes doubling these proportions, it forms majestic trees. The bark of the branches is smooth, but with age it becomes cracked and fissured; it branches irregularly; the leaves are ovate, an inch in length, serrated, dark green above and delicately veined beneath: flowers, male and female, on the same tree. In December it puts forth a profusion of blossom; the anthers are bright pink, large and pendent. The wood is soft, and requires to be well seasoned before it is used, as it is extremely liable to warp. We used it for a great variety of purposes; repaired the boats with it, made chests, &c. The bark tans tolerably well, and has a very agreeable odour. The heart wood is generally unsound, and sometimes the whole wood undergoes a very remarkable and singular change, becoming of a beautiful deep verdigris green. And this colour is not affected by

acids or alkalies—by light or moisture. It is extremely permanent and durable; and the powder mixed with white paint forms an extremely good and lasting colour. This green wood is not luminous in the dark.

There is a parasitic shrub (misidendron?) frequently engrafted upon the evergreen beech. It is generally three or four feet in length, branches forked, bark of a light pale brown, leaves in terminal groups sessile, of a pale green, obovate, half an inch in length, apparently monœcious. The mode in which it is engrafted is peculiar, and resembles the artificial process called budding by gardeners. There are two species of the misidendrons.

The evergreen beech frequently has around the upper parts of the trunk, or on some of the larger branches, large clusters of globular fungi, of a bright orange colour; each fungus is about the size of a small apple, is of a soft pulpy nature, with a smooth yellow skin; as it approaches maturity it becomes cellular and latticed on its surface, and when it drops from the tree, dries and shrivels into a brown mass resembling a morel. The Fuegians eat these fungi with avidity. The gelatinous mass is pale, without taste or odour: at the part in contact with the tree are two germs or processes. From twenty to thirty of these fungi are clustered together and encircle the tree; they form a very conspicuous object, and wherever they are attached they produce a large hard knot, or woody tumour, of considerable density. I did not observe them on any other tree than the evergreen beech.

The other beech of these regions is rare at Staten Island, but much more abundant at Cape Horn, and may be called the Fuegian beech. Amid the forest of evergreens, it is pleasant to see a leafless and a budding tree; and more particularly beautiful in the autumn to observe, amid the unvarying hues of green, the vivid tints of fading leaves. So agreeable is variety, that perpetual verdure cloys, and

charms to please must even decay. The Fuegian beech is much smaller than the evergreen; its leaves are large, soft, plaited, three-lobed, leafing in November, blossoming in December, and changing the colour of its leaf in May, and slowly shedding them.

The next tree to the beeches, both in frequency and in size, is the winterana aromatica, an evergreen with a complete laurel aspect, attaining sometimes to a very considerable magnitude, even to that of twenty feet in circumference. Its general height is eight or ten feet, and girt small. It is of a very quick and rapid growth; the wood soft. It has complete laurel leaves, small white flowers on long foot-stalks. Corolla of eight petals; stamens numerous, crowded; germens one, two, or three, swelling, globose; green berries, one-celled, oblong, containing a glistening fecula, and three or four black seeds. Although Fothergill and Solander have written on the winterana, and it is still retained in the Pharmacopœia, it is scarcely ever used, and its virtues are far from being accurately ascertained. The bark is hot, pungent, slightly bitter, and astringent—its flavour durable, and somewhat unpleasant. Water scarcely extracts its virtues—a mild tincture has very much the flavour of porter. The sealers sometimes smoke the dried bark as a substitute for canella. The winterana keeps flowering throughout the year in a slight degree.

The arbutus aculeata, or the arbutus with sharp pointed leaf, is the pride of these regions. It is an elegant and most pleasing evergreen, with so much of the appearance of a fine myrtle, as generally to obtain from the seamen the name of the myrtle bush. The arbutus is from three to four feet in height, leaves small, and terminated by a prickle, whence its name. It bears small, white, cup-shaped flowers, followed by a profusion of fine red shining berries, which ornament the tree throughout the winter. They somewhat resemble white-heart cherries in appearance;

their flavour is insipid, but somewhat astringent. In the absence of other fruits we frequently made tarts of them, and when mixed with a few raisins they were tolerably good. No peculiar qualities, or virtues, appertain to this shrub, its beauty being its great recommendation.

The barberries were rather prolific, and we noticed three species. The berberis ilicifolia, the holly-leaved barberry, is a common tree, and seems to flower with vigour throughout the year. It is an evergreen, but of no great beauty, and is generally encrusted with a host of lichens and mosses. The fruit resembles the sloe in appearance; it hangs in clusters, and the bloom upon them is pretty; the flavour is insipid. The inner bark is of a fine bright yellow—of a strong bitter taste, yielding its virtues equally to water and to spirit. The wood likewise is of a very deep yellow, and seems capable of being employed as a dye.

The berberis microphylla is a small neat bush, a free and copious bearer of a good and palatable berry, well adapted for tarts or the table.

The apium australe, or celery of the southern regions, is a large, hardy, and luxuriant plant; very common and abundant on the shore, growing in wet places; but, nevertheless, is very palatable, good and wholesome, and seems particularly worthy of notice and of cultivation; for if our celery is the product of a poisonous, or at any rate an unwholesome plant, and has sprung from such a pigmy stock, what may we not expect from the celery of the south, when improved in a similar degree by cultivation? The celery of this place, when uncultivated, is nearly on a par with our garden produce. Horticulturists would find it worthy of attention. We sent home bags of seed; and the crew had it every day for dinner.

The cochlearia officinalis, scurvy grass, or the water cresses of our crew, was very abundant and used by us daily.

The dactylis glomerata, or tussac grass, grows in very

large mounds or tufts; the stems of it were as big round as the middle finger, and the lower parts being blanched and having a sweet flavour, were eaten by us. We attempted to boil some and use it as asparagus, but it was too stringy.

The ground was thickly covered with a creeping plant like a strawberry, diœcious, the male flowers without calyx or corolla, a naked stalk of three or four inches in length, bearing clusters of anthers. Female corolla wanting, clusters of granular germens with a bifid or cleft pink style, succeeded by groups of small bright red coral berries, each containing one small seed.

In April and May the ground is adorned with a profusion of these berries, of the most brilliant colour and cheering aspect; and it would appear that their beauty is neither slight nor transient, for the colour is bright and permanent, unaffected either by acids or alkalies. The colouring principle is between annotta and turmeric, and might be employed with advantage, possessing as it does a strong body of colour, and that of a very permanent nature.

The small hills and little plains are sweetly diversified by soft bright green mounds of a foot or more in height, and several feet in extent. Some parts abound with these hillocks, and the light tint of their verdure, their regular rounded form and compact texture, make them resemble the finest cushions: oftentimes have I sat for hours upon them, enjoying the scenery and examining their structure. A pale, fragrant, resinous juice exudes in spring and summer from the leaves, and concretes into a deep brown resin. The plant would appear to belong to the umbelliferæ. The taste of the plant is warm and bitter, like that of the wild carrot seed. I made a tincture of the concrete resin. The sealers who frequent these parts esteem it a stomachic and diuretic, and use it as a substitute for balsam capivi, with the desired effect, it is said; if so, it deserves notice,

and would be a valuable acquisition. My own experience of it is too limited to speak with certainty of it. I am much disposed to accede to the justness of their statement.

The ribes antarctica, or southern currant bush, was large and luxuriant in wood, but totally deficient in fruit, although loaded with flowers.

The rubus geoides, or strawberry plant, produces a very pleasant and agreeable berry. A small cranberry plant, with an insipid berry, was abundant in some districts.

Having noticed some of the larger and more useful plants, the minor beauties come under note, and these regions are not destitute of flowers of considerable beauty, for who can deny the meed of praise to the fuchsia, an inhabitant of these realms? it blooms amid snow-storms; and if it has no butterfly to hover round it, the humming-bird sucks its honied treasure.

The chelone ruelloides is a handsome scarlet flower, of great beauty: and the Magellan violet, although yellow and scentless, is pleasing. The callixenes resemble lilies of the valley: and the Fuegian auricula is sweetly pretty and interesting. The woods are fragrant with the flowers of the galium in December; and the ground is strewed with orchises, and the mingled bloom of many simple plants. The dry shores are decorated with sea pinks (statice), and the tussilago. The veronica decussata, a creeping andromeda, a very fine and brilliant amellus, the escallonia serrata, two species of drosera, tufts of donatea, and a mniarum, cover the boggy grounds.

There was a little plant very common throughout the island, whose leaves, when dried, had such a strong smell and taste of rhubarb, that I could not help trying its effects. It acted as a mild aperient, and seemed to possess all the virtues of the best rhubarb. Its habitude appeared to be different; but if it should prove to belong to the genus,

which I am inclined to believe it does, it may with propriety be termed rheum humilis. The root was more strong and active; in every sensible effect it equalled the best rhubarb.

There were only two species of ferns, one of which had roots like a zamia.

We hear a great deal of the luxuriant vegetation of the tropics; and we naturally assent to it, because we regard heat and moisture as the chief agents, or aids, to vegetation. And from the miserable accounts that have been given to us of the rigorous climate of these realms, we are disposed to view them as barren and unfruitful; but having seen much of the tropics, and traversed them in various parts, and having no love or predilection for cool climates, I cannot withhold my testimony to the exuberant fertility of Staten Island and Cape Horn. Although the vegetation is not of the same character with the tropics, it is the same in degree. Fernando de Noronha, a fertile isle near the equator, is not more crowded with vegetation than Staten Island. Staten Island is completely covered with plants, and the vegetation is as abundant and copious as within the tropics, and throughout the year it is as green as the tropics. Thus earth's remotest verge bears the impress of the Almighty's bounty, and by apparently different means she produces nearly similar effects. Lichens and mosses are abundant and varied; and the lover of these tribes of the vegetable kingdom will find infinite delight at Staten Island. The trees, rocks, and ground are covered with beautiful lichens. The byssus iolithus encrusts the sides of the loftiest rocks, giving a pleasing roseate hue. In drying, it loses its colour, but obtains the agreeable fragrance of violets. It were well if the charms of fading beauty were always supplanted by some agreeable virtue! The lichen scriptus decorates the rocks upon the sea-shore, and the coralloid lichen grows in large tufts upon the ground; this burns with a bright

flame and without smoke, yielding a large quantity of potass. The elegant and beautiful mosses do not equal in numbers, although they may exceed the lichens in graceful forms.

It would be a very imperfect account of the natural productions of Staten Island to omit the vast masses of sea-weed which entangle the harbours and shores. The sea teems with them, especially in the rough and open bays, while they are comparatively rare in the still sequestered creeks. Oh! wise controlling Power, whose wisdom pervades alike all space and matter! Did they increase in the calm harbours as upon the rougher shores, they would be choked up; and they would form an impervious mesh of cords. But they thrive best in the boisterous element; and where it would seem impossible to obtain a hold, there they grow and gather strength to meet the storms.

Many pages might be justly devoted to the plants of the sea. Here they are gigantic in form, some being three hundred feet in length — some of immense strength and sturdy stems, and becoming, as it were, oaks in the sea; others spread again their tough and leathery substance, like hides, so that buckets, bowls, and cups, may readily be made of it. Some form ropes and cables to moor boats with; some yield a jelly, pure and tasteless, like isinglass, far exceeding that of the fucus crispus, or carrageen moss of our shores; and one pretty tinted green fucus was very acid, being the only species, I am aware of, that has the property. Casks and bags, and boxes of fuci, were gathered and preserved, and the harvest was only begun; many were superbly beautiful and highly interesting, some were ornamental and abounded with peculiar incrustations. Amid the vast forests of sea-weed on these shores, multitudes of curious specimens may be obtained. Some yielded the most delicate tints and colours, and might be employed with evident advantage; many of them abounded with iodine, and yielded it to strong alkaline infusions. The botanical study

of these plants, the chemical investigation of their properties, opens a wide and interesting field of research, and one that cannot fail to yield a rich harvest. The sea is evergreen on these shores, and blooms with verdure. In many of the larger fuci of these regions the appearance of capillary filaments is obvious and distinct; they display concentric rings in their stems, and appear analogous to other plants. The fucin, or woody principle of the sea weeds, is a distinct and peculiar modification, or variety of wood. Some very fine and extraordinary specimens of it were procured and sent home. In some degree, it resembled cork, or "fungin."

DECEPTION ISLAND,

One of the South Shetland Group.

THE whole island being of volcanic origin and yet almost entombed in snow, our knowledge of its geological products must necessarily be very imperfect. One of the chief features was the prevalence of lateritium, or brick-stone, the burnt earths and clay. Many of the hills had very extensive strata of it, and some of the more conspicuous peaks, especially where they were crowded together, obtained the name of the brick-kilns. The crimson hill, near the observatory, had large strata of it. It was dispersed upon the beaches, and lay in large fragments upon the hills; it prevailed in every quarter of the island, and gave great relief to the dull scenery. It was both cellular and compact, and some contained crystals.

The principal rock was blue volcanic whinstone, more or less compact and crystalline. Basalt was found only in one part; it was dark, compact, of a fine lustre, imbedding numerous crystals of felspar; and in many parts finely veined with white felspar. Perlite, or pearl-stone, was found in the dark basalt. Pumice was found on the beach and where the streams of water ran. Large masses of red sandstone, with radiated crystals of gypsum, crystals of sulphate of lime, in a variety of forms, were prevalent; and masses of fine milk-white semi-translucent gypsum were obtained near the hot springs. Many of the stones about the springs were completely bronzed by being coated with pyrites.

Streams of sulphuretted hydrogen were emitted from the caverns, evidenced by the peculiar smell and fœtor; and when this was mixed with steam, the arches against which it issued became covered with efflorescence of sulphur, and occasionally with fine crystals thereof. Where the sulphuretted hydrogen and steam came in contact with a body of clay, sulphur was deposited and alum formed. The alum of the volcanic districts appears to be formed from the sulphuretted hydrogen, and not from sulphurous acid gas, the sulphuretted hydrogen becoming acidified, or the sulphur deposited therefrom; and the gradual deposit of sulphur from its gaseous state, may account for the heat observed in such circumscribed spots, the immediate vicinity of which was frost and snow. Every one was struck with the partial and limited heat, which appeared in many instances in spots and patches, which it was difficult to reconcile to the idea of some great internal heat, but was referable to a local chemical action—the heat arising from the condensation of the sulphuretted hydrogen, and its passing from a gaseous to a solid state, by which a large volume of heat is extricated. At any rate, whatever the cause may be, it is totally inexplicable upon the supposition of any general subterranean heat; for wherever you attempted to dig a few feet into the earth, even in the immediate vicinity of the hot springs, all was frozen and congealed as hard as adamant, and which the pick-axe could with difficulty penetrate, although merely ashes and cinders; and in no part of the island was the temperature of the hottest springs above 190°, however deep you penetrated into them.

The fuci, or sea-weeds, were few and unimportant; the most common was found floating. It was of a pale chocolate colour, stem and branches flat, quarter of an inch in breadth, leaves equitant, thin, delicate, four or five inches long, and at the base of each was a spherical air-cell the size of a grape. The mode of reproduction appeared to be from a cluster of

buds appended to the terminal branches. A species very much resembling the fucus crispus, or carrageen moss, was frequent on the shores of the bay: it yielded a very agreeable pink jelly.

We neither saw nor procured any fish.

The shores were strewed with abundance of small pellucid shrimps, extremely soft and pulpy, unfit to be used as food by man; but these, with the myriads of onisci, or sea lice, are the support of the many millions of penguins. A small lizard-tailed star-fish was very numerous, which, with a handsome species of echinus, constituted the chief portions of the products of the bay. The waters of the sea contained a small medusal fish in considerable quantities. It had the form of a fish with the substance of blubber. The body was white, pale, pellucid, and gelatinous; two inches in length, nearly cylindrical; mouth tubular, ovate; body tapering, with two lateral web-like fins a quarter of an inch from the tail; caudal fin terminal, semi-ovate. At no time did I observe the least tendency to scintillation in the waters of the southern parts; and, although the nights were very dark when we left, the sea was not phosphorescent.

We procured some fine specimens of the anatina australis, a few patellas, and a small dark-coloured muscle-shell.

The harvest of these seas has been so effectually reaped, that not a single fur-seal was seen by us, during our visit to the South Shetland group; and, although it is but a few years back since countless multitudes covered the shores, the ruthless spirit of barbarism slaughtered young and old alike, so as to destroy the race. Formerly two thousand skins a week could be procured by a vessel; now not a seal is to be seen. The Americans are the most enterprising whalers: and if we possess the northern seas, they frequent the southern ocean more, and obtain the spermaceti whales.

Even the Quakers of Nantucket cast aside their usual peaceful habits, and tempt the dangerous main to wield the club and spear.

