

THE VOYAGE OF THE BEAGLE

The Voyage of the Beagle

by Charles Darwin

Chapter 1 - St. Jago -- Cape de Verd Islands

AFTER having been twice driven back by heavy southwestern gales, Her Majesty's ship Beagle, a ten-gun brig, under the command of Captain Fitz Roy, R. N., sailed from Devonport on the 27th of December, 1831. The object of the expedition was to complete the survey of Patagonia and Tierra del Fuego, commenced under Captain King in 1826 to 1830, -- to survey the shores of Chile, Peru, and of some islands in the Pacific -- and to carry a chain of chronometrical measurements round the World. On the 6th of January we reached Teneriffe, but were prevented landing, by fears of our bringing the cholera: the next morning we saw the sun rise behind the rugged outline of the Grand Canary island, and suddenly illuminate the Peak of Teneriffe, whilst the lower parts were veiled in fleecy clouds. This was the first of many delightful days never to be forgotten. On the 16th of January, 1832, we anchored at Porto Praya, in St. Jago, the chief island of the Cape de Verd archipelago.

The neighbourhood of Porto Praya, viewed from the sea, wears a desolate aspect. The volcanic fires of a past age, and the scorching heat of a tropical sun, have in most places rendered the soil unfit for vegetation. The country rises in successive steps of table-land, interspersed with some truncate conical hills, and the horizon is bounded by an irregular chain of more lofty mountains. The scene, as beheld through the hazy atmosphere of this climate, is one of great interest; if, indeed, a person, fresh from sea, and who has just walked, for the first time, in a grove of cocoa-nut trees, can be a judge of anything but his own happiness. The island would generally be considered as very uninteresting, but to anyone accustomed only to an English landscape, the novel aspect of an utterly sterile land possesses a grandeur which more vegetation might spoil. A single green leaf can scarcely be discovered over wide tracts of the lava plains; yet flocks of goats, together with a few cows, contrive to exist. It rains very seldom, but during a short portion of the year heavy torrents fall, and immediately afterwards a light vegetation springs out of every crevice. This soon withers; and upon such naturally formed hay the animals live. It had not now rained for an entire year. When the island was discovered, the immediate neighbourhood of Porto Praya was clothed with trees [note 1], the reckless destruction of which has caused here, as at St. Helena, and at some of the Canary islands, almost entire sterility. The broad, flat-bottomed valleys, many of which serve during a few days only in the season as water-courses, are clothed with thickets of leafless bushes. Few living creatures inhabit these valleys. The commonest bird is a kingfisher (*Dacelo Iagoensis*), which tamely sits on the

branches of the castor- oil plant, and thence darts on grasshoppers and lizards. It is brightly coloured, but not so beautiful as the European species: in its flight, manners, and place of habitation, which is generally in the driest valley, there is also a wide difference.

One day, two of the officers and myself rode to Ribeira Grande, a village a few miles eastward of Porto Praya. Until we reached the valley of St. Martin, the country presented its usual dull brown appearance; but here, a very small rill of water produces a most refreshing margin of luxuriant vegetation. In the course of an hour we arrived at Ribeira Grande, and were surprised at the sight of a large ruined fort and cathedral. This little town, before its harbour was filled up, was the principal place in the island: it now presents a melancholy, but very picturesque appearance. Having procured a black Padre for a guide, and a Spaniard who had served in the Peninsular war as an interpreter, we visited a collection of buildings, of which an ancient church formed the principal part. It is here the governors and captain-generals of the islands have been buried. Some of the tombstones recorded dates of the sixteenth century [note 2].

The heraldic ornaments were the only things in this retired place that reminded us of Europe. The church or chapel formed one side of a quadrangle, in the middle of which a large clump of bananas were growing. On another side was a hospital, containing about a dozen miserable-looking inmates.

We returned to the Venda to eat our dinners. A considerable number of men, women, and children, all as black as jet, collected to watch us. Our companions were extremely merry; and everything we said or did was followed by their hearty laughter. Before leaving the town we visited the cathedral. It does not appear so rich as the smaller church, but boasts of a little organ, which sent forth singularly inharmonious cries. We presented the black priest with a few shillings, and the Spaniard, patting him on the head, said, with much candour, he thought his colour made no great difference. We then returned, as fast as the ponies would go, to Porto Praya.

Another day we rode to the village of St. Domingo, situated near the centre of the island. On a small plain which we crossed, a few stunted acacias were growing; their tops had been bent by the steady trade-wind, in a singular manner -- some of them even at right angles to their trunks. The direction of the branches was exactly N. E. by N., and S. W. by S., and these natural vanes must indicate the prevailing direction of the force of the trade-wind. The travelling had made so little impression on the barren soil, that we here missed our track, and took that to Fuentes. This we did not find out till we arrived there; and we were afterwards glad of our mistake. Fuentes is a pretty village, with a small stream; and everything appeared to prosper well, excepting, indeed, that which ought to do so most -- its inhabitants. The black children, completely naked, and looking very wretched, were carrying bundles of firewood half as big as their own bodies.

Near Fuentes we saw a large flock of guinea-fowl -- probably fifty or sixty in number. They were extremely wary, and could not be approached. They avoided us, like partridges on a rainy day in September, running with their heads cocked up; and if pursued, they readily took to the wing.

The scenery of St. Domingo possesses a beauty totally unexpected, from the prevalent gloomy character of the rest of the island. The village is situated at the bottom of a valley, bounded by lofty and jagged walls of stratified lava. The black rocks afford a most striking contrast with the bright green vegetation, which follows the banks of a little stream of clear water. It happened to be a grand feast-day, and the village was full of people. On our return we overtook a party of about twenty young black girls, dressed in excellent taste; their black skins and snow-white linen being set off by coloured turbans and large shawls. As soon as we approached near, they suddenly all turned round, and covering the path with their shawls, sung with great energy a wild song, beating time with their hands upon their legs. We threw them some vintems, which were received with screams of laughter, and we left them redoubling the noise of their song.