The leopard-seal has been mentioned in the body of the work; but a few words respecting some points of its anatomy are better placed in the Appendix. We dissected three leopard-seals, and noted the particulars, from among which we select the following:

The head is small; the nostril a mere slit or fissure, surrounded with whiskers; no external ear, but on very accurate examination a very minute hole may be found. The animal is dull of hearing; the mouth and tongue small. There are sixteen teeth in each jaw; viz. four incisors, two canine, and ten grinders, of unequal sizes, in the two jaws. The fore-flippers are small, they have five terminal nails; the hind flippers are large, nearly vertical, and, like the tail of a fish, broad, spreading, and crescentic, placed at the very extremity of the body, and acting as a very powerful means of propelling the animal by a semi-rotatory motion. The skull is small; the vertebral column has twenty-seven pieces; the intervertebral substance is deep, particularly towards the centre. Between the bodies of the vertebræ are two large epiphyses. There is no sternum, or breast-bone, consequently the ribs coalesce. The head of each rib is received into a cavity of the body of a single vertebra. The pelvis is small, four and a half inches in greatest diameter, from ilium to ilium, and three from sacrum to pubis. The stomach is remarkable, by its division into two portions by a central contraction. The upper, or cardiac portion of the stomach, is deeply rugous and granulated—it is the larger portion likewise; the pyloric portion is slightly rugous, but not granulated: the pylorus is very thick and fleshy. The bowels are nearly of uniform diameter throughout; they are one hundred and five feet in length and four inches in cir-

cumference. The liver is large, and separated into four or five distinct lobes, not being one organ, as usual, but in detached pieces, lying on a broad connecting membrane. The cystic duct was crammed with worms to a frightful extent, showing the prevalence of disease in every animal, however natural or simple its habits. The spleen small, and of an ash colour. The kidneys are of great size, lobulated and covered with large veins.

One of the most remarkable parts of its structure is displayed in its enormous abdominal vein. On opening the abdomen to inspect the viscera, we perceived on the right side a blue shining surface, which we thought to have been an inflated intestine, but we were astonished to find it to be a vein filled with a vast volume of blood; and we were still more surprised, on prosecuting our research, to find this vein spreading from side to side, lying beneath the arch of the diaphragm, vaulting up the stomach, and floating the liver on its surface, spreading eighteen inches from side to side, being a vein of unparalleled magnitude. It may, perhaps, be regarded more properly as a venous sinus, rather than a true vein, from its not being a cylindrical tube, but a wide expansion of very little depth, viz. three inches. It is a prodigious reservoir of blood; the coats are very thin and soon burst. This vein commences on the sacrum, about the size of the little finger, swells from the tributary veins, and as it passes between the kidneys receives an immense augmentation from those organs, bulging out and increasing in size to eighteen inches: before it passes the diaphragm, it contracts to four inches and immediately enters the heart. There are no valves in the course of the vein, and the heart must exert some suctive power on this stagnant sea of blood. There is no mistake in the magnitude of this vessel; most particular attention was paid by my kind and intelligent friend, Dr. Peter Conolan, and on every occasion we used the graduated rule and compass, and the most

scrupulous regard to veracity and accuracy is hoped to be maintained by us both. We measured and remeasured, doubting even the evidence of our senses. To what purpose is this extraordinary structure subservient?

The habits of this animal would appear to be perfectly aquatic; its fish-like form—its contracted, nay almost closed nostril—its want of ears—its fish-tail flippers—its inability to walk or crawl much—its peculiar internal structure—seems to denote that it comes much less frequently to the surface to respire than others of the seal tribe. In fact, it is a complete water animal; and its immense venous sinus receives and holds the stagnant blood during the long period of impeded respiration. The lungs are small and dense. The right auricle of the heart is large, loose, flaccid. The aorta is large, strong, and very thick; the valves remarkably beautiful. There is no foramen ovale.

There are great advantages in simultaneous teaching, and the deduction from a group of facts is always more valuable than from a single one. With this view I adduce the parallel instance of the prodigious size of the jugular veins of penguins, an amphibious race of birds, analogous in some respects with the leopardine seal. The jugular veins of the penguins are three inches and upwards in circumference, bulging out on either side of the neck. They do not communicate, but empty themselves separately into the right auricle. The right jugular has strong valves at its entrance into the auricle. The left vein runs across in a slanting direction, and enters obliquely into a channel, or groove, at the inner side of the auricle, or rather the auricle itself may be said to be divided by a fleshy partition, which permits the veins to have distinct entrances.

The heart of the penguin is very large and strong. The right auricle is large, lax, distensile, forming an envelope, or wrapper round the heart. It is three times the size of the left auricle. The left ventricle is large, fleshy and strong:

the tricuspid valves, particularly, large and beautiful. There is a great analogy between the leopardine seal and the penguins in respect to the venous dilatations; and there can be little doubt they are reservoirs of the blood during the impeded circulation, which arises from the temporary suspension of respiration.

Not only are the circulatory organs adapted for an aquatic life, but the conformation of the eye of the penguin is suited for vision in the water. The lens is spherical, and the vitreous humour dense and in considerable quantity. The iris brown-coloured, and the pupil frequently square, and capable of contracting to a very small point. The penguin does not see well on shore. The bones of this bird are strong, and without air cells. The stomach has deep rugæ internally, and the outlet of the stomach, or pylorus, is so exceedingly small as to be with difficulty found.

The penguin, though constructed on the model of a bird, has in some degree the habits of a fish; as its wings are converted into flippers, or swimming paws, so its tail is turned into a rudder. The tail feathers are very remarkable; they are few in number, five or six inches in length, very stiff and rigid, the quill part being completely solid and firm, without any cavity or pith, with a very scanty beard or feathered portion. They in fact resemble whalebone; they are grooved or fluted beneath, which very considerably increases the surface, and gives them a greater hold upon the water, and adapts them for acting as a rudder.

Penguins generally lay two eggs, and they maintain the erect posture during incubation, which occupies between four and five weeks; the young ones are covered with very fine down, and are of extremely rapid growth, quickly attaining their full size. They feed the young by regurgitating the contents of their stomach, which consist of comminuted shrimps, &c. The contents are reduced to a pultaceous, or half-digested mass, previous to being given to the young. The eggs of penguins are very good eating.

ST. HELENA ISLAND.

The Geology of this Island is completely and perfectly elucidated by Mr. Robert Seale's Museum, and his indefatigable exertions have discovered the following articles:

Of Iron.—Meteoric native iron, pea-iron ore, reddle, hepatic pyrites.

Of rhombic Corundum.—A variety.

Of Quartz.—The massive and compact crystallized quartz hornstone; chalcedony mammillated, and with concentric veins; common jasper, porcelain jasper, agate jasper, sinopal and fortification agate.

Of fibrous Pumice.—A variety.

Basaltic Hornblende.—Basalt and clinkstone abundant.

Of Limestone.—Crystals of calcareous spar, and fine stalactites.

Of Gypsum.—The earthy in aggregated tufts, granular, compact, fibrous, crystallized, plumose, lamellar, anhydrite. There are beds of gypsum three feet thick in vertical strata.

Volcanic Sulphur.—Rare and in small pieces.

Lavas.—Spongeous, with basaltic hornblende, with crystals of calcareous spar. Cellular lava, mammillated and botryoidal. Heavy slaggy lava, conglomerated. Basaltic columns. Lava with crystals of felspar, with calcareous tufa, selenite, and sandstone. Variety of sandstone-like lavas, and lateritium, or red-brick earth. Transition flinty-slate, grey wacke, sienite, St. Helena porphyry, basalt, containing crystals of quartz, calcareous spar, and selenite.

Rotten Stone.—Volcanic sand, fuller's earth, steatite.

Limestone.—From Sandy bay, from Prosperous bay, from Gregorie's valley, sugar-loaf limestone, oolitic and coralloid, from dry gut.

Clays.—White, red, yellow, pink, purple, mottled, marbled, veined and striped, ochre, boles, &c.

Buccina, vel helix dextra of Mawe, found in great numbers, near the summit of Flagstaff hill, nineteen hundred feet above the level of the sea; and on Bencoolen plain, fifteen hundred and seventy-six feet above ditto.

Bones of the Diomedea exulans, or great albatross, are found at various depths from three to one hundred feet below the surface in Prosperous Bay. Are they not rather the bones of the Pelecanus?

In a quarry, fourteen feet deep, egg shells have been found entire.

The basaltic rock, of a dark blue, or black colour, is the principal constituent, with clinkstone and compact blue lava. There are several instances of basaltic columns here, as displayed at the columnar pile called Asses' Ears; and likewise Lot and Lot's Wife. At Stone Top, they are seen in tabular and columnar masses, twenty-seven feet high and nine and a-half in breadth. Most of the hills are intersected by vertical dykes, and traversed by veins of quartz. In the ravine near the burn, the vast strata of secondary trap rocks are perpendicular or vertical. Phonolite is prevalent; and some porphyritic rocks, towards Turk's Cap Bay, where there are immense veins of hornblende like coal. In one of the islands the isolated stones, or pillars, have a vague resemblance to tomb-stones, hence it is called the Church-yard.

Layers of salt are intermingled with the strata of sulphate of lime in Turk's Cap Bay. Is the gypsum of this island, the product of heat, or the result of an aqueous deposit? It is very abundant, especially on George's island to the westward, and where there are stalactites of sulphate of lime.

There are abundance of salt-water pools; and quantities of salt in the rocks and caves, seven or eight hundred feet above the level of the sea: and in a spring which descends from the end of Friar's hill, salt is found, from passing through a bed of that substance near the summit. There

are one or two mild aperient springs near Turk's Cap Bay.

The limestone is procured from several places, but principally from Sandy Bay.

Oolitic limestone is on Flagstaff hill.

There are limestone hills from Lot's Wife to the sea.

Crystals of hornblende and shorl are found in Turk's Cap ravine. The ring, or exterior coat of the island, is one complete mass of rocks; while the central portion displays marls, clays, and earths, with little or no aspect of the ravages of fire. The rocks are mostly compact and crystalline; and but little of the vesicular or cellular lava prevails.

Lavas, cellular and compact, are interstratified with beds of breccia and layers of earth, of various colours, some horizontal, others at an angle of 20° or 30°. Puzzolana is found towards the beach in fine blocks: it is used in masonry; mixed with lime, it becomes hard under water. A mixture of it with plaster of Paris is used for images and casts.

To undertake a description of the indigenous botany of the island is a task which requires time, and is now a matter of great difficulty. The celebrated Dr. Roxburgh noticed the most of them. But it is a matter of little moment to the general reader; and it is better to know well what there is now existing.

Of the grasses, they have the agrostes purpurascens and stellata, andropogon schænanthus, or lemon grass. The vernal grass, the dog's tail grass, cynosurus corocanus; holcus bicolor, Indian millet; several species of panicum, and especially the polygamum, or Guinea grass. The sugar cane thrives moderately in some of the valleys. The bamboo, maize, wheat, barley, oats. Of the palms, they have the coco-nut and the date; the cycas revoluta, or sago palm.

They have an Horticultural Society, at which have been produced large melons, apples, pears, middling oranges,

lemons, and guavas superior; with plums, pumplemooses, loquats, pomegranates, dates, &c. in great abundance.

In January, China peaches, figs, and loquats are in season. In February, figs, pears, grapes, China peaches, plantains, apples, mulberries. March, figs, pears, apples, plantains, grapes, island peaches and rose-apples: the island peaches are delicious. April, pears, apples, island peaches, rose-apples. May and June, guavas, loquats. The grape does not thrive well. Oranges are rare, and sixpence each. The almond is a large and stately tree, keeps constantly shedding its leaves.

Of vegetables they have potatoes, cabbages, carrots, yams, sweet potatoes, pumpkins, turnips, beet-root, lettuce, radish, green peas, &c., mint, thyme, sage, and the usual potherbs, parsley, celery, capsicums, the egg plant, much used as a vegetable, solanum melongena.

Of flowers and ornamental plants: beautiful camellias, the rose, the jasmine, the balsam, the marvel of Peru, the periwinkle, fuchsia, convolvuluses, spomeas, lilies, hyacinths, pinks, the guelder rose, the China box, the peony, tulip-tree, several handsome species of hibiscus, the psoralea pinnata, or gobble gheer.

Water cresses are very abundant in all the valleys, and may readily be procured. The blackberries are profuse on every hill; they are used for the purpose of making puddings, and a wine from them has obtained the approbation of the Horticultural Society. The common wild plants are the roella, asclepias, cynanchum, argemone Mexicana. The conyza gummifera, or gum wood; the mikanea arborea, or the cabbage tree; several species of solidago, or cabbage trees; aster glutinosus, cotula coronopifolia, or pagoda plant.

The oak and the fir-tree thrive very well. Melhania erythroxylon, the red wood tree; and the Melhania melanoxylon, or ebony, were indigenous and formerly very abundant:

they tanned with the bark of the red wood, and used it as fuel, but it is gone.

The ferns are the most beautiful and interesting: they are very abundant on the hills: they are acrostichum bifurcatum and lanceolatum, aspidium, riparium, pulchrum, vestitutum, capense, coriaceum, asplenium, tenellum, radicans, filamentosum, falcatum, præmorsum, grammites, marginella. Hymenophyllum capillaceum, a parasitic fern; ophioglossum Lusitanicum, or adder's tongue; pteris semiserrata, paleacea, polypodium viscidum, Dicksonifolium, molle, macrocarpum.

The Dicksonia arborescens, the tree fern, is the most majestic and stately; with an erect stem eight or ten feet in height; with a graceful head formed by the arched reclining frons of two or three feet. The arborescent stem is like the trunk of a moderate tree, it consists of concentric rings of woody, and of a series of imbricated scales, one above another, being the remnant or base of the former frons. The stem is covered with moss, and has an antique effect. The aspect of the fern tree is that of the palm, and its mode of growth is not dissimilar; it is from the central head that it increases, putting forth frons after frons, the old ones decaying as the others increase; the stem is cylindrical, and never increases in diameter. Frons bipinnate, stalks and ribs downy, leaflets oblong, obtuse, convex, pinatified; fructification at the summit of each lobe, globose; a granular capsule, opening longitudinally, containing numerous flat imbricated seeds. The stem of this fern abounds with a dark sweet liquor, like treacle, which dries into a brown insipid gum. The young frons are enveloped in a bed of soft cotton-like fibres of a brown colour; it is sufficiently abundant to be useful for stuffing mattresses, &c. The number of ferns, which prevail upon the highlands of this small island, suggests the inquiry as from whence they came,

Were the minute seeds wafted by the winds from Africa? or were they brought by the birds? If so, why does not Ascension possess them all?

It has always struck me, that naturalists have been somewhat at variance with the geologists. They have found on, or given peculiar *species* of plants, &c. to remote islands, when these islands have been thought to be of a later origin than the continents themselves; while species have been limited to the first periods of creation. For example; if St. Helena is of subsequent formation to the great continents, then its possessing a *distinct* and new *species* of plant, or animated being whatsoever, must either be a conclusive proof that a successive creation of species goes forward, or that the naturalists are wrong in their definition or discrimination of species: most probably the latter. But I have no confidence in the vagueness and blindness of geological speculation; but abide rather by the wisdom of the Apostle, who says, "through faith we understand that the worlds were framed by the word of God, and the things which are seen were not made of things which appear."

ASCENSION ISLAND.

The first inspection of the island portrays its volcanic origin, and every step confirms it: around you on every side are heaps of scoriæ, cinders, ashes, and lava; and the whole island is one complete mass of pyrogenous rocks, among which basalt is the principal constituent, under various forms and modifications.

1. Clinkstone, or phonolite, with or without crystals of quartz or felspar, &c.

2. Compact, dark, heavy, augitic basalt.

3. The volcanic whinstone, a sub-species of blue-grey basalt, is the prevailing rock, and forms the substratum. The tanks and buildings are excavated in this; it forms a

rough, durable building-stone—it is a compact, crystalline mass, without any determinate fracture, and wrought with great difficulty and labour. Its constituents are hornblende and felspar.

Trap porphyry, from the numerous crystals of felspar embedded in the basalt.

The vast scattered masses of scoria and vesicular and slaggy lava which abound are the preceding rocks altered and acted upon by the fire, probably ejected in a state of fusion: they differ from the solid rocks merely in their physical state of being cavernous and cellular, whatever may have produced it. The various grades and transitions present some curious and fantastic forms; and there is one state in which the lava is found here which I have not noticed elsewhere, in any of the volcanic isles we have visited, and they are so abundant, and so uniform in their general features, that there must have been some peculiar cause for their presence. I am alluding to the apparent castings of lava, which simulate the aspect of fluted columns and small pillars of ovate grooved twists, of grooved twisted ovates, petrified wood, and trunks of old trees, and more closely, in some instances, like petrified bananas or cucumbers; in other cases it precisely resembles rolls of compressed sheets of papyrus, nor are these resemblances vague and ill-defined: in all cases they are more or less grooved, fluted, and ridged, and appear to be the refuse of iron-foundries or rejected castings. Basalt is the constituent material of these singular types, which certainly are not the least curious among the remarkable forms which that rock assumes. These basaltic types are the castings of volcanoes, Nature's great foundry. They have particular localities, and form small mounds of rubble.

The ridges and heaps of cellular lava and scoria appear in such regularity as to induce persons, at first sight, to suppose that they have been gathered up for some particular

purpose. Among many of the groups you will find packed masses of basaltic nodules, like cairns. Around these pillars or columns is abundance of vesicular basaltic lava; but the basalt of the pillars is compact, crystalline, and unaltered, and seems to have withstood in some degree the ravages of the fire.