One morning the view was singularly clear; the distant mountains being projected with the sharpest outline on a heavy bank of dark blue clouds. Judging from the appearance, and from similar cases in England, I supposed that the air was saturated with moisture. The fact, however, turned out quite the contrary. The hygrometer gave a difference of 29.6 degs., between the temperature of the air, and the point at which dew was precipitated. This difference was nearly double that which I had observed on the previous mornings. This unusual degree of atmospheric dryness was accompanied by continual flashes of lightning. Is it not an uncommon case, thus to find a remarkable degree of aerial transparency with such a state of weather?

Generally the atmosphere is hazy; and this is caused by the falling of impalpably fine dust, which was found to have slightly injured the astronomical instruments. The morning before we anchored at Porto Praya, I collected a little packet of this brown-coloured fine dust, which appeared to have been filtered from the wind by the gauze of the vane at the masthead. Mr. Lyell has also given me four packets of dust which fell on a vessel a few hundred miles northward of these islands. Professor Ehrenberg [note 3] finds that this dust consists in great part of infusoria with siliceous shields, and of the siliceous tissue of plants. In five little packets which I sent him, he has ascertained no less than sixty-seven different organic forms! The infusoria, with the exception of two marine species, are all inhabitants of fresh-water. I have found no less than fifteen different accounts of dust having fallen on vessels when far out in the Atlantic. From the direction of the wind whenever it has fallen, and from its having always fallen during those months when the harmattan is known to raise clouds of dust high into the atmosphere, we may feel sure that it all comes from Africa. It is, however, a very singular fact, that, although Professor Ehrenberg knows many species of infusoria peculiar to Africa, he finds none of these in the dust which I sent him. On the other hand, he finds in it two species which hitherto he knows as living only in South America. The dust falls in such quantities as to dirty everything on board, and to hurt people's eyes; vessels even have run on shore owing to the obscurity of the atmosphere. It has often fallen on ships when several hundred, and even more than a thousand miles from the coast of Africa, and at points sixteen hundred miles distant in a north and south direction. In some dust which was collected on a vessel three hundred miles from the land, I was much surprised to find particles of stone above the thousandth of an inch square, mixed with finer matter. After this fact one need not be surprised at the diffusion of the far lighter and smaller sporules of cryptogamic plants.

The geology of this island is the most interesting part of its natural history. On entering the harbour, a perfectly horizontal white band, in the face of the sea cliff, may be seen running for some miles along the coast, and at the height of about forty-five feet above the water. Upon examination this white stratum is found to consist of calcareous matter with numerous shells embedded, most or all of which now exist on the neighbouring coast. It rests on ancient volcanic rocks, and has been covered by a stream of basalt, which must have entered the sea when the white shelly bed was lying at the bottom. It is interesting to trace the changes produced by the heat of the overlying lava, on the friable mass, which in parts has been converted into a crystalline limestone, and in other parts into a compact spotted stone. Where the lime has been caught up by the scoriaceous fragments of the lower surface of the stream, it is converted into groups of beautifully radiated fibres resembling arragonite. The beds of lava rise in successive gently-sloping plains, towards the interior, whence the deluges of melted stone have originally proceeded. Within historical times, no signs of volcanic activity have, I believe, been manifested in any part of St. Jago. Even the form of a crater can but rarely be discovered on the summits of the many red cindery hills; yet the more recent streams can be distinguished on the coast, forming lines of cliffs of less height, but stretching out in advance of those belonging to an older series: the height of the cliffs thus affording a rude measure of the age of the streams.

During our stay, I observed the habits of some marine animals. A large *Aplysia* is very common. This sea-slug is about five inches long; and is of a dirty yellowish colour veined with purple. On each side of the lower surface, or foot, there is a broad membrane, which appears sometimes to act as a ventilator, in causing a current of water to flow over the dorsal branchiae or lungs. It feeds on the delicate sea-weeds which grow among the stones in muddy and shallow water; and I found in its stomach several small pebbles, as in the gizzard of a bird. This slug, when disturbed, emits a very fine purplish-red fluid, which stains the water for the space of a foot around. Besides this means of defence, an acrid secretion, which is spread over its body, causes a sharp, stinging sensation, similar to that produced by the *Physalia*, or Portuguese man-of-war.

I was much interested, on several occasions, by watching the habits of an Octopus, or cuttle-fish. Although common in the pools of water left by the retiring tide, these animals were not easily caught. By means of their long arms and suckers, they could drag their bodies into very narrow crevices; and when thus fixed, it required great force to remove them. At other times they darted tail first, with the rapidity of an arrow, from one side of the pool to the other, at the same instant discolouring the water with a dark chestnut-brown ink. These animals also escape detection by a very extraordinary, chameleon-like power of changing their colour. They appear to vary their tints according to the nature of the ground over which they pass: when in deep water, their general shade was brownish purple, but when placed on the land, or in shallow water, this dark tint changed into one of a yellowish green. The colour, examined more carefully, was a French grey, with numerous minute spots of bright yellow: the former of these varied in intensity; the latter entirely disappeared and appeared again by turns. These changes were effected in such a manner, that clouds, varying in tint between a hyacinth red and a chestnut-brown [note 4], were continually passing over the body. Any part, being subjected to a slight shock of

galvanism, became almost black: a similar effect, but in a less degree, was produced by scratching the skin with a needle. These clouds, or blushes as they may be called, are said to be produced by the alternate expansion and contraction of minute vesicles containing variously coloured fluids [note 5].

This cuttle-fish displayed its chameleon-like power both during the act of swimming and whilst remaining stationary at the bottom. I was much amused by the various arts to escape detection used by one individual, which seemed fully aware that I was watching it. Remaining for a time motionless, it would then stealthily advance an inch or two, like a cat after a mouse; sometimes changing its colour: it thus proceeded, till having gained a deeper part, it darted away, leaving a dusky train of ink to hide the hole into which it had crawled.