The trachytic and congenerous rocks form a conspicuous feature, especially the greystone, or white clinkers, as they are emphatically called by the people; and whoever has the task of walking over the plain of white clinkers will have reason to remember their *roughness*. Among this pleasant species must be placed the Devil's Riding-school, an elevated, circular mound, surrounded by a wall of the most rugged material, of greystone, fretted and worn into every annoying shape that the most mischievous imagination could invent. If the roads of evil were but in any degree an approximation to this, the patrons of it would be few, and their course but very slow. I could perceive no evidence of its having been an active crater. The coarse yellow jasper and brown obsidian are found within the area of it. The base of the green mountain, and the greater part of the mountain itself, except the summit, is composed chiefly of the trachytic rocks, the weathering of the surface producing a whitish silicious crust, like the exterior of a flint. As we ascend, the trachytic scoriæ appears; and about the level of the mountain-house black ashes and cinders appear, and cap the surface. Beds of agglutinated cinders and cemented ashes alternate, and strata of the various coloured tufas run through them. Here the black rock displays its chasm; while in the deep dell below the bright green pennon-leaf of the banana delights the eye.

Common, coarse, white opal, and its various gradations, earthy felspar, and domite, are found contiguous to the base of the green mountain.

The obsidian ridge, or lava rock, is at the foot of the

green mountain on the north-west side; the obsidian lies scattered about the surface in loose detached pieces, from an ounce to eight or ten pounds in weight, but generally about a pound, and the size and aspect of a common large black flint. The obsidian has a beautiful polished vitreous surface, and might be taken for masses of coarse dark glass.

There are many shades and varieties of obsidian; some light green and waved, others speckled, but generally dark, and shining like pitch; many pieces are partly converted into pumice, and many specimens display the gradual transition.

Obsidian is defined to be "lava suddenly refrigerated and perfectly vitrified." I put some large pieces into the stove-fire; it cracked and splintered, but in a short time became converted into perfect pumice, swimming upon water with great facility: I was surprised at the conversion of such a dense, compact, heavy substance so speedily into such a fragile, light texture. The ground and surface of the obsidian ridge is composed of a grey sandstone, with very extensive beds of fine, soft, white, silicious sand, resulting probably from the disintegration of the sandy greystone; and, as felspar is a great constituent thereof, is the obsidian or volcanic glass, the result of the heat combining the impure silicious sand and the potass? Obsidian does not contain any bitumen, nor have volcanic rocks or lava any indication of that material, notwithstanding they have been said to contain it by some experimenters. Some of the scoriæ, if fused in a furnace, run into a perfect glaze, and they might probably be employed for that purpose with good effect, and the dark glaze may be thought to contain a bituminous principle. The obsidian strikes fire like a flint, and it cuts like glass; some species are conchoidal, like agate jasper.

1. Pumice exists in very large quantities in many parts of the island, and affords some very fine specimens of asbetoid, or satin pumice, of a bright fawn colour. 2. Coarse fibrous

pumice. 3. Common grey pumice, with numerous embedded crystals of glassy felspar. 4. Pumice scoria, or cinder. 5. Pumice injected with earthy matter.

There are various specimens of fragments of granite, and other primitive rocks, found scattered indiscriminately among the lava, or lying in the beds of cinders, and they bear more or less the marks of the action of fire. Some of the species of granite are very perfect and complete; others are semi-calcined and brittle. The quartz rock appears converted into a mass like red sandstone. Argillaceous schist, and grey-wacke, and syenite are likewise found. These seem to have escaped the full action of the fire in a manner difficult to conjecture; there are no beds of these rocks to be discerned in any part of the island, and yet the evidence of these masses would seem to denote their contiguity.

On the dusty plains are abundance of loose crystals of glassy felspar, which have resisted the action of the external agents that caused the disintegration of the matrix in which they were embedded.

Amygdaloid basalt, the cavities filled with zeolites.

Crosshill is principally formed of a slaggy tufa, of a reddish tinge, reposing on immense beds of basaltic lava and clinkstone.

Lateretium, or brick-earth, is not so common as it usually is in volcanic isles.

There are beds of specular iron ore, which are highly magnetic; the ore is in small lamina, or plates, resplendent, and set upon a dark granular lava. The plates are sometimes beautifully tinged with blue, and are rather handsome specimens.

The foregoing is a list of the principal volcanic products of Ascension; there are many varieties, which it would be difficult to describe, and when so done it would be a useless task. There are two subjects which remain to be discussed, but they are accessory or secondary products, and are in

daily progress of formation; they are the beds of limestone, and the stalactites of gypsum.

On the northern side of the island are extensive sandy beaches of comminuted shell and coral, which become agglutinated into solid, compact limestone of various degrees of fineness; some are coarse, loose, and granular, while other specimens are hard and compact, where all appearance of shell is obliterated. The formation of limestone appears to take place in the lower beds of the sand. The constant percolation of water through the upper beds of loose sand may be supposed to dissolve a minute portion of the carbonate of lime, which is deposited again upon the lower masses. A long action of water, with a small excess of carbonate of lime in solution upon the lower strata, will in time cement the granules, and by interstitial deposit will consolidate them into one uniform mass. That a process of this kind does take place appears from the simultaneous formation of calc sinter on these beaches. The deposit of the carbonate of lime from its solution cements the stones and boulders together, affixes the shells to the rocks, agglutinates the various substances on the beach, and glazes in a remarkable manner the rocks, shells, and stones, and gives frequently to the limestone itself a perfectly smooth, polished surface. Is the cementing power augmented by the animalculæ of the sea-water?—Probably. The calc sinter forms singular porcelanous glazes of various colours, from shining jet to opaque china white; the former have been taken for volcanic products, and caused some confusion, but shells being coated with it have removed the doubt. The difference of colouring I cannot account for.

The limestone is in extensive beds, and appears regularly stratified, and with a dip of 45°, but with reverse aspects on the same beach. Thus, on a sweeping, circling beach, the beds dip in opposite directions: on one side they dip to the south-east, while those on the opposite side dip to

the south-west; and in the centre of the beach they dip to the southward; this is caused by the inclination of the beach and the angles it forms.

There is a species of marbled limestone with red veins and tints; it is exceedingly hard, and appears to be constructed by an aggregated mass of verminous tubes, with subsequent interstitial deposit of carbonate of lime from its solution. The shifting of the sands at different periods of the year often uncover and disclose the consolidated limestone.

The contemporaneous formation of salt and gypsum, as exhibited on this island, was to me an interesting and novel phenomenon. I walked to the windward side of the island, the only part where it is exhibited, to witness the circumstance. As you approach the shore, the rocks are incrusted with salt and small beds of sulphate of lime; but on the table-ledges of rock, which project a little to seaward, and which are elevated about twenty or thirty feet above the level of the sea, a heavy spray is continually thrown up. Evaporation goes forward rapidly, by which the saline particles are left, a constant percolation taking place at the same time through the fissures or crevices of the rock. The sea has undermined the base and left a sort of cavern, the roof of which is a thick bed of rock. Month after month the process goes on; the spray, being thrown up into the hollow part of the ledge, is evaporated, till a large quantity of the saline contents are accumulated—and what are they but muriate of soda, sulphate of magnesia, and sulphate of lime? The two former, being soluble, are of course carried off by percolation through the rocks; the sulphate of lime, being the more insoluble, remains and forms a bed of earthy gypsum one or two feet in depth, with occasional masses of radiated crystals. The sea-water continuing to be thrown up, runs through the bed of gypsum, and carries with it a minute portion of the earthy substance, which crystallizes

as it trickles from the roof, and becomes appended thereto as a stalactite of gypsum. The floor of the cave, from the drippings before stated, produces a stalagmite of the same formation: thus, in the lapse of years, are formed gypseous caves, and beautiful stalactites of alabaster, from the drainings of sea-water.

The rock on which it is formed is augitic basalt; the constant south-east trade-wind keeps up a heavy surf on this side of the island, and replenishes the pool or basin in the rock before it is emptied. On the surface of the rock I found a bed of earthy gypsum two feet or more in thickness, with some small portion of salt. On going down to the caves, which is occasionally impracticable from the great swell, I saw the water oozing from every pore of the rock; it was extremely salt, and the cavern abounded with the most elegant translucent stalactites and coarser stalagmites. Some were of great size, four or five feet in length and forty or fifty pounds weight, but others of the most delicate proportions: the larger ones were tinged within of a bright green, probably from a sulphate or muriate of iron derived from the action of the water on the basaltic rock. On the basement-floor of the cave were some little pools of very strong, bitter, salt water, and around the edges of the rock crystallized salt; the water contained sulphate of magnesia, or Epsom salts, and would form an aperient spring.

Gypsum occurs in many volcanic islands; we found it at South Shetland. It is abundant at St. Helena, in veins among the lofty ridges of basaltic rock; but it may in these cases have a different origin, and be a true igneous formation, from the evolution of sulphureous acid coming in contact with the earthy base; and thus form anhydrous gypsum; for we had sulphur and alum at South Shetland with the gypsum. Here we have demonstration of its marine origin, forming extensive beds, and crystallizing in a variety of ways; we have likewise evidence of the contemporaneous

formation of common salt; and the production of sulphate of magnesia, or a mineral aperient spring. At St. Helena they have aperient springs issuing from the rocks near the gypsum veins; but I nevertheless do not think it an analogous formation to this now described. It is right to state that in some of the low parts of the island, near the shore, casual crozier-shaped crystals of acicular gypsum are picked up.

I have been particular in stating the circumstances, and in connecting them with others; because, facts are valuable only in reference to some general law. And what is obscure in one part, is often elucidated in some other, and the interest of the whole is increased by the comparison.

And here it becomes me to mention, with gratitude and respect the kind attentions of Lieutenant Evans, who gave me every assistance in his power; and whatever information I may have obtained is due to him, and the errors of statement alone to myself. And whatever the warmheartness of Captain W. F. Owen (who kindly introduced me to him) might wish of him to show me, he did so to the full extent of the most sanguine expectations; and I stand debtor to both.

The botany of the island is comprised in a few words. The purslane, portulaca oleracea, and euphorbia oviganoides, are the most common plants on the plains. Ocimum verticillatum, and a species of orobanche, are found in the runs. On the beach is a solitary convolvulus arenarius.

On the mountain are the physalis edulis, or gooseberry plant. Asclepias Curassavica, with its silky villus or hair; angelica bracteata, chenopodium ambrosioides, carex pedunculata, a fine thistle, some luxuriant castor oil plants, and a few exotic weeds introduced with the garden seeds; but to say what is precisely indigenous, would now almost be impossible: they are so few and unimportant as almost to escape notice. The cinder caves are very prettily decorated with ferns; and

my attention was attracted by one creeping on the soil, and the leaves sending down filamentous radicles from the midrib or the under surface. The leaves were five-tenths of an inch in length; edges slightly waved. The upper surface of a bright blue green; along the centre of the leaf, corresponding with the midrib below, are the little clusters of seeds, each leaf bearing about four or five, with small intervening spaces. The leaves of the plant are crowded together, covering the ground for five or six inches in extent, like some of the mosses. Panicum dactylon or wire grass, agrostes stellata, and the aristida Ascensionis, are the principal grasses. Its agricultural and garden products we have noticed when speaking of the mountain.

The sterna fuliginosa, the black-backed tern, is the egg-bird of Cook and other navigators. It was very appropriately called the egg-bird, from the circumstance of its laying only one egg, of an extraordinary size for so small a bird. The bird itself weighs between six and seven ounces, and lays an egg the size of a common pullet's, and weighing an ounce and a quarter. The egg has a bluish ground with black spots. These eggs supply the table for breakfast, and serve for the usual domestic purposes. These birds congregate in flocks, cover large spaces of ground, and their assemblages are called "fairs," by the Islanders; the birds themselves, from a fanciful idea suggested by their noisy notes, are called *wide-a-wakes*, but I could never hear them utter such sounds.

The bird itself is elegantly shaped, and has an immense spread of wing, of two feet nine inches. It is swift and rapid in its flight; has a piercing acute eye; it frequently keeps on the wing all night, as if catching insects; but it repairs in the day-time to a considerable distance at sea for its prey.

The pelecanus bassanus (the gannet goose) and pelecanus piscator are numerous. The pelecanus fiber, the brown

gannet, is the most elegant of the genus; its breast is snow white, and its back a light brown. The delicate chamois-yellow of its webbed feet gives it a graceful attraction; and if ladies sometimes pride themselves upon the smartness of their feet, this bird may assuredly lay claim to some admiration for the beauty which nature has given to its webbed feet. Its gait however is waddling and awkward. It generally lays two eggs, and hatches them upon the rocks. It endeavours to make a nest by huddling a straw and a feather together, but the island cannot supply them with materials enough, so the poor creature has but an apology for a nest. The inner feathers are beautifully soft, and form the very best of featherbeds, for which they are plucked; it is, in fact, as soft as the down of Cytherea's doves, or snows that fall upon a tranquil sea. It rivals swansdown, and each bird produces a large quantity.

The different tribes of gannets live widely apart from each other, and preserve a perfect and distinct clanship. The rocks and plains in many parts are whitened by the masses of birds' dung, in some parts forming little pyramids three or four feet in height, which from the absence of rain and the drying nature of the climate, become a hard solid earthy mass, one of which was brought on board by Lieutenant Williams for preservation, having attracted his notice while surveying. It was dry, inodorous, resembling the guano of Peru, which is such a serviceable manure, and imported from the neighbouring islands in large quantities. Fourcroy and Vauquelin analyzed it.

Pelecanus aquila, the man-of-war bird, frigate bird, or sea eagle, has a sharp strong curved bill, like a flesh hook; amazing spread of wing, seven feet, for a bird not bigger than a crow; and strong quill feathers. His foot is but imperfectly webbed, insomuch that I believe he cannot take the water; his toes are armed with sharp talons, the central toe longest, differing altogether from the genus. This is a very

rapacious bold bird, waylaying and attacking other sea fowl; when he thinks they have got some fish in their maw, he pounces down upon them; and when, to lighten themselves, the birds disgorge, he with surprising agility catches it before it falls into the water. He likewise attacks the young turtle as soon as they leave the egg, and devours many of the brood. He has great power of wing; and soars over the ocean a great distance from land, watching and attending always upon other sea fowl. He has an orange coloured pouch. The œsophagus is large and distensile; the stomach simple, membranous, lying very low in the abdomen. It has no horny coat. Liver lying on the stomach.

There are some points of analogy between the frigate bird, and the larus cataractes, or port Egmont hen, or the skua gull. The gull is very bold and rapacious, attacking other birds, of great power of flight, has a strong curved hooked bill, and though web-footed, is armed with sharp talons. They each are piscivorous, and yet the internal organization, as of the stomach, is very different, the skua gull having a strong muscular gizzard, and a horny tunic inside of his stomach. The gull is very carnivorous, and so is the frigate bird; but I do not perceive the exact relation of the food to its strong gizzard stomach. The gull has the power of rejecting balls of feathers from its stomach. The investigations of the internal structure of animals, though highly important, and absolutely necessary to complete our knowledge of any creature, is no better guide for classification, or natural systematic arrangement, than the external characters.

Of the echini or sea eggs, we have the long spined, the acicular, the banded or striped acicular, the palæaceous or chaffy, and the obtuse; some of them are handsome, but very difficult to preserve entire. There are two or three species of crab; the gecarcinus, or land crab, the king crab, and the little pale egg lobster, from its resemblance in colour

to a linnet. It is an inch in length, and seven broad, has five pair of legs, and a tail of six unequal pieces; the sacral piece is armed laterally with a pair of curved reflex claws.

The fishes are cavalloe, bonita, and the small mackarel called the scomber glaucus vel Ascensionis, from its abundance here in some seasons. The syngnathus, or pipe fish. The genus balistes has several species here, as the black fish, the old wife, and the parrot fish. Clupea tropica, the sun-fish, bream, silver fish or atherina, the pilot fish, several of the genus labrus. It were almost superfluous to say there are many sharks.

Among the fish of Ascension the "congers" hold a conspicuous station; in fact, they are one of its staple commodities, not only supplying their own tables, but leaving a little surplus for exportation. Although called "congers," they do not belong to the eel tribe of naturalists; but are referable to a distinct genus "gymnothorax," from their having no pectoral fins, body anguilliform, viscous, without scales, variegated with lively colours, orifice of the spiracles or breathing organs, strait, inclining to an oval form, and without either gill cover, or membrane; mouth sharp, teeth strong, nostrils tubular, back and anal fin united with the tail.