While looking for marine animals, with my head about two feet above the rocky shore, I was more than once saluted by a jet of water, accompanied by a slight grating noise. At first I could not think what it was, but afterwards I found out that it was this cuttle-fish, which, though concealed in a hole, thus often led me to its discovery. That it possesses the power of ejecting water there is no doubt, and it appeared to me that it could certainly take good aim by directing the tube or siphon on the under side of its body. From the difficulty which these animals have in carrying their heads, they cannot crawl with ease when placed on the ground. I observed that one which I kept in the cabin was slightly phosphorescent in the dark.

St. Paul's Rocks

In crossing the Atlantic we hove-to during the morning of February 16th, close to the island of St. Paul's. This cluster of rocks is situated in 0 degs. 58' north latitude, and 29 degs. 15' west longitude. It is 540 miles distant from the coast of America, and 350 from the island of Fernando Noronha. The highest point is only fifty feet above the level of the sea, and the entire circumference is under three-quarters of a mile. This small point rises abruptly out of the depths of the ocean. Its mineralogical constitution is not simple; in some parts the rock is of a cherty, in others of a felspathic nature, including thin veins of serpentine. It is a remarkable fact, that all the many small islands, lying far from any continent, in the Pacific, Indian, and Atlantic Oceans, with the exception of the Seychelles and this little point of rock, are, I believe, composed either of coral or of erupted matter. The volcanic nature of these oceanic islands is evidently an extension of that law, and the effect of those same causes, whether chemical or mechanical, from which it results that a vast majority of the volcanoes now in action stand either near sea-coasts or as islands in the midst of the sea.

The rocks of St. Paul appear from a distance of a brilliantly white colour. This is partly owing to the dung of a vast multitude of sea-fowl, and partly to a coating of a hard glossy substance with a pearly lustre, which is intimately united to the surface of the rocks. This, when examined with a lens, is found to consist of numerous exceedingly thin layers, its total thickness being about the tenth of an inch. It contains much animal matter, and its origin, no doubt, is due to the action of the rain or spray on the birds' dung. Below some small masses of guano at Ascension, and on the Abrolhos Islets, I found certain stalactitic branching bodies, formed apparently in the same manner as the thin white coating on these rocks. The branching bodies

so closely resembled in general appearance certain nulliporae (a family of hard calcareous sea-plants), that in lately looking hastily over my collection I did not perceive the difference. The globular extremities of the branches are of a pearly texture, like the enamel of teeth, but so hard as just to scratch plate-glass. I may here mention, that on a part of the coast of Ascension, where there is a vast accumulation of shelly sand, an incrustation is deposited on the tidal rocks by the water of the sea, resembling, as represented in the woodcut, certain cryptogamic plants (Marchantiae) often seen on damp walls. The surface of the fronds is beautifully glossy; and those parts formed where fully exposed to the light are of a jet black colour, but those shaded under ledges are only grey. I have shown specimens of this incrustation to several geologists, and they all thought that they were of volcanic or igneous origin! In its hardness and translucency -- in its polish, equal to that of the finest oliva-shell -- in the bad smell given out, and loss of colour under the blowpipe -- it shows a close similarity with living sea-shells. Moreover, in sea-shells, it is known that the parts habitually covered and shaded by the mantle of the animal, are of a paler colour than those fully exposed to the light, just as is the case with this incrustation. When we remember that lime, either as a phosphate or carbonate, enters into the composition of the hard parts, such as bones and shells, of all living animals, it is an interesting physiological fact [note 6] to find substances harder than the enamel of teeth, and coloured surfaces as well polished as those of a fresh shell, reformed through inorganic means from dead organic matter -- mocking, also, in shape, some of the lower vegetable productions.

We found on St. Paul's only two kinds of birds -- the booby and the noddy. The former is a species of gannet, and the latter a tern. Both are of a tame and stupid disposition, and are so unaccustomed to visitors, that I could have killed any number of them with my geological hammer. The booby lays her eggs on the bare rock; but the tern makes a very simple nest with seaweed. By the side of many of these nests a small flying-fish was placed; which I suppose, had been brought by the male bird for its partner. It was amusing to watch how quickly a large and active crab (*Graspus*), which inhabits the crevices of the rock, stole the fish from the side of the nest, as soon as we had disturbed the parent birds. Sir W. Symonds, one of the few persons who have landed here, informs me that he saw the crabs dragging even the young birds out of their nests, and devouring them. Not a single plant, not even a lichen, grows on this islet; yet it is inhabited by several insects and spiders. The following list completes, I believe, the terrestrial fauna: a fly (*Olfersia*) living on the booby, and a tick which must have come here as a parasite on the birds; a small brown moth, belonging to a genus that feeds on feathers; a beetle (*Quedius*) and a woodlouse from beneath the dung; and lastly, numerous spiders, which I suppose prey on these small attendants and scavengers of the water-fowl. The often repeated description of the stately palm and other noble tropical plants, then birds, and lastly man, taking possession of the coral islets as soon as formed, in the Pacific, is probably not correct; I fear it destroys the poetry of this story, that feather and dirt-feeding and parasitic insects and spiders should be the first inhabitants of newly formed oceanic land.

The smallest rock in the tropical seas, by giving a foundation for the growth of innumerable kinds of seaweed and compound animals, supports likewise a large number of fish. The sharks and the seamen in the boats maintained a constant struggle which should secure the greater share of the prey caught by the fishing-

lines. I have heard that a rock near the Bermudas, lying many miles out at sea, and at a considerable depth, was first discovered by the circumstance of fish having been observed in the neighbourhood.

FERNANDO NORONHA, Feb. 20th. -- As far as I was enabled to observe, during the few hours we stayed at this place, the constitution of the island is volcanic, but probably not of a recent date. The most remarkable feature is a conical hill, about one thousand feet high, the upper part of which is exceedingly steep, and on one side overhangs its base. The rock is phonolite, and is divided into irregular columns. On viewing one of these isolated masses, at first one is inclined to believe that it has been suddenly pushed up in a semi-fluid state. At St. Helena, however, I ascertained that some pinnacles, of a nearly similar figure and constitution, had been formed by the injection of melted rock into yielding strata, which thus had formed the moulds for these gigantic obelisks. The whole island is covered with wood; but from the dryness of the climate there is no appearance of luxuriance. Half-way up the mountain, some great masses of the columnar rock, shaded by laurel-like trees, and ornamented by others covered with fine pink flowers but without a single leaf, gave a pleasing effect to the nearer parts of the scenery.

BAHIA, OR SAN SALVADOR. BRAZIL, Feb. 29th. -- The day has passed delightfully. Delight itself, however, is a weak term to express the feelings of a naturalist who, for the first time, has wandered by himself in a Brazilian forest. The elegance of the grasses, the novelty of the parasitical plants, the beauty of the flowers, the glossy green of the foliage, but above all the general luxuriance of the vegetation, filled me with admiration. A most paradoxical mixture of sound and silence pervades the shady parts of the wood. The noise from the insects is so loud, that it may be heard even in a vessel anchored several hundred yards from the shore; yet within the recesses of the forest a universal silence appears to reign. To a person fond of natural history, such a day as this brings with it a deeper pleasure than he can ever hope to experience again. After wandering about for some hours, I returned to the landing-place; but, before reaching it, I was overtaken by a tropical storm. I tried to find shelter under a tree, which was so thick that it would never have been penetrated by common English rain; but here, in a couple of minutes, a little torrent flowed down the trunk. It is to this violence of the rain that we must attribute the verdure at the bottom of the thickest woods: if the showers were like those of a colder climate, the greater part would be absorbed or evaporated before it reached the ground. I will not at present attempt to describe the gaudy scenery of this noble bay, because, in our homeward voyage, we called here a second time, and I shall then have occasion to remark on it.

Along the whole coast of Brazil, for a length of at least 2000 miles, and certainly for a considerable space inland, wherever solid rock occurs, it belongs to a granitic formation. The circumstance of this enormous area being constituted of materials which most geologists believe to have been crystallized when heated under pressure, gives rise to many curious reflections. Was this effect produced beneath the depths of a profound ocean? or did a covering of strata formerly extend over it, which has since been removed? Can we believe that any power, acting for a time short of infinity, could have denuded the granite over so many thousand square leagues?

On a point not far from the city, where a rivulet entered the sea, I observed a fact

connected with a subject discussed by Humboldt [note 7]. At the cataracts of the great rivers Orinoco, Nile, and Congo, the syenitic rocks are coated by a black substance, appearing as if they had been polished with plumbago. The layer is of extreme thinness; and on analysis by Berzelius it was found to consist of the oxides of manganese and iron. In the Orinoco it occurs on the rocks periodically washed by the floods, and in those parts alone where the stream is rapid; or, as the Indians say, "the rocks are black where the waters are white." Here the coating is of a rich brown instead of a black colour, and seems to be composed of ferruginous matter alone. Hand specimens fail to give a just idea of these brown burnished stones which glitter in the sun's rays. They occur only within the limits of the tidal waves; and as the rivulet slowly trickles down, the surf must supply the polishing power of the cataracts in the great rivers. In like manner, the rise and fall of the tide probably answer to the periodical inundations; and thus the same effects are produced under apparently different but really similar circumstances. The origin, however, of these coatings of metallic oxides, which seem as if cemented to the rocks, is not understood; and no reason, I believe, can be assigned for their thickness remaining the same.

One day I was amused by watching the habits of the *Diodon antennatus*, which was caught swimming near the shore. This fish, with its flabby skin, is well known to possess the singular power of distending itself into a nearly spherical form. After having been taken out of water for a short time, and then again immersed in it, a considerable quantity both of water and air is absorbed by the mouth, and perhaps likewise by the branchial orifices. This process is effected by two methods: the air is swallowed, and is then forced into the cavity of the body, its return being prevented by a muscular contraction which is externally visible: but the water enters in a gentle stream through the mouth, which is kept wide open and motionless; this latter action must, therefore, depend on suction. The skin about the abdomen is much looser than that on the back; hence, during the inflation, the lower surface becomes far more distended than the upper; and the fish, in consequence, floats with its back downwards. Cuvier doubts whether the *Diodon* in this position is able to swim; but not only can it thus move forward in a straight line, but it can turn round to either side. This latter movement is effected solely by the aid of the pectoral fins; the tail being collapsed, and not used. From the body being buoyed up with so much air, the branchial openings are out of water, but a stream drawn in by the mouth constantly flows through them.

The fish, having remained in this distended state for a short time, generally expelled the air and water with considerable force from the branchial apertures and mouth. It could emit, at will, a certain portion of the water, and it appears, therefore, probable that this fluid is taken in partly for the sake of regulating its specific gravity. This *Diodon* possessed several means of defence. It could give a severe bite, and could eject water from its mouth to some distance, at the same time making a curious noise by the movement of its jaws. By the inflation of its body, the papillae, with which the skin is covered, become erect and pointed. But the most curious circumstance is, that it secretes from the skin of its belly, when handled, a most beautiful carmine-red fibrous matter, which stains ivory and paper in so permanent a manner that the tint is retained with all its brightness to the present day: I am quite ignorant of the nature and use of this secretion. I have heard from Dr. Allan of Forres, that he has frequently found a *Diodon*, floating alive and distended, in the stomach of the shark,

and that on several occasions he has known it eat its way, not only through the coats of the stomach, but through the sides of the monster, which has thus been killed. Who would ever have imagined that a little soft fish could have destroyed the great and savage shark?

March 18th. -- We sailed from Bahia. A few days afterwards, when not far distant from the Abrolhos Islets, my attention was called to a reddish-brown appearance in the sea. The whole surface of the water, as it appeared under a weak lens, seemed as if covered by chopped bits of hay, with their ends jagged. These are minute cylindrical confervae, in bundles or rafts of from twenty to sixty in each. Mr. Berkeley informs me that they are the same species (*Trichodesmium erythraeum*) with that found over large spaces in the Red Sea, and whence its name of Red Sea is derived [note 8]. Their numbers must be infinite: the ship passed through several bands of them, one of which was about ten yards wide, and, judging from the mud-like colour of the water, at least two and a half miles long. In almost every long voyage some account is given of these confervae. They appear especially common in the sea near Australia; and off Cape Leeuwin I found an allied but smaller and apparently different species. Captain Cook, in his third voyage, remarks, that the sailors gave to this appearance the name of sea-sawdust.