But this generic character does not comprise the different kinds. The one most frequently met with, and used at their tables, is the purple-boned conger, which is the gymnothorax echidna. Its length forty-four inches, and its circumference eight inches; head, flat; jaws, eked, projecting; eyes, small, placed very forward; the cornea covered, and defended by a cuticle stretching over it, but which is transparent. Teeth of the lower jaw, very small, pointing backwards; those of the upper jaw are from a fifth to a seventh of an inch curved backwards; two small cirri at the nose. The dorsal fin, the whole length of the body. Anal fin from vent to fin; gill-flap, none; gills, four; fauces and mouth, dark-coloured, lined with the skin and spotted. The

bones are purple, but bleach beautifully white. The œsophagus is of a dark colour, and is a continuation of the reflected skin. Stomach, an oblong pouch, extending the whole length of the abdomen, from œsophagus to the vent; the inner surface rugose. The pylorus is on a parallel line with the cardia; at the top and side of the stomach, the pylorus is very small and contracted. The intestinal canal is very short, strait and simple; as long only as the stomach, with an extremely villous vascular internal tunic. The intestinal canal of a uniform diameter throughout. The liver long, slender, lying on the œsophagus; of a reddish brown colour; gall, a watery dilute liquor; ovaries long, granular, the lower part of a vermilion red, as if portions were cast at a time. The milters have a milky fluid. The heart is inclosed in a strong bag or pericardium; and both the auricle and ventricle by numerous tendinous cords. The aortal bulb is large and strong, plicated with three valves at its base. The air-bladder lies dorsal of the œsophagus, from one and a-half to three inches in length, and a sixth in breadth. The air-bladder has two tunics; the inner tunic is very fine, almost like goldbeater's skin — it is extremely vascular, having many vessels ramifying on it. The air-bladder appears to have a capillary tube communicating with the cellular membrane of the abdomen: there are two large fleshy muscles at the mouth of this tube, which may act as sphincters, or propellers. The eye is protected by a process of common skin, or integuments continued over or across the orbit; but how admirably it changes its nature, becoming, just for that small space, perfectly transparent like the cornea. It is an additional defence, or guard to the eye, which from being placed extremely forward, but most advantageously for its seeing, would be peculiarly liable to injury. Have not some of the guanos, or lizards this guard?

The vertebræ are one hundred and twenty in number.

The urinary bladder is below the vent, and contains a pinky fluid.

This fish frequents the rocks, under ledges in deep water, is extremely voracious, and bites exceeding hard. Notwithstanding its repulsive and snake-like aspect, it is very rich and delicious when fried, being extremely white and delicate. It takes salt readily and forms a tolerable article for sea. This applies to the conger: but there are others called by the people sea snakes and serpents, and which if separated from gymnothorax, may be ranked under a genus to be styled icthyophion, of which I have seen three kinds.

The first was three feet in length, circumference six inches, without pectoral, dorsal, anal, or caudal fin; mouth very small, but long; teeth numerous, in a double row; one-twentieth of an inch in length; rounded tips; palate armed with teeth; colour of the skin, a deep golden yellow, with black patches and numerous black spots.

The second, length two feet, circumference five inches; colour, dark brown, with numerous yellow spots; nostril prolonged, with four erect cirri. Without dorsal, or anal fin, but with a caudal fin.

The third was ten inches in circumference; teeth, in four or five rows, very small, sharp-pointed, bent backwards; body of a deep brown, with large bright yellow bands; no fins, either dorsal, anal, or caudal; two short cirri above the nostril.

FERNANDO DE NORONHA.

The geology of Fernando de Noronha offers some points of interest, inasmuch as it presents features more in accordance with the prevailing opinions than some we have heretofore noticed. The general and prevailing structure comes under the denomination of trap rocks, consisting

chiefly of basalt, hornblende and greenstone, with a superincumbent mass, in some parts, of limestone. Having had the opportunity of seeing several volcanic islands, and being familiar with the usual products, we could not for a moment resist the inevitable conclusion, that heat or fire had been an active agent in the formation or elevation of this island. The rocks were so similar to many of the rocks in the volcanic countries, that we associated and classed them together. The identity is so perfect, that the most superficial observer did not fail to recognize them; and the most experienced can detect no difference on examination. It is, and yet it is *not*, volcanic; for though many of the rocks assimilate, there is no vesicular lava — no scoriæ or cinders — no ashes or sand. Therefore, although heat has apparently acted an important part, yet it is probable that it has been submarine heat, or heat under great pressure; and that there has been at no time any open volcano, or any eruption, for there is no evidence of any ejected materials. The elevation has been quiescent and regular: the limestone, in the less elevated parts, caps the basalt, and appears to have suffered little or no change. The basalt in the higher parts peers above, and limestone does not appear. If submarine volcanic heat is the heaving force, can the upper surface of the rocks acquire a higher temperature than 212°, since it is in contact with such a vast volume of cold water?

I am inclined to think, that a very moderate and mitigated degree of heat prevails; and that it is to the conjoint influence of heat and pressure that we owe the effects. Eruptive volcanoes alter basalt amazingly: basaltic scoriæ are very common; hence compact basalt we cannot positively affirm to have been fused. Whether the basaltic rocks are the products of heat, is only presumed from their presence in volcanic countries; they may be associated with volcanic products, they may be in part the cause of

volcanic heat; certainly, we see no reason whatever to sanction the idea of plains of fused basalt, &c. any more than the fusion of granite. In fact, we are in the habit of talking very vaguely about volcanoes, and the igneous origin of rocks. I do not know that fire makes anything in this way — it can only mould and alter the materials — and what are the materials? And is it not quite as rational and as easy to suppose granite, basalt, &c. to be primordials, as secondary materials? We might as rationally argue about the origin of man from his bones and flesh, and the successive periods of their formation, as argue concerning the earth from the rocks and strata about the earth. However unpalatable such an assertion may be, all we do know and ever shall know is, that great changes have taken place on the earth by the fiat and will of the Almighty. Neither fire nor water are the creative or formative agents of the rocks, but the unknown will of God. In geology, we experience much delight and instruction—it opens the casket of the earth and displays its treasure; it gives us an intimate acquaintance with the wonderful and sublime architecture of the globe, and the materials of its structure; it enlarges the faculties, and is a pleasing and fascinating study, tending to our benefit, and increasing our riches and resources.

The basalt forms ledges, steps, stairs, walls and pillars.

The horizontal ledges stretch out to sea-ward, while the steps and stairs mount directly from the beaches up the hills by such a regular series and successive gradations as really to appear the work of art, and are called by the people of the island "escalada." The isolated pillars, or columns, are formed by aggregated masses of basaltic balls, or nodules, symmetrically arranged. The walls seem like partitions belonging to some decayed building, and they are generally on the verge of the hills. The basalt is dark, compact, close-grained, heavy, dense, with occasional crys-

tals of olivine. The basalt is incrusted with gypsum on the beach; and the veins of it are occasionally filled with infiltrated gypsum. In the clay-pits on the hill, near the fort, there are packed aggregated masses of basaltic balls, or nodules, from one to two feet in diameter. It is of a light blue colour, like flint in appearance, or the lead blue obsidian: these masses obstruct the workmen. The phonolite, and felspar porphyry, or the blue compact crystalline lava, with crystals of felspar dispersed through the mass, prevails in some parts. Hornblende rock, or hornblende, felspar and quartz in chemical union, is one of the most common of the rocks; hornblende enters largely into the composition, or is diffused in separate crystals through the mass of the greater number. Some of the rocks resemble syenite, from the hornblende permeating the mass in soft veins, or delicate striæ. The black heavy hornblende rock has a volcanic aspect, with minute specks and crystals of olivine. I have picked up masses of hornblende, four or five inches square, looking like small pieces of coal. The streams in the rainy season wash this down in small particles, and it forms the black sand which they gather.

Felspar, porphyry, with concretions of quartz, resembling the volcanic rock. Some masses of lateritium, brownish red; the cells filled with infiltrated crystals. The greenstone prevails in the next degree to the basalt and hornblende.

The peak is of this variety of trap rock; it resembles very much some of the rocks at Cape Horn. The pyramid rock is of a dull leaden green, compact, crystalline, shining; composed of felspar, quartz, and a little hornblende: the felspar is in small oblong crystals, white, glistening. The quartz, the great component mass, is of a very dull olive or green; the hornblende is in minute specks, but not very abundant; the weathered surfaces present the felspar in conspicuous shining faces; the hornblende becomes more

visible in black specks; and the rock altogether wears a whiter hue; on friction it emits the odour of quartz.

Embedded in the peak are immense blocks, of some tons weight, of siliceous schist, like imperfect, coarse agate-jasper; the base of the peak is strewed with several which have fallen out. Some years ago, one of them overwhelmed and destroyed the fort near the base of the peak; the schist is imperfectly veined into lamellated bands or streaks. The beaches are of fine siliceous sand, perfectly horizontal; they are of course very shallow, and whenever there is a surf it is difficult to land. The boulders of basalt and greenstone upon the windward shores are like cobblers' lapstones.

Greystone is abundant, and contiguous to the basaltic masses. 1. Dark greystone-paste, semi-vesicular, with abundance of hornblende in crystals, and some felspar. 2. Simple greystone; minute crystals of felspar very abundant. 3. Greystone and hornblende; vesicular lava of a light brown; cavities lined with infiltrated bole, or yellow sulphur mass, precisely analogous to what I met with at Ascension; condensed pumice, like earth, with felspar crystals.

Some of the cliffs present an appearance of being white-washed, the pellicle or coating is less than one-tenth of an inch; it is on the quartose rocks, and I never saw so pure and uniform a white surface on any rock before, except the porcelain surface of flints. Five hundred yards north-west of the peak is a fine basaltic structure of horizontal columns, the columns being six or seven feet in length and one foot and a half in diameter, disposed in prismatic joints and in the most regular order. Quartz rock, like massive jasper, and some approximating even to sandstone, especially to the red sandstone, and containing sometimes a few particles of hornblende. Some red semi-vesicular quartz rock is lying in immediate contact with the basalt.

I have found fine translucent quartz. The scattered

rocks in the woods appear vesicular, but they are merely water-worn; they are of the compact blue lava, with crystals of olivine and hornblende.

Rat and Booby islands are composed of limestone; they are of moderate elevation, with a fertile soil and open downs. Salt crystallizes abundantly on the windward side.

On the windward side of the Island of Fernando, near South-west bay, there are cliffs and beds of limestone of an altitude of one hundred and sixty feet; they appear in the upper part in strata, inclined at an angle of 45°. The lower portion or base is crystalline and compact, radiated and crystallized in various forms. The ledge that connects the main island and the fort is of basalt, and basaltic boulders; in the centre of it is a basaltic mound, capped with limestone.

The botany of Fernando displays the South-American character. Few of the trees are of any magnitude to afford timber for many useful purposes, rarely exceeding six or seven inches in diameter, and the largest a foot. The most common is the dark and laurelled bara, belonging to the natural order euphorbiacæ; it abounds with an acrid, caustic, milky juice, very much dreaded by the inhabitants, producing inflammation of the skin and severe ophthalmia. The tree is made no use of, and is regarded as a nuisance, inasmuch as it acts as a powerful depilatory, and removes the hair from the horses and cows, and gives them a diseased appearance.

The Swartzea pennata fajo is denoted by the long carmine pod, with its pulpy seeds adhering. The flowers are large and white; that in the evening gaily blooms, but in blooming dies. The wood is exceedingly hard, strong, and heavy, sinking in water: when the cows eat the leaves, the milk acquires a very unpleasant garlic flavour.

The jatropha, or pinhao: the seeds vomit and purge, when several are eaten; the doves live upon them. The

plant abounds with a watery sap or liquor, which stains linen and calico of a permanent brown. The wood is extremely light; it casts its leaves in July and August.

The cassea occidentalis et falcata are diffused over the island: the seeds have precisely the flavour of raw coffee, and when roasted are used as a substitute. The leaves are a tolerable purgative, and but little inferior to senna.

The acacias are the graces of the woods, and cast a sweet perfume around. The pod turns black in drying, and contains a strong gum. The seeds contain gallic acid; they are of a very unpleasant flavour. The wood is very hard, and makes excellent charcoal.

The erythrina exaltata is the largest tree on the island.

There are several species of indigofera. I made many experiments on the fermentation, mixing alum, sulphate of iron, &c. with the infusion, without any decided effect. Solanums, as tomatas, capsicum, and several ornamental kinds, in the woods. Malvas, hibiscuses, and pavonias. The arbus precatorius, the rosary bead or coral pea, climbs up every shrub, and hangs its scarlet seeds on every bough: the smell of the immature husk is particularly unpleasant. The leaves have the liquorice flavour, and seem to contain a small portion of indigo.

The grasses of the island are not very numerous or abundant, but are elegant in their inflorescence, especially a paspalum.

Among the solanums I should have mentioned the solanum pariculata, the jurubeba of the inhabitants, the virtues of which are extolled in dropsies, in cachexia, and debilities, acting as a purgative, diuretic, and tonic, in a very surprising manner. The testimony of Withering, and other medical writers on the solanum dulcamara, so nearly agree with the statements of these people, that I am inclined to believe there is some truth. The cactus quadrangularis and the jatropha urens are troublesome and annoying.

Of Fruits.—The melon, water-melon, and pumpkin, in perfection. The wild cucumber bursts, and its saponaceous pulp is used for washing with; it forms an excellent emollient poultice, and pillows stuffed with it are reported to procure sleep: an infusion of it cures the itch. The orange, the lime, and the pomegranate, the cashew apple and the tamarind, are the principal fruits of the island. They have grapes twice a year, of an amazing size. The palma christi yields oil for their lamps, and the cotton-shrub displays its fleecy treasure.

The ficus indica, (the banyan-tree,) one of the most extraordinary of vegetable products, is much esteemed by the inhabitants of the island. Its mode of growth is surprising. It is a large and stately tree, fifty or sixty feet in height, with fine spreading branches; from the lofty and main branches a bud swells into a little branch, which drops downwards to the earth in a perpendicular line. As it comes downwards, it begins to put forth a bundle of fibrous roots; the descending branchlet grows and increases in size, the fibrous roots elongating, till they reach the soil and penetrate therein. Now becoming a prop, and giving stability and firmness to that from which it derived its origin, it becomes an independent stem; the branch from which it sprung spreads wider and extends by the increase of vigour which it acquires from the propulsion of sap, till another rooting branch is sent off in the same manner. The branches on all sides do the same. Thus the tree goes on to an indefinite extent, the young and old being incorporated together, and flourishing in vigour for ages; and by a thousand roots sucks the earth, forming the most natural and extensive bower, where age may repose and lovers meet, and walk amid the shady maze of one vast tree: it affords a delightful retreat in these sunny climes. The function exhibited by this tree does not altogether accord with some of the prevalent and exclusive theories of vegetation. The

nutrient or sap-vessels are capable of assuming a retrograde action; there is no apparent propelling force, and the leaves do not altogether raise the sap, for these rooting branches, or accessory stems, are leafless. The plant abounds with a tenacious milky juice, of which they make birdlime. There is a very peculiar circumstance appertaining to its bark, which in the old branches is particularly tough and strong, being used for rope and common string. It produces a small edible fig.

The island has some remarkably fine banana dells, presenting their vast spikes of fruit ready to supply the wants of man. The banana is more capable of being used as food than any other fruit, requiring no preparation or cooking. It is the esculent fruit of the tropics—to gather and to eat it is all that is required; it is wholesome, nutritious, and agreeable. The banana is very prolific, and has within itself powers of perpetuity; for while the parent stem is bearing fruit, young shoots are springing up around it to supply its place and give the earnest of another harvest. The old one withers as the fruit perfects, or is more commonly cut down to afford the young ones room. There is something elegant in the aspect of the banana—the brightness and delicacy of its large, broad, green leaf, rolled as a silken pennon, and sprouting up vertically, till it unfolds with gracefulness, and expands in purity to the dazzling light. The stem is moist, herbaceous, and succulent, in fine concentric rings. It is about seven or eight feet in height; its leaves are revolute, and form a shade for its own water-loving roots, or shelter for its tender young. The leaf is three or four feet in length, and one foot and a half broad, a pure, simple expansion, so delicately crimped and so divinely bright, that Eve might well be supposed to have taken it as an apron, and worn it with the pride of exultation for its simple and unrivalled beauty. From among the centre of its leaves the flower-stalk proceeds and bends downwards; it is very strong, and

two feet in length; bears semi-ringlets of flowers at intervals of five or six inches. The fruit is somewhat in aspect like a cucumber, of four or five inches in length by two in breadth; it has a green rind or skin, and contains a mealy, semi-farinaceous, sweetish pulp or mass, sufficiently cohesive to be cut: the fruit is rarely attacked by insects. The stem affords food for milch cows and goats; the leaves, as they are cast off, dry into a natural paper, and are used for wrapping small articles in. The whole plant abounds with gallic acid, and strikes a fine blue-black with salts of iron; the colour is extremely good, and might be used in conjunction with galls for dyeing. The merits of the banana as a food are great; it offers a simple and a wholesome diet in part, but to extol it so far beyond all others is undue praise.

The male flowers are pendent at the lower part of the spadix, and much below the females; they not only flower *last*, but also are in the most unfavourable position; but so amply has nature provided for the perpetuating of the plant, that seeds are not needed, by which means the fruit contains the greatest quantity of pulp available for the use and nutriment of man. By the numerous shoots from each root, there is a constant succession throughout the year, and every month has abundance of bananas. I have seen a spike of bananas of sixty pounds.

The animal kingdom is chiefly confined to rats and lizards. The little lizard is very beautifully coloured and elegantly formed. They peep out from every rock, and when you whistle, they seem attracted and even pleased with the noise, so that they approach you, and even come upon the stick you lay down. They are very difficult to catch, as they cast their tails at a particular joint. The lower eyelid is the only moveable one, and in the centre of the lid, or where it opposes itself to the pupil, it is transparent, forming an adventitious or palpebral cornea, which is as a little window to peep through, so that when the creature shuts

his eyes, he sees as perfectly as when the eyelid is not closed, which acts therefore as a complete protection from injury, without depriving him of the use of the organ. Its cornea is very small, the lens large, and almost spherical. The tongue is fleshy, leech-shaped, terminated by a tubular proboscis capable of taking up the smallest object. The external ear is large and open; the hearing is exceedingly good. The stomach is large and membranous, containing both seeds and insects. All parts of the heart appeared to act simultaneously.

The house lizard or gecko lævis, runs about the rooms, and along the joists and roofs, against the law of gravity. It is a repulsive looking creature, about three inches long. The tongue is long, fleshy, protrusile, terminating with a rough scabrous surface, and bedewed with a clammy moisture. Stomach, an inch in length, pylorus and duodenum stuffed with worms; bowels, in numerous annular contractions and dilatations; cæcum, an enormous dilatation and sac, nearly as big as the stomach. The heart very small; the auricle contracted after death, when the ventricle was quiescent. Its feet are lobated, toes lamellated beneath, transverse lamellæ parallel to each other, with a longitudinal furrow, bearing some resemblance to the structure on the head of the Echineis remora, or sucking fish. By this contrivance it walks down the walls, adhering to the surface by the vacuum between each lamellæ. The lamellæ, or plates, point obliquely forward, like the laths of a venetian blind, and while the edges are fixed, the base of each, which is connected with the sole of the foot, is drawn up, so that a vacuum is formed between them, by which it sticks to the roof or ceiling.

Of birds we have nothing particular to enumerate. Doves and linnets, with the gannets, and man-of-war-birds, form the chief part of the list. Nor are the insects more worthy of note, being few and unimportant, confined chiefly to lice,

fleas, bugs, musquitoes, moths, wasps, beetles, and crickets, those nightly revellers which make the air resound.

The shells are patellus, neritas, muscles, pectens, cones, the pearly and the strawberry trochus, and a hairy murex. Corals are few, but a serpuloid-marbled limestone is abundant. Sea-weeds are very scarce. I repeatedly found small clusters of spherical vesicles; they cast off apparently a small globule, by which they are perhaps continued. The vesicles are from the size of a pin's head to a hazel-nut, clustered together, containing a clear transparent saline liquor, with fine bright green atoms or minute particles: whether the globe bursts like an hydatid, and discharges this dust, which in its turn becomes similar vesicles, I cannot say; neither, whether it is a vegetable or an animal product. There was a little sea-weed in the pools which had the aspect of a land-plant, leaves linear, pinnate, an inch in length, and of a very bright green. The sea furnishes these with the chief part of their subsistence, and there is considerable variety of fish about the island.

The soldier fish is the most esteemed; there are abundance of sardinias, cavalloes, congers, &c. The cyclopterus lumpus, or a sucking-fish, adhering by its ventral fins. The most remarkable one which I noticed was the following, trigla volitans. Length, four inches; head, broad and flat, over the orbits, two inches; broadest part of the body, one inch and three quarters, gradually tapering towards the tail; the under surface of the body and belly is flat-bottomed, and about two inches; pectoral fins, nine inches in length by six in breadth when expanded. The pectoral fins extend to the commencement of the tail; they are of a slimy membrane, like eel-skin, the rays of the fins ending in curved flexible nails. Appended to these large pectoral fins are a pair of supernumerary ones: they are superior or dorsal to the larger; they have five bony rays, terminating in still more remarkable nail-like processes; these supernumerary pectoral

fins are three inches in length, they have the same slimy web. Two dorsal fins: anterior dorsal two inches and a quarter in length; the posterior dorsal three inches in extent, with eight bony spiny rays erect: two ventral fins, immediately under the pectoral; they are slightly digitated and nailed. The anal fin, two inches in length, and six rayed; tail, two inches, with the same slimy web. The fish is rigid, stiff, incased in a thick tough skin; the scales rough and harsh, divided by longitudinal ridges on the back and upper parts of the body, so as to form channels. The base of the tail has on each side two obliquely converging scales, which must tend very much to contract the current of water, and give it velocity, and especially as the lower ledge of scales on the body, as they approach the tail, are much enlarged, and give the direction to the water, by which it is probable the power of the tail is much increased without augmentation of size. The head of the fish is hard, bony, and scabrous; eyes large, well protected by the projecting margin of the upper ledge of the orbit; gill-flap, small; on the upper part of the back, between the anterior dorsal and the pectoral fin, is a bony spiny ridge; while from the lower jaw there runs backward a sharp, strong, bony spine, an inch in length, and projecting between the pectoral and ventral fins. The internal structure had nothing very particular; the stomach small and contracted; numerous appendices pyloricæ; intestines short, no food in the stomach or intestines; air bladder of a moderate size. The colour of the pectoral fins of an olive green, richly varied with bright blue spots, while the tail is of a pale violet. The structure and build of the fish is very remarkable, its general conformation is like that of the flying fish; its flat bottom and large pectoral fins, keep it towards the surface, and adapt it for flying. But of what use are its nail-like processes? the strong elastic webbed fins seem to have some other purpose in view.

The mean of the barometer is about 30 inches, the range from 29·63 to 30·21. The highest barometer is at night.

Low barometer in the day. The diurnal range is very regular. A heavy fall of rain for the day causes no alteration in the barometer. Neither is there any alteration in the course of the wind, nor abatement of its force during several days' protracted rain; but a steady trade blows fresh and strong. What is the cause of the rain? The mean temperature about 80°. The observed range during our stay, from 75 to 81.

Temperature of air at sun-rise	75°	dew point	72°.
Noon	80	do.	74.
Sun-set	77	do.	73.

CLIMATE AND SEASONS OF PARA.

Situated immediately beneath the equator, the climate is hot and sultry; the thermometer averaging throughout the day, from 84 to 89°, in the shade; and at night occasionally falling as low as 75°; with very heavy and copious dews, especially upon the river, wetting the boats as if a shower of rain had occurred. The river water is warm, generally 84°; as the air cools in the evening, it chills the surface of the water; and in doing so, it emits steam or aqueous vapour into the cool atmosphere. Thus the fog, or mist, arises from the warm water of the river, and is not a deposit of dew from the atmosphere upon a surface cooled by radiation. Precisely similar to what occurs in the colder regions of the north, when water is rapidly losing its temperature, previous to freezing, it smokes with steam, and emits a vast volume of vapour, not a drop being deposited on the land. And it is to this that we must refer the mists and fogs, *rising* from the warm valleys, often before sun-set, and not ascribe them to the deposit of dew from the atmosphere. A cup of tepid water of 84° emits steam into the air while cooling, and a little fog bank forms over it.

There is no difference of temperature throughout the year; the mean is 84°. There are two seasons, the wet and dry. The wet, or rainy season, commences in the latter end of December, and continues until July, raining more or less, every day, for many hours, without intermission. The air is sultry and oppressive, with light variable winds, the most awful thunder and lightning, violent squalls of wind occasionally from different points of the compass, and tremendous heavy rain. I should think there is not much less than an inch of rain per day, during the wet season; and that we cannot estimate the annual quantity under 80 inches. Ships are often detained several months; not being able to take in their cargo. It generally begins to rain about eleven o'clock in the forenoon, and continues until nine or ten at night. The early part of the morning from midnight is mostly fine. The thunder-storms take place most frequently in the afternoon about two or three o'clock. The same circumstance occurs at Rio, &c. Has it any connexion with the horary oscillation of the barometer? Is there a coincidence with the period of the low barometer? I think there naturally is a dependence, as cause and effect. This view affords a solution of phenomena; and as a fact, is confirmatory of the accuracy of the observations of the horary oscillation, the minimum in the tropics being about two or three P. M. The period of the hour of the storms is not confined to this place, but occurs at many others. The country is flooded in many parts during the rainy season.

Amid the many speculations that have taken place upon the deluge, and the cavils it has met with, no one has reverted to the vast store of concrete water lodged on the mountains of the globe. Who can calculate the depth or extent of the tremendous piles of snow and ice, resting on the mountains! The Andes and the Himalaya mountains must have a prodigious quantity of this. If an avalanche overwhelms a village and floods the plains, what would the

liquefaction of all the snow and ice, even now upon the face of the globe, effect! It would sweep us puny mortals from the world! Thousands and tens of thousands of miles of snow, loosened from their barriers, would overwhelm the earth. And who knows, whether there was not a thousand times the present quantity in antecedent periods?

In all these vague and visionary surmises I have no faith; nor do I ever wish to pretend to discern how God fashioned the world, or let my imagination dwell for a moment as to the means he had to mould it at his will,—or to modify or annihilate it at his pleasure, knowing that all things are possible with God; and that our conjectures upon these points are vain, and partake of man's natural imbecility. With reluctance I presume to adduce hints of natural causes, not perhaps heeded, but yet important; and multitudes of instances might be brought forward to show the speculators how many points and contingencies enter into the hypothesis, which is truly but the baseless fabric of a vision.

The dry season at Para is from July to December. During this period rain is a frequent occurrence, and thunderstorms likewise in the afternoon. This is the windy season, it blowing fresh from the north-east during the day, with a light breeze only in the evening. Lightning is frequent in the horizon every night.

When we anchored at Para, I thought, from the appearances of the banks of the river, from the swamps, the long line of muddy beaches, and the masses of filth, that serious disease might justly be apprehended: such however, happily, was not the case, for during our stay of five weeks we had little or no fever. I was not the only individual who viewed our situation with some degree of alarm; for those officers who had been in Africa exclaimed, "Here we are in the centre of yellow fever!" This is precisely like the worst pestilential spots of Africa; woods and swamps there could not be more, and half-dry banks of mud; in fact,

every requisite detailed by authors as the exciting causes of disease were here in abundance. And let it not be set down to cleanliness in the ships, or care or good management, for we had near us a Brazilian prison-ship crowded and filthy in the extreme, yet they had no disease more than ourselves; and in the canoes they are huddled together, and sleep in the very hot-bed of malaria, yet they are healthy. We talk of imponderable fluids, but miasma is uncognizable, and the volumes that have been written on it leave the subject in obscurity. *It is in the air*, the common people say, and we know no more, and there are local peculiarities in it which we cannot unravel. There is something superadded in certain places—an unfavourable constitution of the air, which renders diseases endemic;—it is a very fortunate exemption for this place, and Para must, for the torrid zone, be regarded as healthy. Intermittent fevers or agues attack new-comers, and higher up the river they are more common. Those employed in the gathering of the sarsaparilla are very frequently attacked with fever, and numbers of the natives die of it. Dysentery, tetanus, and the diseases mentioned as prevailing at Maranham, are common here. The small-pox in 1825 is said to have killed five thousand people, and to have proved the most destructive scourge they ever witnessed. Hydrophobia is almost unknown.

The botanical productions of this place would require volumes to detail; I can only cull a few, and my observations are scanty, for I was confined to the ship by some very large and troublesome boils on my thighs; so that the short time I had to ramble in the vicinity of the city afforded me very little insight into the riches of the vast storehouse of Nature. The spontaneous gifts of Nature here almost supply the wants of man; no one with the least degree of industry can be deficient of the necessaries and the comforts of life. They have an abundance of fuel—an inexhaustible supply

of timber of the very best quality. They have rice and Indian corn, and the favourite mandioc root, which supplies them with flour and tapioca; bananas, plantains, and yams; cotton and dyes for their garments; abundance of nutritious and wholesome fruits; coffee, cocoa, and sugar; a variety of oils for light as well as for domestic purposes; all the spices and aromatics man can need; a catalogue of drugs and medicines; cordage and twine in any required quantity; barks for tanning, gums and resins, and some of the most delicate and admired scents. The calabash furnishes them with many utensils; the palms, with thatching, mats, and baskets.

The palms are among the most conspicuous and useful of the vegetable kingdom. One, with a slight and slender stem of most delicate proportions, bends its clusters of minutely pinnated leaves like the weeping willow; another, more rough and stately, spreads its groups of stiff flabelliform leaves; while others are loaded with spikes of rich, orange-coloured, imbricated drupas. There is the slender and slim areca tenuis, the acrocomia fusiformis, and the Mauritia palms, of diversified habits and aspects; the eti, an unknown genus, whose spathe makes a perfect nightcap, and its fruit is a double-headed drupa; the elais occidentale, the Mauritia flexuosa, the caryota urens, and a multitude of others. There is a very lofty areca, one hundred and thirty feet in height. The palms afford them food and drink; for the pith of some produces a sago-like substance, and the pericarp of several yields a pleasant beverage. The leaves afford cover for their houses, and materials for hats and baskets; some yield them oil, and the trunks of others form canoes and boats.

Fruits.—Several varieties of the most exquisite pine-apples; oranges remarkably fine and large, the peel acrid and hot, the juice of a rich flavour; the skins are very thick, and contain a large quantity of oil. Limes; sweet

lemons (passiflora); custard apples; cherimoyas; alligator-pears of an immense size (laurus Persea); the grenadilla and the murucuja, both the fruits of passiflora; tamarinds; guavas; the genipa (gardenia); cocoa-nuts, and several of the palm drupas; papaws; the fruit of the myrtus pedunculata, and other species; the maronobea esculenta; the Cashew apple; superb melons; mangoes in profusion, especially the peach-mango; several species of the achras, called sapotas by the inhabitants; the abricot, a stately tree, bearing a large drupa, three inches in diameter, having the flavour of an apricot; the bacuri; the averrhoas; the soft pulpy ingas; the rose-apple (eugenia jambos); the bread-fruit and jacks; figs; sapodillas; the abiu, fruit the size of an apple, with a rich pulp; macoubea (solanum Peruviana), used for tarts, and as good as immature apples. They have a small crop of grapes three times a year.

Their vegetables are—cabbages; a variety of beans; yams of several kinds, purple and white, large, mealy, and nearly as good as a potato; pumpkins; cucumbers; lettuce; chilis; tomatas, and the egg-apple. Solanum melongena is boiled, and esteemed as a very delicious vegetable, having the flavour of an artichoke; the ochra, or hibiscus esculentus, is put in all their soups. They have also the cassada root.

Para is exceedingly rich in oils. I noticed the following, and doubtless many others are to be procured:—1. They have the turtle-oil, procured from the fat of the turtle; it is brought down in jars, and is used for frying, and other culinary purposes. Six thousand jars, of seven gallons each, are annually received at Para. The turtle frequent the upper part of the river in immense numbers. 2. The azeite mammona, or castor-oil, for lamps, and common lamp-oil. 3. The oil or butter of Cacao (theobroma) is a solid concrete fat, not easily becoming rancid; it is kept in the apothecaries' shops, and is used in the manufacture of soap. 4. The oil of Patacia, a fine sweet oil resembling olive-oil, procured

from the pericarp of a palm drupa by expression. 5. The bacova, a species of palm-oil. 6. The common cocoa-nut oil. 7. The oil of Anderoba, procured from the Carapa Guaroides, a fine lamp-oil, and used likewise in the manufacture of soap. Each of these oils is very abundant, and might be procured to any extent at a very cheap rate, so that there is no fear of deficiency of oil for any purpose; and they might be made an object of commercial importance.

They have an immense variety of timber trees; wood for every purpose man can require it, from the soft cork-wood of the ochroma sayopus, to the dense hard iron wood. The cedrela odorata is the soft cedar wood, very handsomely veined; the white cedar, or bignonia leucoxylon, the balsam copaiva tree, affords good timber. They have excellent woods for ship-building, equivalent to the teak of India. The country produces ornamental woods of every hue, rose wood, satin wood, yellow wood, black ebony, &c.

Of dyes, they have indigo, annotta, crajaru, or the juice of a plant (bignonia) formed into cakes of a bright red. It is prepared by the Indians, and is a capital and very durable oil colour. The amomum sylvestris yields a blue.

Among the spices and aromatics, they have turmeric, ginger, black pepper, cayenne, native nutmeg, laurus cinnamomoides; it is a very agreeable aromatic, but inferior in strength to the true nutmeg. The clove bark (the bark of a tree) with precisely the flavour of cloves, and used as such, and sold for cloves in the shops; some aromatic amomums; they have several species of pepper, piper amalayo, and ginger pepper. They have laurels, cinnamon, cloves, and allspice cultivated for sale. The tobacco is reported to be the genuine Orinoco.

The medicinal plants and drugs are, sarsaparilla, balsam copaiva, tonquin beans (dipteryx odorata), vanilla annotta, gum copal (from hymenea corberil) of a spurious quality, gum caju or the gum of anacardium, or cashew apple: it is

not perfectly soluble in water, it is sold at 2*d.* per lb. The pod of the cassia fistularis, and the leaves of several of the cassias, are as good as senna. The portlandia hexandria is a very excellent febrifuge; it is emetic and cathartic in the first instance, the secondary effects a strong tonic; it is very bitter. The mirabilis jalapa, or the jalap of the country; the quassia excelsa. The sarsaparilla is chiefly exported to Lisbon, and thence to London; it is neatly done up in large rolls or bundles. The West Indian sarsaparilla is largely adulterated with the roots of agave vivipara. The balsam copaiva is sent home in casks, and is sold at a dollar a gallon; it is esteemed a capital vermifuge in large doses, and is sometimes used to mix paint with: it gives the work the appearance of being varnished. The seeds are large and black, and are kept in the apothecaries' shops as an astringent; they contain a quantity of sweet oil, and some prussic acid. The tree is very large and lofty, and is used for timber.