Near Keeling Atoll, in the Indian Ocean, I observed many little masses of confervae a few inches square, consisting of long cylindrical threads of excessive thinness, so as to be barely visible to the naked eye, mingled with other rather larger bodies, finely conical at both ends. Two of these are shown in the woodcut united together. They vary in length from .04 to .06, and even to .08 of an inch in length; and in diameter from .006 to .008 of an inch. Near one extremity of the cylindrical part, a green septum, formed of granular matter, and thickest in the middle, may generally be seen. This, I believe, is the bottom of a most delicate, colourless sac, composed of a pulpy substance, which lines the exterior case, but does not extend within the extreme conical points. In some specimens, small but perfect spheres of brownish granular matter supplied the places of the septa; and I observed the curious process by which they were produced. The pulpy matter of the internal coating suddenly grouped itself into lines, some of which assumed a form radiating from a common centre; it then continued, with an irregular and rapid movement, to contract itself, so that in the course of a second the whole was united into a perfect little sphere, which occupied the position of the septum at one end of the now quite hollow case. The formation of the granular sphere was hastened by any accidental injury. I may add, that frequently a pair of these bodies were attached to each other, as represented above, cone beside cone, at that end where the septum occurs.

I will add here a few other observations connected with the discoloration of the sea from organic causes. On the coast of Chile, a few leagues north of Concepcion, the Beagle one day passed through great bands of muddy water, exactly like that of a swollen river; and again, a degree south of Valparaiso, when fifty miles from the land, the same appearance was still more extensive. Some of the water placed in a glass was of a pale reddish tint; and, examined under a microscope, was seen to swarm with minute animalcula darting about, and often exploding. Their shape is oval, and contracted in the middle by a ring of vibrating curved ciliae. It was, however, very difficult to examine them with care, for almost the instant motion ceased, even while crossing the field of vision, their bodies burst. Sometimes both

ends burst at once, sometimes only one, and a quantity of coarse, brownish, granular matter was ejected. The animal an instant before bursting expanded to half again its natural size; and the explosion took place about fifteen seconds after the rapid progressive motion had ceased: in a few cases it was preceded for a short interval by a rotatory movement on the longer axis. About two minutes after any number were isolated in a drop of water, they thus perished. The animals move with the narrow apex forwards, by the aid of their vibratory ciliae, and generally by rapid starts. They are exceedingly minute, and quite invisible to the naked eye, only covering a space equal to the square of the thousandth of an inch. Their numbers were infinite; for the smallest drop of water which I could remove contained very many. In one day we passed through two spaces of water thus stained, one of which alone must have extended over several square miles. What incalculable numbers of these microscopical animals! The colour of the water, as seen at some distance, was like that of a river which has flowed through a red clay district, but under the shade of the vessel's side it was quite as dark as chocolate. The line where the red and blue water joined was distinctly defined. The weather for some days previously had been calm, and the ocean abounded, to an unusual degree, with living creatures [note 9].

In the sea around Tierra del Fuego, and at no great distance from the land, I have seen narrow lines of water of a bright red colour, from the number of crustacea, which somewhat resemble in form large prawns. The sealers call them whale-food. Whether whales feed on them I do not know; but terns, cormorants, and immense herds of great unwieldy seals derive, on some parts of the coast, their chief sustenance from these swimming crabs. Seamen invariably attribute the discoloration of the water to spawn; but I found this to be the case only on one occasion. At the distance of several leagues from the Archipelago of the Galapagos, the ship sailed through three strips of a dark yellowish, or mudlike water; these strips were some miles long, but only a few yards wide, and they were separated from the surrounding water by a sinuous yet distinct margin. The colour was caused by little gelatinous balls, about the fifth of an inch in diameter, in which numerous minute spherical ovules were imbedded: they were of two distinct kinds, one being of a reddish colour and of a different shape from the other. I cannot form a conjecture as to what two kinds of animals these belonged. Captain Colnett remarks, that this appearance is very common among the Galapagos Islands, and that the directions of the bands indicate that of the currents; in the described case, however, the line was caused by the wind. The only other appearance which I have to notice, is a thin oily coat on the water which displays iridescent colours. I saw a considerable tract of the ocean thus covered on the coast of Brazil; the seamen attributed it to the putrefying carcase of some whale, which probably was floating at no great distance. I do not here mention the minute gelatinous particles, hereafter to be referred to, which are frequently dispersed throughout the water, for they are not sufficiently abundant to create any change of colour.

There are two circumstances in the above accounts which appear remarkable: first, how do the various bodies which form the bands with defined edges keep together? In the case of the prawn-like crabs, their movements were as coinstantaneous as in a regiment of soldiers; but this cannot happen from anything like voluntary action with the ovules, or the confervae, nor is it probable among the infusoria. Secondly, what causes the length and narrowness of the bands? The appearance so much resembles that which may be seen in every torrent, where the stream uncoils into long streaks

the froth collected in the eddies, that I must attribute the effect to a similar action either of the currents of the air or sea. Under this supposition we must believe that the various organized bodies are produced in certain favourable places, and are thence removed by the set of either wind or water. I confess, however, there is a very great difficulty in imagining any one spot to be the birthplace of the millions of millions of animalcula and confervae: for whence come the germs at such points? -- the parent bodies having been distributed by the winds and waves over the immense ocean. But on no other hypothesis can I understand their linear grouping. I may add that Scoresby remarks that green water abounding with pelagic animals is invariably found in a certain part of the Arctic Sea.

Notes:

1.I state this on the authority of Dr. E. Dieffenbach, in his German translation of the first edition of this Journal.