The tonquin beans are procured in vast quantities in the woods; when kept long, a quantity of white crystals, to the extent of several pounds, may be brushed from them; they are said by Dr. Paris to be benzoic acid. I had a friend here who had a bushel of the crystals, which he threw away. The tonquin beans yield, by distillation with spirits or with water, an odorous essential oil; but by expression, a sweet oil like that of almonds. A tincture of tonquin beans is very fragrant.

The vanilla perfumes the woods, and creeps up the trees like a large and elegant-leaved ivy. The pod is eight inches long, and two-thirds of an inch in diameter, of a triangular form, and filled with numerous minute granular seeds; the recent pod abounds with mucilage. The scent is extremely agreeable, and the ladies place a little beneath their hair, which diffuses a delightful aroma in the ball-room. It is used to enhance the flavour of chocolate, and is much

esteemed by the Italians and Turks. We have lately imparted its flavour to a liqueur.

There are three species of annotta here, the smooth, the rough capsule, and the small; bixa glabra, bixa echinata, and bixa parva. The bixa glabra, or smooth-capsuled, produces the best colouring material; it is the envelope or material surrounding the seed; it is washed off, allowed to settle, collected, and dried for exportation. They are favourite trees with the inhabitants, and the blossom resembles that of a peach. The roots of the tree are an excellent dye.

The mirabilis jalapa is very common here; it is a weaker purgative than jalap; from its large roots a starch or fecula is prepared, which is used as a mild laxative for infants, being made the same as arrow-root or panada; it has scarcely any flavour. The seeds of the mirabilis consist almost entirely of pure and delicate starch, and so white as to be used by the ladies to powder their faces with, in order to borrow its delicate lustre.

The galega toxicaria, and the piscidia erythrina, are used by the natives to intoxicate fish with: the bruised roots of the galega are poisonous, and with them the slaves are in the habit of killing themselves when offended by their masters. The plumerias are handsome and fragrant flowers. The cerbera ahovai, and thevetia, are common; the dried capsular husks of the latter are used by the Indians as knee-bells in dancing. The tatermomtana laurifolia has a powerful scent, like the syringa; the bombax, or silk cotton trees, are lofty ornaments of the wood, as are the ingas, the stately geoffria inermis, the carolineas, the handsome sickingia, beautiful acacias of the most lovely foliage, broad-leaved cecropias, the hura crepitans with its majestic spread, and the erythrina exaltata with its splendid show of flowers.

Among the useful and curious products of the place, the siphonia elastica cahuchuc must not be forgotten. It is the

tree which produces the elastic gum; it is among the largest trees of the forest, and yields an abundance of milky juice, which rapidly concretes into the well-known substance called India rubber, one of the most singular products of the vegetable kingdom. It abounds to such a degree in this province, as to be one of the staple articles of commerce. Para is the great emporium of it for the supply of all Europe. Shoes are made of it on a last, and smoke-dried; they are elastic, grasping the foot equally in all parts, and are perfectly water-proof, and form excellent galoches and snow-shoes; they are sold here at 1*s.* 4*d.* per pair; when a hole is cut in them, they may be mended by the application of very hot water, which causes them to unite again. They make all sorts of grotesque figures, as men on horseback, birds, &c. The immense bladders, big enough almost for a balloon, are very curious; they are thinner than a common bladder, and quite transparent: they likewise make balls of it; and Captain Foster had a boarding-cap made of it. The India rubber cloth, which they manufacture here, is merely a piece of linen coated on each side with the milk; it is very strong and durable. Soon after the juice is drawn from the tree, it separates into two parts; the solid coagulum, and an unpleasant stinking watery liquor. How very analogous this is to the separation of the blood into serum and crassamentum! This is the white blood of the tree, and the same reasoning that has been employed on the coagulation of the blood, may be equally applied to the concretion or coagulation of the cahuchuc; and whatever distinctions we may make between animal and vegetable substances, the constituent principles of this material show they are rather fallacious. We have heard a great deal about the fibrin of the papaw juice resembling animal matter; but I think we shall find a greater approximation to animal principles in the milky juice of the cahuchuc. I never recognised the fibrin in the papaw, though I have repeatedly tried the recent juice.

They have many of the passion-flowers, which are peculiarly elegant, and convolvuluses grand and magnificent, and splendid ipomæas; while the interesting sensitive plants attract your attention by the action of their leaves. But the most delicate of all is the mimosa viva; it is minute and humble, but tremblingly alive to the least touch: thus humility has oftentimes the greatest sensibility. Can we divine the purpose of this action?—I neither see the object nor the mode of its motion, though I have sat watching and cogitating by them for a long time; it is the instinct of the plant. The mimosa pudica is a very common bush, and its prickles blister the tongues of the cattle, and prevent them from eating; its modesty is not to be so roughly treated without its resenting the attack, and those who do not observe its sensitiveness must feel the rebuke for their rudeness. The cassias are very numerous, and the pods of the cassia grandis are three feet in length, and hard and strong enough for a sword-case. The dolichos has many species, some of which have very showy flowers. Of the dolichos purpureus the beans are eaten, while of the dolichos urens the seeds are poisonous; and a poisonous or very deleterious property belongs to many of the leguminous plants, as more than one of the cytisuses, the galeya, &c.; while, on the contrary, the extensive genus of solanums, formerly stigmatised as deleterious and noxious, contains several pleasant and wholesome fruits. I do not allude to the invaluable potato, but to the berries of the solanum. The solanum melongena is esteemed a delicious vegetable, as well as the tomata, and the fruit of the peruvianum makes as good tarts as apples; other species likewise yield agreeable fruits. The solanums are particularly numerous here; the genus affords some useful medicines, more worthy of notice than they at present obtain.

The bignonias are abundant, and among them one could not but admire the extraordinary capsule of the bignonia

echinata, so much like a roughened shagreen case for jewels, for which purpose it is used sometimes by the ladies, the interior is so nicely wadded and lined; and we might enumerate a long list of vegetable productions, but shall close the account with one or two. The bertholletia excelsa is a lofty spreading tree of rather an elegant aspect, producing an amazing hard, round, woody capsule, three inches in diameter; it is very heavy and solid, requiring the powerful blow of a sledge-hammer to break it: it seems like a large hand-grenade, and in falling from the tree would break a person's head. The Indians are afraid of walking under them. It contains a number of angular nuts, well known in the London markets as the Brazil nut. The bark of this tree is stripped off in large masses, and beaten out into flakes, and used as oakum and hemp for the caulking of ships.

The lecythis ollaris, or pot-tree, is another singular example; it produces a capsule or seed-vessel, so exactly resembling an old rusty iron pot with a lid, that it might pass for one from Herculaneum. The lid of this drops off and lets the seeds out. The nuts of this tree are oblong, grooved, and esteemed of a very superior quality to the preceding kind: they are sent as a present from the interior. The pot-like capsule is used for water, and is thought to be good for the gravel; the nuts are called sapo cayos.

The carapa guareoides, or anderaba, is a large tree sixty feet in height, branching irregularly: leaves of a bright shining green, smooth, often beautifully variegated with waved lines; flowers small, pale, and inconspicuous, one-twelfth of an inch in size, borne on slender flexile twigs. The capsule is nearly two inches in diameter, of a deep brown colour, four-sided, knobbed, tuberculated, four-celled, each cell containing several large unequal-sized nuts or seeds of a deep brown. The substance of the perisperm or nut is white, firm, and not apparently dicotyledonous; the corculum small, situated at the apex, of a dull flesh-colour.

The taste of the seed is nauseous and bitter, with a sub-astringency. The bark of the tree is strong and fibrous, and capable of making rope; an infusion of it with salts of iron strikes a good black: it likewise contains tannin. The tree itself makes good masts or timber. The exterior of the capsule is covered with a gummy exudation. The seeds yield, by grating, a quantity of starch or fecula; but the chief use of the plant is the oil yielded by the seeds. The seeds are put into warm water to steep, to separate the husk; they are then beaten into a paste, and made into balls, and exposed to the sun on an inclined plane, the oil exudes and runs into a trough. After having undergone this process, they are boiled with water, to extract any remaining portion: that which is obtained by the heat of the sun is the best—the other is coarse and mucilaginous. The oil is very bitter and stimulating; it is used as a dressing for cattle, and is said to be equal, if not superior, to the Macassar, or any other known oil, for making the hair grow. It is the common and general lamp-oil of the country, and is used in the manufactory of soap: it is a good remedy for the itch. The properties of the oil deserve investigation, and the plant merits attention from the union of so many rare qualities.

Many of the trees of the forests of this province yield a milky juice; the figs especially, and they are numerous: but there are many others of more suspicious characters, and it behoves a person to be cautious in tasting them without some judgment or knowledge of their properties. There is, however, one among them with which you may make free, and refresh yourself with as fine a bowl of milk as that from a cow—the vaccodendron lactifera, the milk-bearing cow-tree, I presume to call it, from its extraordinary property of yielding milk; the Portuguese and natives call it masaranduba. The tree is among the loftiest in the forest, and one hundred feet and upwards in height. The bark is of a brownish colour; the leaf large and ovate. The tree

flowers in February, and it produces a delicious edible fruit, like strawberries and cream. The fruit is perfected in April, and contains from two to four seeds. I have to regret that the period of our being at Para was not the season of its flowering or of its fruit. I obtained abundance of the milk, through the kindness and politeness of my amiable friend, Mr. Hesketh, the vice-consul, whose lady gave me intimation of the tree. It seems rather startling to talk of a tree yielding milk; but such is the fact, and it is drunk by the people in large quantities, and was used by us at the gun-room table, for mixing with tea, in lieu of cow's milk, from which it is no ways distinguishable in general use. The milk is a rich, white, bland fluid, without odour, and of the taste and flavour of common milk. It mixes readily with tea or coffee, without curdling or undergoing any change, and in every respect seems like cow's milk. Boiling water does not alter it. It keeps unaltered six or seven days in the temperature of 85°. In fourteen days it evolved a sour odour, but had not coagulated; a gummy pellicle adhered to the cork. Some vinegar was added to the recent milk without producing any immediate change; in forty-eight hours it acquired an unpleasant odour. Bicarbonate of soda thickened it a little, and in forty-eight hours produced a separation into a watery and creamy mass, the latter on the surface—quantities about equal. A spirituous solution of bichloride of mercury thickened it a little, and seemed to produce a pellicle of gummy matter. Sulphate of iron thickened it and discoloured it slightly. The diluted sulphuric acid produced no immediate effect. It appears to differ from all the known milky juices of plants, and to approach in obvious properties to animal milk, from which it differs widely in chemical composition. There is no cream or caseous matter. I kept a bottle of the milk until our arrival at Trinidad, eight weeks after my procuring it, when it was sent to the Admiralty. Some which I had myself had then

separated into a sourish milky water and a white solid mass, which, when taken out and dried in the air, was a white inflammable substance, not softening at the temperature of the body, melting at 143°, tasteless, insoluble in water or spirits, and resembling white wax more than any other substance to which I could compare it. It burnt with a bright and agreeable flame, without smell, and was neither greasy nor resinous; I am therefore inclined to consider it as a species of wax. I particularly requested Mr. Hesketh to send the flower, fruit, and seeds home as soon as he could procure them. It is right, perhaps, here to notice what Humboldt has said of the cow-tree in the fourth volume of his Personal Narrative, which is:—

"On the barren flank of a rock grows a tree with coriaceous and dry leaves: the large woody roots can scarcely penetrate into the stone. For several months of the year not a single shower moistens its foliage. The branches dead and dried; but when the trunk is pierced, there flows from it a sweet and nourishing milk. It is at the rising of the sun this vegetable fountain is most abundant; the blacks and natives are then seen hastening from all quarters, with large bowls to receive the milk, which grows yellow and thickens at its surface." He calls it, the arbol de leche, palo de vaco, or cow-tree; and says it prevails along the Cordillera of the coast, from Barvula to Maracaybo, and is to be found at San Mateo.

Sir Ralph Woodford, the intelligent governor of Trinidad, sent his botanist Mr. Lockhart, a very able and practical man, to the Caraccas to bring away specimens of the milk-tree, which Humboldt described as being found in the Sitta mountains; but Sir Ralph failed in obtaining any. And Sir Robert Kerr Porter, our Consul General at Caraccas, has since made a diligent search on the same spot with no better success. However, he says it may be seen beyond Valencia.

Thus far is stated about Humboldt's palo de vaco, or cow-

tree; and it is evident that there is no accordance between our accounts, and that we cannot be describing the same tree. There may be, therefore, two different genera: and I have therefore denominated the one at Para the vaccodendron lactifera. I forgot to mention in my account of it, that this tree affords the most valuable timber for ship-building, and that the massaranduba is used in the dock-yard at Para.

Some have conjectured, that the milk-tree might belong to the order laurinæ; but analogy does not sanction this supposition, but rather associates it with the achras, as an allied genus, especially to the achras caimito, from which a rich milky liquor exudes in small quantities. The fruit of the caimito is at first green, round when ripe, of a deep purple, and abounding with a luscious cream. The milk of the caimito is in very small quantity, concretes into a gum resin, elastic and inflammable. This is the nearest resemblance, I know of, to the milk-bearing cow-tree.

The fruit of the laurus persea, or alligator pear, is extremely large and fine at Para. It forms part of the subsistence of the people. It is a fruit altogether *sui generis*, without resemblance to any other. It is delicious with a little sugar, or with pepper and salt. It may be eaten as butter, and is sometimes called "Subaltern's butter;" or as a fine fruit, or as a vegetable with cold meat. When boiled it is truly vegetable marrow. The large fleshy perisperm, or seed, is well known to contain a substantive colour, and linen is often marked with it. It is extremely durable, and resembles marking ink. The seed is a stimulant, but without flavour. In spirit it acquires a fragrant and aromatic odour. It communicates its colouring principle to water, and might be employed in dyeing, as a mordant perhaps.

The maranta, or arrow-root genus, affords several edible roots: the maranta comosa and capitata have tuberous roots, which are boiled by the natives; and the leaves of several

produce a small quantity of fecula or starch, a very unusual circumstance, and I believe without a known parallel.

The canna lambestina yields a very good arrow root, or starch. The roots of the alstroemeria multiflora are the size of walnuts, and are taken up and eaten by the Indians.

The country abounds with wild animals, monkeys, snakes, and lizards; in fact, every department of nature is rich in the extreme, and a thousand interesting subjects might be selected.

The vampires, or vespertilio spectrums, fly about at night in considerable quantities, to the great annoyance of those who may be desirous of sleeping with their windows open. The body is about twice the size of a mouse, or seven or eight inches in length, covered with fine hair, ugly contracted face, small eyes, very large erect ears, with a subulate membranaceous flap, and very sharp-pointed incisor teeth in each jaw. The lips are large and fleshy, projecting considerably over the teeth, and forming a labial sac or pouch; the extent of wing membranes nearly two feet; tongue pointed, terminated with prickles, and beset with sharp papillæ directed backwards.

The bat tribe afford the most remarkable exception to the class of quadrupeds in the structure of their extremities, though some conformity is still retained in the bones. In accommodating a quadruped with wings, greater deviation takes place than in converting the extremities into flippers for swimming with, as in seals. There is but a remote analogy in the wings of a bat to the feet of quadrupeds. We cannot but admire the beautiful mechanical disposition in these alipedes: the extent of wing — the lightness of the bones — the peculiarity of motion — the articulation of the shoulder — the extraordinary absence of muscles in the wing — the angle of elevation the most favourable for raising it, and giving effect to its action on the

air — the compound action of the wing, not only by the reciprocating stroke, but by its semi-folding motion, which propels it forward. The connexion or union of the upper and lower extremities by the wing membrane, is an unique character, remote from all other animals whatever. There are no muscles attached to the fingers, or metacarpal bones; it is therefore probable that the web of the wing is a fine muscular expansion, in part possessing the power of contraction, and that it is liberally supplied with nerves and vessels. The mechanical structure of the folding of the wings is worthy of observation. If a man would fly, let him regard the bat's wings, and calculate the proportions between himself and a bat; and then he will be able to have some idea of the quantity of wing necessary for his aërial voyage, which would require five or six hundred square feet of wing ; a tolerable proportion to stow away.

However reluctant and sceptical some naturalists may be to admit the blood-sucking powers of the vampire bats, no doubt can exist upon the subject in these countries. It is not an uncommon thing to find your toe or foot tapped, and the bed very much stained with blood, and a vampire in the room: shut the windows and keep them out, and you lose no blood. They do it very quietly and dexterously, so that a person is rarely disturbed by it; and in the morning you see a redness about the part, and the skin somewhat abraded. But some have affected to deny it, on the ground of the structure of the animal not adapting it for such an operation. For my own part, I see every thing well adapted for the purpose; he scarifies you very gently with his tongue; and the retroverted spines or knobs, or papillæ, are peculiarly suited to this; because as he applies his tongue, he keeps hold of the part by this very means, and they gently drag the orifices open, and the labial pouches enable him to suck extremely well; and I believe this is all that is necessary for the perfect art of cupping. He is not a phle-

botomist so much as a dexterous cupper. The cattle, especially the horses, are very much distressed by these nocturnal visitors, and many are killed by them; they take half a pint of blood at a time. The vampires hook themselves on to a bough, and embrace their young in the folds of their wings and suckle them — thus the young are cradled in their wings as in a hammock the most perfect and secure.

The whip-tailed guano is a large lizard; its body eighteen inches in length, its tail three feet, tapering to a point, banded. It has a spinous dorsal crest, and a gular pouch. It has five toes on each foot, armed with long nails; teeth numerous, small serræ, colour of the body ash grey, frequently variegated, and exhibiting sometimes a slight change of colour like the chameleon. He has great tenacity of life, and is very difficult to kill even when embowelled: a strong convulsive action of the muscles of the anterior extremity occurs from touching the axillary plexus of nerves with a scalpel. The heart beats for many hours after its removal from the body; the auricles acting more powerfully and frequently than the ventricle; the action of the heart not depending upon the stimulus of the blood, since none was transmitted nor none received. The heart consists of two auricles and of one ventricle, with a movable cartilaginous septum, as in the turtle, making two cells of the ventricle. Some of the trunks, arising from the heart, had evident muscular, or contractile power. The trachea is small, and terminates immediately in the upper part of the lungs. There are no bronchial cells, or tracheal ramifications. The lungs are situated in the abdomen—are of a bright vermilion colour; they are three inches by one, tied by serous membrane to the vertebral column. They admit of amazing dilatation, to four or five times the ordinary size. The lungs are of a very singular structure, having no fleshy substance or parenchyma; they are hollow bladders into which the windpipe opens; on the interior surface of this bladder the

pulmonary vessels ramify. The upper part of the lungs is somewhat cellular; but more than half of the lower part is only a delicate membranous bladder, so that there are no bronchial or air cells. Here is a demonstrative proof that the contact of air alone is sufficient for oxygenation, precisely the same as in Priestley's Experiments of blood being exposed in a moistened bladder to the influence of atmospheric air. Here is an amazing resiliency of the lungs. The lungs are a reservoir or storehouse of air, which it can ruminate at pleasure. The lungs are very closely united together, but do not communicate with each other. The œsophagus is three inches long, plaited and rugose internally. Stomach two inches by two-thirds, curved, simple mucous membrane internally. I found grass, &c. in it. The pyloric orifice is marked by a sudden transition of structure; the duodenum being a thick-coated intestine with a deep brown granulated tunic. The duodenum terminates at right angles in the cæcum, which is a capacious pouch larger than the stomach, celled and banded internally. The cæcum ends in the rectum, which contains pellets of herbaceous fæces. The liver large, of a deep blue colour; spleen very small. I observed no lymphatic or mesenteric glands; brain small, size of a cherry. In opening the abdomen, the first thing that presents itself is the vast chain of eggs, distending the oviducts on each side. There are thirty-six or forty eggs in general — the larger ones an inch in length, covered with a soft membranous skin. The egg contains no white or albumen; but a thick tenacious yolk of yellow colour, and minutely granular. I was surprised to find that each of the eggs contained a fœtus or embryo guano; the heart of it was beating strongly—it was embedded in a matrix or placental mass, and a beautiful zone of vessels was displayed. In all the females of this species which I could obtain, the eggs were uniformly the same, and contained a live young one. It is therefore ovoviviparous; how long it

is retained I know not, nor what period elapses between the extrusion of the ovum and the birth of the young one: our stay was too short, and my opportunities too limited, to admit of this. I have stated, when noticing the chameleon at the Cape, that it was believed to be viviparous. This is contrary to the general remarks of authors. I have some doubt upon the chameleon, not having witnessed it myself: but there are so many anomalies in the herpetology, that we should be cautious in deciding upon them. The circumstance of the guano being ovoviviparous, or bringing forth live eggs, completely annuls the discovery of some learned naturalists respecting the impregnation of the egg.

The guano, by its hideous and extraordinary aspect, with crested back and throat, and inflated gular pouch, intimidates people, and leads them to suppose it to be a venomous creature; but it is so harmless, that its very ugliness is a boon —it is as timid as a hare. It is liable to be attacked sometimes by snakes, and a battle takes place between them. The guano lashes on to the snake with his long tail, and skips aside in a moment to return again with another lash. He evades the snake, and oftentimes kills him; but the snake is occasionally successful in twisting himself round his adversary. The guano is an esteemed article of food, and the eggs particularly so, with the Spaniards; insomuch that they even open the abdomen and cut out the oviducts with the chain of eggs, and let the animal go again, in the hopes of catching him again next year, for nature repairs the injury. The eggs are boiled hard, and kept in the oviducts, and hung up in the houses: they keep some time. These animals have, it is well known, great powers of restoring injuries, as in renewing their tails when taken off by injury.

The river banks are infested with alligators, the crocodilus lucius, and sclerops. The Island of Marajo is their rendezvous. They lay their eggs in the sand; they are the size of a goose egg, rough and scabrous. We procured one

alive; it was three feet in length—its breadth about six inches, of a lizard-like form and structure, with a tail eighteen inches in length. Its body is covered with scales; it has a low, flat, compressed head, long eked jaws of a most capacious gape and magnitude, both jaws equally movable and free. The very external edges or margins of the jaws are armed with a row of saw-like teeth, which, when he shuts his mouth, appear on the outside, and which dovetail mutually into each other. The creature's feet are palmated, the fore-feet having five toes and nails; the hinder feet larger and more webbed. The tail is vertical, and acts as a rudder and a propelling force in the water. The skin is of a dusky grey, with black spots, but delicately white below. The eyes are sunken and lurid; and it has a nictitating membrane, which it sweeps repeatedly over the cornea. The ear is very remarkable; it is a longitudinal slit or aperture; it has a curved stiff flap on its upper edge. The nostril is at the apex of the jaw, and has two little fleshy processes. It has no vestige of a tongue: the internal membrane of the mouth is like soft chamois-leather, and appears to be a reflection of the cuticle. The lower jaw has a faucial membrane stretched across it by which it closes the œsophagus. About the upper part of the fauces are some yellow glands, with a viscid secretion. The larynx lies immediately behind the fauces. The heart has a strong pericardium, and they are tied to each other by strong tendinous cords at the apex. The stomach contained nothing but stones and sand; cardia and pylorus both in the upper part, and contiguous. There is no division of the intestines into large and small; they are the size of a common quill, very thick-coated, and about one yard in length. The cæcum contained scybala, and concreted sabulous matter, without any odour. The liver was large, and in two very distinct lobes, scarcely connected by a very narrow shred. The articulation and conformation of the jaws are very remarkable,

by which he moves both jaws. Of the skin excellent leather is made.

The electrical eel attains to a considerable size, and sometimes kills a horse that is wading the streams: when he comes in contact with the chest of the horse about the region of the heart, the power of his stroke knocks him down and kills him. A man, attempting to lift a small one carefully, has been knocked down by it. It kills frogs and fish instantaneously. It is of a dull leaden colour, with small lurid eyes: it sails with as much facility backwards as forwards. The electricity is not permanent, nor the power always at his command; when hungry the power is at the greatest intensity.

Para has a large supply of fish both from the river and the sea; but it so soon spoils, that it is difficult to get any perfectly fresh. The dorado is the most esteemed. There are two large fishes, of the silurus tribe, which yield isinglass, but a better sort is procured from the gurujuba, a fish in appearance somewhat like a sturgeon; it is caught at the mouth of the river. The pereiba is a very large fish, from five to six feet in length, of a shark-like aspect, glaucous hue; head large, flat, depressed; jaws wide; eyes small, situated on the upper part of its shovel-nosed cranium. It has six large tentacula; branchiostegeal rays four, with two feathered gill rows on each; two pectoral fins; ventral fins two, with ten bony rays; two dorsal fins, the anterior seven-rayed, posterior ten; one anal, opposite the posterior dorsal. It has two large air-bladders or sounds, and two uteri; it is said to be ovoviviparous. The air-bladders are dried and exported as an inferior kind of isinglass; two thousand pounds of it are annually procured. That procured from the gurujuba is said to dissolve entirely in water; it fetches about 56*s.* the arroba of thirty-two pounds: but the inferior will scarcely dissolve. They are said to be used by the brewers.

The river is infested with a little fish called cundaroo, which sometimes proves a great annoyance to the bathers by insinuating itself very unpleasantly and unceremoniously into the different parts of the body, unless due precautions are adopted. The pirarucoa is a very large fish, which they salt; the bony tongue of it is used as a grater.

The birds are well known to be of great beauty and splendour in these regions; there are parrots, paroquets, macaws, toucans, and every variety of humming-birds, from the tiny one scarce an inch in length, and not exceeding the ordinary size of a beetle. The male has whiskered feathers, or lateral tufts, on each side of the head, with pavonaceous spots—they are elegant, and peculiar to this least among the gems of the feathered tribe: the female is without these appendages.

When night waneth, and 'the day-spring from on high visiteth us'—while the grey mantle of mists still rests on the horizon, and the dew is yet fresh upon the grass—is in this climate the most delightful time for a walk; it is then deliciously cool. The finches and corn-birds are chirping, when the first tints of morn flush the horizon and proclaim the dawn of day—the edges of the floating clouds, now fringed with light, now deepening into perfect day—when lo! the sun peers over the forest, and bursts upon you with gorgeous splendour, and with fervid heat dissipates the glistening dew-drops. The black vulture is drying and repluming his wings, and standing with his back to the sun to dry his feathers. Now the little humming-birds are fluttering from flower to flower, to sip the honied dew ere the sun robs them of their treasure; these little beauties sport amid the morning rays, and vie with the gayest of the flowers. See the ruby topaz fluttering in the sunbeams; how exquisitely brilliant is its head! a blaze of glowing colours, divinely bright!—can imagination boast, amid her gay creation,

hues like these? See it sporting in the zephyr, and sipping nectar from the flowers! Some have thought that they feed on insects; but the honey has run from their little bills when captured, and who does not know that insects are fond of sweets, and are frequently entangled by them to their destruction?—thus the humming-bird may sip them in. To tell of their multifarious beauties would be to paint the lily and scent the rose; they are inimitable specimens of beauty and colouring. This fatal charm of beauty allures many to possess them. The breasts of most are iridescent, and it is well to look at them through a microscope, to behold the glory of their vest, and the chasteness of the workmanship of the Divine Being. The delicate structure of the feathers, as fine as gossamer, seem twisted into spiral coils, like the tassels of an epaulette, with all the hues the gems possess. These little creatures sometimes build their nests in lofty trees, as the hura crepitans, whose spiny bark prevents the ascent of snakes. The monkeys, equally cunning, have recourse to the same for the protection of their young.

The insatiable variety of nature, as displayed in the insects of these regions, would require volumes to describe. The ants alone would be the labour of a person's life to detail; in every fruit, on every flower, there is almost a peculiar ant. Some have erected domes of earth three feet in height, hard, durable, and impenetrable by the heaviest rains; others again suspend their nests in the trees; others dwell under ground; some are busily employed in stripping the trees of their leaves, and each carrying a piece of leaf over them, hence called the umbrella ant, and these make tracks and pathways over the grass; rotten wood affords refuge to several, the trunks of the trees are covered with archways of earth formed by one tribe, while sound wood is the chosen food and refuge of others. Each has its own peculiar habitude

and instinct. The large black ants are called the chasseurs, from driving everything out before them: if they enter a house, the rats quit it; and if they get into a snake's hole, they soon force it out, and make it writhe with pain. Everything around, both abroad and in the houses, bears marks of their destructive energies, and I do believe there are more than a thousand species of ants in this country alone. The gay and sportive butterflies afford splendid specimens, and just objects of admiration; many of them exceed the humming birds in size; they take all hues and shades, and one species has almost a feathered process. Moths and beetles of every variety of conformation, and we need no kaleidoscope to pourtray patterns or colours, when such an infinite number of combinations are yet unnoticed: the diamond beetle has clusters of gems, but how elegant its feet are, tufted and cloven! they present models of mechanism. The rhinocerous beetle in his black and polished jet coat, incased in armour, and displaying the most odd structure; the acari are pests, and stick to every part of the body; and the bête rouge, a little red creature scarcely visible, annoys you dreadfully; there are myriads of tenthredoes, and wasps without end.

At night how beautiful the fire-flies, sparkling among the trees, and in the bushes now a bright spark, and then vanishing in a moment, like little splendid meteors: this appearance of the light and sudden obscuration arises from the action of its wings in flying, sometimes covering the tail, from whence the light proceeds, thence it dazzles you for a moment, and immediately is hid. But if the fire-fly is interesting (and from their numbers and picturesque effect they must be so) to every new-comer, how much more surprising is the elater noctilucus, a species of coleopterous beetle, an inch and a half in length, by half an inch in breadth, of a brown cinnamon colour; its eyes are large, and

immediately contiguous to its mouth; and situated low down on the lateral parts of the corslet are two bright yellow spots, one twelfth of an inch in diameter, which in the day-time are not eclipsed; but at night-time, how transcendently beautiful! for they beam with uncommon lustre. When unexcited, the orbs are corneous, and somewhat dull; but when in activity, or roused, no creature carries such resplendent lamps to illuminate its path. Is it a beacon to recall its wandering mate? or is it to allure its prey by the fascinating brilliancy of its light? It would be indecorous to rob the humble glow-worm of its wreath of fame, and it would be invidious to depreciate the sparkling charms of the sportive fire-fly. But this humble creature requires not that others should be underrated; for she is the queen of light, the evening star of insects. I am inclined to think from the position of its eyes and the colour of its body, that it grovels on the ground, (where indeed I always found it,) and that the light affords means for discerning its prey. I put it into a common wooden pill-box, which it rendered quite transparent, and when the lid was removed, many of the officers read with facility by its light a page of a magazine. There was no intermission of light; it lived four or five days, and retained its uncommon powers of illumination to the last.

Some of the spiders are extremely large and venomous. I found their nests at the base of the frons of the cocoa-nut trees; the nest bag was six inches by two, and it contained thirty young ones: the mother was with the young; she was two inches and a quarter in length, and weighed seven drams or nearly an ounce. The thorax was 1·2 inches by one inch in breadth; the abdomen one inch and a quarter by two-thirds of an inch; this was in the natural and unimpregnated state; but when with the ovarial bag, they are bigger than a goose egg; the thorax is smooth on the dorsal surface, but

hairy beneath; the abdomen very hairy on all sides, of a rusty brown colour; legs five pair, the anterior pair short, the posterior ones double the length: the legs are beset with very long hairs. The extremities of the legs or feet are broad and cushioned like a cat's paw, of a reddish colour. Eyes, three pair, extremely minute on the anterior part of the thorax, the central pair the largest. It had a pair of sharp crooked claws or forceps, of a horny strong nature, arising from a broad base in the front of the body, terminated by a very sharp horny point; these claws were four-tenths of an inch in length, having on the convex side, near the point or apex, a small aperture or slit for the exudation of the poisonous liquor. I saw drops of liquid ooze through it, and remain at the aperture. This poisonous liquor causes the most dreadful irritation and death. As Lieutenant Williams and myself carried it through Para transfixed on a large thorn, it effectually cleared the streets for us, as all the people ran away with horror from it. If a hornet's sting, which is not one fiftieth part so large as the nippers of this spider, produces oftentimes severe inflammation, what might we not expect from this tremendous creature? Each nipper or claw is larger than the sting of the scorpion's tail of the Cape of Good Hope; and as that produces oftentimes alarming effects, why should not this do even more? Leuwenhoek asserted that the claws of spiders had a slit or aperture, through which the poisonous juice is injected. Dr. Mead denied it, having never been able to discover any such opening, not even in the claws of the largest species. Dr. Leach more lately investigated this point, and found in many species a groove; but was confident it was nothing more, never having been able to discover any opening in the groove. In the spider we have been describing, the thing is self-evident; we see the aperture, and drops of clear liquid coming through it; and there is, on examination, a con-

tinuous tube through the claw. This spider appears not to see very well; but his feet are adapted for running softly and gently. This venomous spider is less prolific than the smaller ones.

Para has many snakes, and among them the enormous boa constrictor, which strangles an ox and gorges it, lying afterwards in its tremendously distended state as a lifeless log, and easily to be killed. Its skin (one-tenth of an inch in thickness) makes capital leather; is a pure and good isinglass, forming capital jelly or soup; and capable of being used in the arts for all the purposes of that expensive material, when the scales are rasped off. It is far superior to the isinglass procured at this place from a fish which we have described. There are snakes floating on the water, six or seven feet in length, and of a beautiful grass green colour, and some in the river. Snakes are suspended in the trees over your head and ready to let themselves down upon you, and multitudes lurking in the grass. Yet the accidents from them are not so numerous, as terror would lead one to suppose. The coluber variegata is very poisonous.

The geology of Para will detain us a very little while; as there is very little variety or novelty. Precisely the same materials are found here as at Maranham, so that it would be impossible to distinguish them. It is a rare and unusual circumstance to find such a striking coincidence, in two different places. The soil upon which the city stands is of clay and sand. The beds of clay are very extensive, and frequently thirty or forty feet deep. There is scarcely any rock, and that only in particular and isolated masses; it is a coarse dark iron sandstone, with numerous particles of quartz in it. This is their only stone: it is used for their buildings. This dark iron sand-stone, with fragments of white quartz, is observable at Maranham, and is the predominant formation at St. Paul's, a little to the southward of Rio.