2.The Cape de Verd Islands were discovered in 1449. There was a tombstone of a bishop with the date of 1571; and a crest of a hand and dagger, dated 1497.

3.I must take this opportunity of acknowledging the great kindness with which this illustrious naturalist has examined many of my specimens. I have sent (June, 1845) a full account of the falling of this dust to the Geological Society.

4.So named according to Patrick Symes's nomenclature.

5.See Encyclop. of Anat. and Physiol., article Cephalopoda

6.Mr. Horner and Sir David Brewster have described (Philosophical Transactions, 1836, p. 65) a singular "artificial substance resembling shell." It is deposited in fine, transparent, highly polished, brown-coloured laminae, possessing peculiar optical properties, on the inside of a vessel, in which cloth, first prepared with glue and then with lime, is made to revolve rapidly in water. It is much softer, more transparent, and contains more animal matter, than the natural incrustation at Ascension; but we here again see the strong tendency which carbonate of lime and animal matter evince to form a solid substance allied to shell.

7.Pers. Narr., vol. v., pt. 1., p. 18.

8.M. Montagne, in Comptes Rendus, etc., Juillet, 1844; and Annal. des Scienc. Nat., Dec. 1844

9.M. Lesson (Voyage de la Coquille, tom. i., p. 255) mentions red water off Lima, apparently produced by the same cause. Peron, the distinguished naturalist, in the Voyage aux Terres Australes, gives no less than twelve references to voyagers who have alluded to the discoloured waters of the sea (vol. ii. p. 239). To the references given by Peron may be added, Humboldt's Pers. Narr., vol. vi. p. 804; Flinder's Voyage, vol. i. p. 92; Labillardiere, vol. i. p. 287; Ulloa's Voyage; Voyage of the Astrolabe and of the Coquille; Captain King's Survey of Australia, etc.

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Chapter 2 - Rio de Janeiro

<Imagine: * >Rio de Janeiro <Imagine: * > Excursion north of Cape Frio <Imagine: * >
Great Evaporation <Imagine: * > Slavery <Imagine: * > Botofogo Bay <Imagine: * >
Terrestrial Planariae <Imagine: * > Clouds on the Corcovado <Imagine: * > Heavy Rain
<Imagine: * > Musical Frogs <Imagine: * > Phosphorescent Insects <Imagine: * > Elater,
springing powers of <Imagine: * > Blue Haze <Imagine: * > Noise made by a Butterfly
<Imagine: * > Entomology <Imagine: * > Ants <Imagine: * > Wasp killing a Spider
<Imagine: * > Parasitical Spider <Imagine: * > Artifices of an Epeira <Imagine: * >
Gregarious Spider <Imagine: * > Spider with an unsymmetrical Web.

APRIL 4th to July 5th, 1832. -- A few days after our arrival I became acquainted with an
Englishman who was going to visit his estate, situated rather more than a hundred miles from the
capital, to the northward of Cape Frio. I gladly accepted his kind offer of allowing me to
accompany him.

April 8th. -- Our party amounted to seven. The first stage was very interesting. The day was
powerfully hot, and as we passed through the woods, everything was motionless, excepting the
large and brilliant butterflies, which lazily fluttered about. The view seen when crossing the hills
behind Praia Grande was most beautiful; the colours were intense, and the prevailing tint a dark
blue; the sky and the calm waters of the bay vied with each other in splendour. After passing
through some cultivated country, we entered a forest, which in the grandeur of all its parts could
not be exceeded. We arrived by midday at Ithacaia; this small village is situated on a plain, and
round the central house are the huts of the negroes. These, from their regular form and position,
reminded me of the drawings of the Hottentot habitations in Southern Africa. As the moon rose
early, we determined to start the same evening for our sleeping-place at the Lagoa Marica. As it
was growing dark we passed under one of the massive, bare, and steep hills of granite which are
so common in this country. This spot is notorious from having been, for a long time, the residence
of some runaway slaves, who, by cultivating a little ground near the top, contrived to eke out a
subsistence. At length they were discovered, and a party of soldiers being sent, the whole were
seized with the exception of one old woman, who, sooner than again be led into slavery, dashed
herself to pieces from the summit of the mountain. In a Roman matron this would have been
called the noble love of freedom: in a poor negress it is mere brutal obstinacy. We continued
riding for some hours. For the few last miles the road was intricate, and it passed through a desert
waste of marshes and lagoons. The scene by the dimmed light of the moon was most desolate. A
few fireflies flitted by us; and the solitary snipe, as it rose, uttered its plaintive cry. The distant
and sullen roar of the sea scarcely broke the stillness of the night.

April 9th. -- We left our miserable sleeping-place before sunrise. The road passed through a narrow sandy plain, lying between the sea and the interior salt lagoons. The number of beautiful fishing birds, such as egrets and cranes, and the succulent plants assuming most fantastical forms, gave to the scene an interest which it would not otherwise have possessed. The few stunted trees were loaded with parasitical plants, among which the beauty and delicious fragrance of some of the orchideae were most to be admired. As the sun rose, the day became extremely hot, and the reflection of the light and heat from the white sand was very distressing. We dined at Mandetiba; the thermometer in the shade being 84 degs. The beautiful view of the distant wooded hills, reflected in the perfectly calm water of an extensive lagoon, quite refreshed us. As the venda [1] here was a very good one, and I have the pleasant, but rare remembrance, of an excellent dinner, I will be grateful and presently describe it, as the type of its class. These houses are often large, and are built of thick upright posts, with boughs interwoven, and afterwards plastered. They seldom have floors, and never glazed windows; but are generally pretty well roofed. Universally the front part is open, forming a kind of verandah, in which tables and benches are placed. The bed-rooms join on each side, and here the passenger may sleep as comfortably as he can, on a wooden platform, covered by a thin straw mat. The venda stands in a courtyard, where the horses are fed. On first arriving it was our custom to unsaddle the horses and give them their Indian corn; then, with a low bow, to ask the senhor to do us the favour to give up something to eat. "Anything you choose, sir," was his usual answer. For the few first times, vainly I thanked providence for having guided us to so good a man. The conversation proceeding, the case universally became deplorable. "Any fish can you do us the favour of giving?" -- "Oh! no, sir." -- "Any soup?" -- "No, sir." -- "Any bread?" -- "Oh! no, sir." -- "Any dried meat?" -- "Oh! no, sir." If we were lucky, by waiting a couple of hours, we obtained fowls, rice, and farinha. It not unfrequently happened, that we were obliged to kill, with stones, the poultry for our own supper. When, thoroughly exhausted by fatigue and hunger, we timorously hinted that we should be glad of our meal, the pompous, and (though true) most unsatisfactory answer was, "It will be ready when it is ready." If we had dared to remonstrate any further, we should have been told to proceed on our journey, as being too impertinent. The hosts are most ungracious and disagreeable in their manners; their houses and their persons are often filthily dirty; the want of the accommodation of forks, knives, and spoons is common; and I am sure no cottage or hovel in England could be found in a state so utterly destitute of every comfort. At Campos Novos, however, we fared sumptuously; having rice and fowls, biscuit, wine, and spirits, for dinner; coffee in the evening, and fish with coffee for breakfast. All this, with good food for the horses, only cost 2s. 6d. per head. Yet the host of this venda, being asked if he knew anything of a whip which one of the party had lost, gruffly answered, "How should I know? why did you not take care of it? -- I suppose the dogs have eaten it."