The beds of clay at Para are of various qualities; some are admirably adapted for bricks, tiles, and coarse pottery; others again very fine, and capable of making utensils vying with the Wedgewood ware. Beds of yellow ochre are common; and this is generally used for painting their houses with.

Limestone is imported from Portugal, granite from Rio, and slabs and sills from Europe. A gold mine is said to be found in a mountainous hill, on the coast near Selina. No organic remains have as yet been discovered in these parts.

REPORT OF THE COMMITTEE

ON WHICH THE FOREGOING VOYAGE WAS ORDERED.

At a Meeting of the Committee for considering and resolving on the most advantageous objects to be attained by Captain Foster in the course of his intended scientific voyage, January 28th, 1828, present

Mr. Davis Gilbert, President, in the Chair.
Captain Beaufort, R.N.
Dr. Fitton, President Geological Society
Mr. Herschel,* President Astronomical Society.
Captain Kater.
Dr. Roget.
Captain Sabine.

Captain Foster, and Mr. Horsburgh, Hydrographer to the East India Company, were present by invitation—

The following Report was agreed upon, and directed to be proposed for the Meeting of the Council on Thursday the 31st January.

The Committee conceive that it is impossible for them to preface the following Report of their opinions, which on mature deliberation they have been led to adopt thereon, otherwise than by congratulating the country and the scientific world in general on the liberal and enlightened views which have actuated his Royal Highness the Lord High Admiral in directing the outfitting of an enterprise destined

* The present Sir William Herschel.

solely and simply for the promotion of scientific research, and the extension of the bounds of human knowledge; and they feel that, called on as they are to state their opinions as to the most desirable ends to be accomplished in its prosecution, they should ill merit the confidence reposed in them by approaching the subject with anything short of the most serious attention they are able to bestow on it. Among the great number of interesting objects of scientific inquiry which present themselves on such an occasion, the first place in point both of theoretical dignity and practical importance must indisputably be accorded to those observations which have for their object the elucidation of great problems of physical astronomy; and of those susceptible of solution by observations thus instituted, that on which the great weight of scientific interest is actually concentrated is the determination of the true figure of the earth, and the law of the variation of gravity in different points of its surface. The observations on which the extension of our knowledge on these profound and delicate points is now universally admitted most directly to rest are those of the invariable pendulum, made in the manner suggested by Captain Kater, and already practised with much success, and to a considerable extent, but not so far as, in the opinion of the Committee, the importance of the subject, and the degree of uncertainty still subsisting as to the final results, required. They have therefore no hesitation in giving it as their opinion that the determination of the length of the seconds pendulums at a great number of stations, judiciously chosen, in all parts of the globe, but more especially in the immediate vicinity of the equator, in high southern latitudes, and at the nearest practicable point to the antipodes of London, in a *purely scientific point of view*, forms the prominent object to which the conduct of the expedition ought

to be directed, and to which all others ought to be regarded as secondary.

The Committee therefore propose to consider the expedition primarily, with reference to this object: and first, regarding only the stations at which it is desirable to obtain observations, without regard to the order in which they may most conveniently be visited, they would divide them into Equatorial, Middle, and Southern; regarding as equatorial stations all which are comprised within a zone of the earth's surface, extending 10° on either side of the equator; as middle, all stations included between the 10th and 50th degrees of latitude; and as southern, all beyond, or immediately bordering on, the last-mentioned limit.

A well-selected line of equatorial stations would, in the opinion of the Committee, be of very essential use in affording (independent of all observations in middle latitudes, whether north or south,) a mean equatorial pendulum, disencumbered of local irregularities, and, in all probability, not less so of any which may originate in a deviation of the general figure of the earth from the elliptic form, or in a want of symmetry in the distribution of the attractive forces in the two hemispheres. Such a line of stations, taken in conjunction with those of St. Thomas, Maranham, and the Galapagos, (which have been already well determined by Captain Sabine and Captain Hall, and which, it is considered, need not be revisited,) they conceive might be the following:—

Patta, on the east coast of Africa, nearly under the line.
A station on one of the Maldive Islands; for instance, on Peros Bentros.
Pointe de Galle.
Sincapore.
Christmas Island.

A station near Cape St. Francisco.

Fernando Noronha.

Para.

Cayenne.

In the list of desirable stations in middle latitudes, those of perhaps the higher interest are Ohwyhee and Otaheite, lying on either side of the line, at nearly equal latitudes, and in the Mid-Pacific Ocean; the stations of St. Catherine's Island and Monte Video on the eastern, and Lima, Acapulco, and Valparaiso on the western coast of South America; to which may be added the station of Cape Lewin, at the south-western extremity of Australia, which, lying nearly in the parallel of latitude with Port Jackson, the Cape of Good Hope, and Monte Video, the two former of which are already well determined, would thus afford another belt of the globe in a mean latitude of 35° south, being very favourable for computation.

First in the list of southern stations, in point of interest, stands the antipodes of Great Britain, which may be regarded as nearly the centre of the aqueous hemisphere; London being, in fact, (as seems to have been first particularly remarked by Colson, in an early volume of the transactions of this Society,) that of the terrestrial hemisphere: the difference of the attraction of the shells of land and water covering the two opposite halves of the globe (if sensible at all) ought in such a situation to be most advantageously observed, unless the vicinity of the continent of Australia should be regarded as diminishing the sensible effect. Chatham Island, or Auckland's Islands, appear likely to afford suitable stations, being each situated at no great distance from the antipodes of London.

The choice of several stations at the southern extremity of the continent of America, so as to vary the geological,

without materially varying the geographical situation, would afford a mean measure for this very remarkable point of the earth's surface, dependent only on the more general causes determining the force of gravity at that point. A chain of stations at the entrance, middle, and exit of Magellan's Straits, with one at Staten Island, taken in conjunction with the well-ascertained pendulum station of Falkland's Island, would, it is considered, furnish the requisite data in the best manner.

But perhaps the most important of all the southern stations is that of New South Shetland, or yet more so of any other land in still higher southern latitude.

The Committee, however, are very far from recommending that this expedition should be considered at all in the light of a voyage of discovery; although they unhesitatingly state their opinion that the importance of observations in high southern latitudes, to counterbalance in some measure those in regions far to the north, would be such as might justify a departure from a beaten track, were time and circumstances permitting.

The stations, the Committee would observe, may be considered in calculation according to any other view; and in particular those chosen on the western coast of America, lying nearly on one meridian along the line of the Andes, admit of being considered in a point of view directly opposite to that in which their combination in zones of equal latitude places them.

The number of stations above indicated may at first sight appear likely to extend the duration of the voyage beyond usual or reasonable limits, when it is considered that the average time to be allowed for erecting the instruments, and making the requisite observations at each station, can hardly be calculated at less than three weeks or a month; but

nothing prevents that the necessary operations of refitting and provisioning should be going on simultaneously with the observations: it is considered by the Committee that the whole might be comprised within reasonable limits, consistent with the health and comfort of the crews, and the good condition of the ship and of the stores; and availing themselves, therefore, of the best information they possess, or have been able to procure, relative to the opportunities afforded by the winds and seasons for the prosecution of the voyage from station to station, they would suggest the following as a sketch of the course which, in their opinion, would most conveniently combine them in one line of route.

The stations at which the ships might be revictualled and refitted are distinguished by an asterisk; and it will be seen that the interval between these stations in no instance exceeds six months, being the period for which they are informed the Chanticleer may be victualled.

Stations. 1828.	PERIODS OF Arrival.	Departure.
Madeira		May 1.
Cape Verds	May 7.	June 1.
Rio	July 1.	July 14.
St. Catherine's	July 18.	August 18.
*Monte Video	August 24.	October 1.
Eastern end of Magellan's Straits	October 14.	November 14.
Staten Island	November 20.	December 20.
1829.		
New South Shetland	January 1.	March 1.
*Cape of Good Hope	April 1.	May 1.
Patta	May 21.	June 21.
Peros Bentros, one of the Chagos Islands	July 1.	August 1.

Stations.	Arrival.	Departure.
Pointe de Galle	August 6.	September 1.
*Sincapore	October 1.	November 1.
Java Head	November 14.	November 21.
Cape Lewin, or King George's Sound	December 14.	January 14.
1830.		
Auckland's Islands, or Chatham Island	March 1.	April 1.
*Hobart's Town	April 14.	May 14.
Otaheite	July 1.	August 1.
Christmas Island, or some land similarly situated	August 12.	September 12.
Owhyhee	September 24.	October 24.
*Lima	December 24.	February 24.
1831.		
A port near Cape Saint Francisco	March 1.	April 1.
Acapulco	April 15.	May 15.
Valdivia	July 15.	August 15.
*Valparaiso	August 20.	November 1.
Straits of Magellan	December 1.	February 1.
1832.		
*Rio	March 1.	April 1.
Fernando Noronha	April 20.	May 20.
Para	June 1.	July 1.
Cayenne	July 7.	August 7, and home.

All the above are proposed as pendulum stations, except Madeira, Rio, Cape of Good Hope, and Java Head.

Although, in what has been before said, the Committee have regarded the pendulum experiments as the chief scientific object of the said expedition, and have framed the fore-

going route so as to pass through as many stations as possible adapted for such experiments, they have not been unmindful of the other numerous and important scientific objects which may be accomplished in its course. Among these the precise determination of the geographical situation of remarkable points, and investigations connected with the theory and application of magnetism, hold the first place, both in a scientific and a national point of view. But these, so far from interfering with, go naturally hand in hand with the observations required for the determination of the pendulum; so that, in fact, each of the pendulum stations may be equally regarded as a zero point of longitude, or as a magnetic station. The longitudes, astronomically determined at any or all of these points, as well of those of such principal ports and commercial stations as the expedition may have occasion to touch at without remaining longer than is necessary for the precise determination of time, or at which pendulum observations have been already made with sufficient exactness, may be transported by chronometers from point to point; and then a series of differences of longitude may be obtained of a highly interesting and important nature. The Committee are far from considering that great intervals of longitude thus obtained, even by the means of a great number of chronometers, can be compared in point of accuracy with those resulting from direct independent determinations from astronomical observations, such as eclipses, occultations, and the lunar methods: but they conceive that, by the employment of twelve, eighteen, or any greater number of these instruments, of good and ascertained character, which can be placed at Captain Foster's disposal, not only may a satisfactory estimate be formed of the actual efficacy of the method of chronometers, by checking their results, in trips of various lengths, with those already well known, or

determined by better means, in the course of the expedition; but also that a great number of smaller intervals, of high importance to navigation, may thus be ascertained with a great degree of approximation, which the other objects of the expedition would not allow of being determined independently.

The Committee, having requested the attendance of the Hydrographers of the Admiralty and of the East India Company, have been furnished by them with the accompanying list of stations convenient to the proposed route, the determination of the longitudes of which they consider of principal advantage to navigation; a considerable proportion of which might possibly recall Captain Foster's attention, provided it could be done without inconvenience to the object which has appeared to the Committee to deserve his primary consideration, and without increasing the respective periods assigned.

Should it be convenient to Captain Foster, the longitudes of the following points may be determined, in addition to those mentioned in the proposed track:—

Between Monte Video and Straits of Magellan .	Cape Blanco.
Between Staten Island and South Shetland .	Island of Diego Ramiez.
Between Cape of Good Hope and Patta .	Cape Corientes, Mozambique, and Zanzibar.
Between Pointe de Galle and Sincapore . .	Pulo Rondo, (north-western part of Sumatra,) Prince of Wales's Island, Fort Cornwallis, Malacca flag-staff.

Between Sincapore and Java Head	East point of Lingin Island, Seven Islands, (north-west part of Banca,) Monopin Hill, (Banca,) Lucepara Island, (south part of Banca Straits,) Hog Point (south point of Sumatra).
Between King George's Sound and Auckland's, or Chatham Island	Some of the southern extremes of Van Diemen's Land.
Between Hobart's Town and Otaheite . .	Any prominent point of New Zealand.
Between Owhyhee and Lima .	As Capt. Foster will probably have to stretch considerably to the southward, an opportunity may be afforded of touching at several islands.
Between Cape Francisco and Acapulco	Any prominent points will be very desirable, our charts of this coast being imperfect.
Between Para and Cayenne .	As many points as possible.

(Signed) W. PARRY, Hydrographer to the Admiralty.
JAMES HORSBURGH.

Magnetic observations, fortunately, admit of being multiplied in proportion to their importance and utility; and the experience and distinguished success of Captain Foster in this branch of physical inquiry, leaves no room to doubt that the essential particulars of dip, intensity, and direction, and their periodical changes, will, in all cases and at all stations, be observed in the most satisfactory manner.

Among the astronomical observations which may be ad-

vantageously made in southern latitudes, the Committee would point out to Captain Foster the opportunity not to be neglected of observing the periodical comet of Encke in its return from the sun in the beginning of the next year. This remarkable body will disappear from European observation about the middle of December, but will continue visible in southern latitudes probably till the middle of February, according to the annexed ephemeris, when observation of its place would be of peculiar value.

Meteorological observations form a branch of inquiry of no small moment in this and all similar expeditions. Could a series of simultaneous barometric and other observations be obtained at different stations considerably remote between the tropics, there is no doubt that much light would be thrown on the subject. A comparison of the direct force of solar radiation at the level of the sea, and at considerable elevations in various latitudes, and under various circumstances of atmospheric pressure and moisture, would be of the highest interest, as connected not merely with the ordinary meteorological points, but with questions which regard the probable former and future climate of different regions of the East, the permanence or variability of the solar influence at different epochs, and the stability of the actual equilibrium of meteorological agents. The Committee, therefore, would recommend these several points of inquiry to be attentively borne in mind during the voyage; and that at each station regular observations of the barometer, thermometer, hygrometer, and the direction and force of the wind, should be daily made; and of instruments proper for measuring the solar and terrestrial radiation at favourable opportunities and various levels. The peak of Mordua Roa, if accessible, would afford an admirable station for this last species of observation.

The Committee also recommend as a highly interesting and important inquiry, that of the law which the aqueous vapour in the atmosphere follows in the decrease of its elasticity in ascending from the earth's surface. Islands of considerable elevation, distant from other land, such as the Cape Verd and the Sandwich Islands, form the most desirable points of the globe for this inquiry, which has the farther recommendation of requiring very simple observations with instruments which will be in common use during the voyage, and occupying at the most not more than two or three days on those very few occasions when they may be made with advantage. The great number and varied position of the places at which Captain Foster is to touch, and the length of time during which his experiments with the pendulum will render it necessary that he should remain in every station, afford such extraordinary advantages for research in the several departments of natural history as can very seldom be expected. Your Committee therefore would willingly have recommended one or more persons competently acquainted with natural history, whose appropriate duty should have been to collect specimens and obtain information; but having been informed that the small dimensions of the ship, and other arrangements connected with the naval service, would render this impracticable, in the present case they confine themselves to suggesting that an additional person be appointed to serve with the expedition in the character of botanical collector, whose exclusive duty it shall be to procure and preserve botanical specimens and seeds, and whose collections shall from time to time be delivered to the care of the commanding officer, to be transmitted to England as occasion may occur. That Mr. Webster, the surgeon of the ship, be directed to attend to the collection and preservation of specimens in zoology, mine-

ralogy, and geology united; and the Committee will hold themselves in readiness to furnish to Mr. Webster and to the botanical collector, such further instructions in detail as may be required.

The Committee also beg to express their confidence that the several officers of the expedition will, as far as their other duties allow, lose no opportunity of collecting and preserving objects of natural history, and of noticing the phenomena connected with them, and of assisting and promoting the operations of Mr. Webster and the botanical collector by all the means in their power; they have reason to believe that as much practical information relating to these subjects will be communicated to Captain Foster and his officers in person, as the short interval from the present time to that of their departure, and the urgency of their official occupations, will permit.

And to avoid the risk of loss, and prevent encumbrance to the ship, the Committee suggest that it will be expedient to send home to the Admiralty from time to time, and from such points as afford fit opportunities, packages containing the various specimens, drawings, and notes previously collected and prepared, with such information respecting them as may render the collection and information available in case of accident.

Finally, your Committee would have thought it their duty, upon this occasion, to bring the subject of natural history more fully before the Council for the consideration of the proper department of his Majesty's Government, but for the existence of circumstances above referred to; as they are convinced that the reputation of their country is materially advanced by attention to such inquiries, and that the promotion of them would contribute to sustain the high station which England at present occupies among the civilized nations of the world.

At a meeting of the Committee for correcting and resolving on the most advantageous objects to be attained by Captain Foster in the course of his intended scientific voyage, January 31, 1828.

Present,

The PRESIDENT in the Chair.
MR. BAILY.
CAPTAIN BEAUFORT.
MR. R. BROWN.
DR. FITTON.
MR. HERSCHEL.
CAPTAIN SABINE.

Captains Parry and Horsburgh attended by invitation.

The Report of the Committee, as finally drawn up, was read, approved, and ordered to be referred to the Council.

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