Leaving Mandetiba, we continued to pass through an intricate wilderness of lakes; in some of which were fresh, in others salt water shells. Of the former kinds, I found a *Limnaea* in great numbers in a lake, into which, the inhabitants assured me that the sea enters once a year, and sometimes oftener, and makes the water quite salt. I have no doubt many interesting facts, in relation to marine and fresh water animals, might be observed in this chain of lagoons, which skirt the coast of Brazil. M. Gay [2] has stated that he found in the neighbourhood of Rio, shells of the marine genera *solen* and *mytilus*, and fresh water *ampullariae*, living together in brackish water. I also frequently observed in the lagoon near the Botanic Garden, where the water is only a little less salt than in the sea, a species of *hydrophilus*, very similar to a water-beetle common in the ditches of England: in the same lake the only shell belonged to a genus generally found in estuaries.

Leaving the coast for a time, we again entered the forest. The trees were very lofty, and remarkable, compared with those of Europe, from the whiteness of their trunks. I see by my notebook, "wonderful and beautiful, flowering parasites," invariably struck me as the most novel object in these grand scenes. Travelling onwards we passed through tracts of pasturage, much injured by the enormous conical ants' nests, which were nearly twelve feet high. They gave to the plain exactly the appearance of the mud volcanos at Jorullo, as figured by Humboldt. We arrived at Engenhodo after it was dark, having been ten hours on horseback. I never ceased, during the whole journey, to be surprised at the amount of labour which the horses were capable of enduring; they appeared also to recover from any injury much sooner than those of our English breed. The Vampire bat is often the cause of much trouble, by biting the horses on their withers. The injury is generally not so much owing to the loss of blood, as to the inflammation which the pressure of the saddle afterwards produces. The whole circumstance has lately been doubted in England; I was therefore fortunate in being present when one (*Desmodus d'orbignyi*, Wat.) was actually caught on a horse's back. We were bivouacking late one evening near Coquimbo, in Chile, when my servant, noticing that one of the horses was very restive, went to see what was the matter, and fancying he could distinguish something, suddenly put his hand on the beast's withers, and secured the vampire. In the morning the spot where the bite had been inflicted was easily distinguished from being slightly swollen and bloody. The third day afterwards we rode the horse, without any ill effects.

April 13th. -- After three days' travelling we arrived at Socego, the estate of Senhor Manuel Figuereda, a relation of one of our party. The house was simple, and, though like a barn in form, was well suited to the climate. In the sitting-room gilded chairs and sofas were oddly contrasted with the whitewashed walls, thatched roof, and windows without glass. The house, together with the granaries, the stables, and workshops for the blacks, who had been taught various trades, formed a rude kind of quadrangle; in the centre of which a large pile of coffee was drying. These buildings stand on a little hill, overlooking the cultivated ground, and surrounded on every side by a wall of dark green luxuriant forest. The chief produce of this part of the country is coffee. Each tree is supposed to yield annually, on an average, two pounds; but some give as much as eight. Mandioca or cassada is likewise cultivated in great quantity. Every part of this plant is useful; the leaves and stalks are eaten by the horses, and the roots are ground into a pulp, which, when pressed dry and baked, forms the farinha, the principal article of sustenance in the Brazils. It is a curious, though well-known fact, that the juice of this most nutritious plant is highly poisonous. A few years ago a cow died at this Fazenda, in consequence of having drunk some of it. Senhor Figuereda told me that he had planted, the year before, one bag of feijao or beans, and three of rice; the former of which produced eighty, and the latter three hundred and twenty fold. The pasturage supports a fine stock of cattle, and the woods are so full of game that a deer had been killed on each of the three previous days. This profusion of food showed itself at dinner, where, if the tables did not groan, the guests surely did; for each person is expected to eat of every dish. One day, having, as I thought, nicely calculated so that nothing should go away untasted, to my utter dismay a roast turkey and a pig appeared in all their substantial reality. During the meals, it was the employment of a man to drive out of the room sundry old hounds, and dozens of little black children, which crawled in together, at every opportunity. As long as the idea of slavery could be banished, there was something exceedingly fascinating in this simple and patriarchal style of living: it was such a perfect retirement and independence from the rest of the world.

As soon as any stranger is seen arriving, a large bell is set tolling, and generally some small cannon are fired. The event is thus announced to the rocks and woods, but to nothing else. One morning I walked out an hour before daylight to admire the solemn stillness of the scene; at last, the silence was broken by the morning hymn, raised on high by the whole body of the blacks; and

in this manner their daily work is generally begun. On such fazendas as these, I have no doubt the slaves pass happy and contented lives. On Saturday and Sunday they work for themselves, and in this fertile climate the labour of two days is sufficient to support a man and his family for the whole week.

April 14th. -- Leaving Socego, we rode to another estate on the Rio Macae, which was the last patch of cultivated ground in that direction. The estate was two and a half miles long, and the owner had forgotten how many broad. Only a very small piece had been cleared, yet almost every acre was capable of yielding all the various rich productions of a tropical land. Considering the enormous area of Brazil, the proportion of cultivated ground can scarcely be considered as anything, compared to that which is left in the state of nature: at some future age, how vast a population it will support! During the second day's journey we found the road so shut up, that it was necessary that a man should go ahead with a sword to cut away the creepers. The forest abounded with beautiful objects; among which the tree ferns, though not large, were, from their bright green foliage, and the elegant curvature of their fronds, most worthy of admiration. In the evening it rained very heavily, and although the thermometer stood at 65 degs., I felt very cold. As soon as the rain ceased, it was curious to observe the extraordinary evaporation which commenced over the whole extent of the forest. At the height of a hundred feet the hills were buried in a dense white vapour, which rose like columns of smoke from the most thickly wooded parts, and especially from the valleys. I observed this phenomenon on several occasions. I suppose it is owing to the large surface of foliage, previously heated by the sun's rays.

While staying at this estate, I was very nearly being an eye-witness to one of those atrocious acts which can only take place in a slave country. Owing to a quarrel and a lawsuit, the owner was on the point of taking all the women and children from the male slaves, and selling them separately at the public auction at Rio. Interest, and not any feeling of compassion, prevented this act. Indeed, I do not believe the inhumanity of separating thirty families, who had lived together for many years, even occurred to the owner. Yet I will pledge myself, that in humanity and good feeling he was superior to the common run of men. It may be said there exists no limit to the blindness of interest and selfish habit. I may mention one very trifling anecdote, which at the time struck me more forcibly than any story of cruelty. I was crossing a ferry with a negro, who was uncommonly stupid. In endeavouring to make him understand, I talked loud, and made signs, in doing which I passed my hand near his face. He, I suppose, thought I was in a passion, and was going to strike him; for instantly, with a frightened look and half-shut eyes, he dropped his hands. I shall never forget my feelings of surprise, disgust, and shame, at seeing a great powerful man afraid even to ward off a blow, directed, as he thought, at his face. This man had been trained to a degradation lower than the slavery of the most helpless animal.

April 18th. -- In returning we spent two days at Socego, and I employed them in collecting insects in the forest. The greater number of trees, although so lofty, are not more than three or four feet in circumference. There are, of course, a few of much greater dimensions. Senhor Manuel was then making a canoe 70 feet in length from a solid trunk, which had originally been 110 feet long, and of great thickness. The contrast of palm trees, growing amidst the common branching kinds, never fails to give the scene an intertropical character. Here the woods were ornamented by the Cabbage Palm -- one of the most beautiful of its family. With a stem so narrow that it might be clasped with the two hands, it waves its elegant head at the height of forty or fifty feet above the ground. The woody creepers, themselves covered by other creepers, were of great thickness: some which I measured were two feet in circumference. Many of the older trees presented a very curious appearance from the tresses of a liana hanging from their boughs, and resembling bundles of hay. If the eye was turned from the world of foliage above, to the ground beneath, it was

attracted by the extreme elegance of the leaves of the ferns and mimosae. The latter, in some parts, covered the surface with a brushwood only a few inches high. In walking across these thick beds of mimosae, a broad track was marked by the change of shade, produced by the drooping of their sensitive petioles. It is easy to specify the individual objects of admiration in these grand scenes; but it is not possible to give an adequate idea of the higher feelings of wonder, astonishment, and devotion, which fill and elevate the mind.

April 19th.--Leaving Socego, during the two first days, we retraced our steps. It was very wearisome work, as the road generally ran across a glaring hot sandy plain, not far from the coast. I noticed that each time the horse put its foot on the fine siliceous sand, a gentle chirping noise was produced. On the third day we took a different line, and passed through the gay little village of Madre de Deos. This is one of the principal lines of road in Brazil; yet it was in so bad a state that no wheeled vehicle, excepting the clumsy bullock-wagon, could pass along. In our whole journey we did not cross a single bridge built of stone; and those made of logs of wood were frequently so much out of repair, that it was necessary to go on one side to avoid them. All distances are inaccurately known. The road is often marked by crosses, in the place of milestones, to signify where human blood has been spilled. On the evening of the 23rd we arrived at Rio, having finished our pleasant little excursion.

During the remainder of my stay at Rio, I resided in a cottage at Botofogo Bay. It was impossible to wish for anything more delightful than thus to spend some weeks in so magnificent a country. In England any person fond of natural history enjoys in his walks a great advantage, by always having something to attract his attention; but in these fertile climates, teeming with life, the attractions are so numerous, that he is scarcely able to walk at all.

The few observations which I was enabled to make were almost exclusively confined to the invertebrate animals. The existence of a division of the genus *Planaria*, which inhabits the dry land, interested me much. These animals are of so simple a structure, that Cuvier has arranged them with the intestinal worms, though never found within the bodies of other animals. Numerous species inhabit both salt and fresh water; but those to which I allude were found, even in the drier parts of the forest, beneath logs of rotten wood, on which I believe they feed. In general form they resemble little slugs, but are very much narrower in proportion, and several of the species are beautifully coloured with longitudinal stripes. Their structure is very simple: near the middle of the under or crawling surface there are two small transverse slits, from the anterior one of which a funnel-shaped and highly irritable mouth can be protruded. For some time after the rest of the animal was completely dead from the effects of salt water or any other cause, this organ still retained its vitality.

I found no less than twelve different species of terrestrial *Planariae* in different parts of the southern hemisphere. [3] Some specimens which I obtained at Van Dieman's Land, I kept alive for nearly two months, feeding them on rotten wood. Having cut one of them transversely into two nearly equal parts, in the course of a fortnight both had the shape of perfect animals. I had, however, so divided the body, that one of the halves contained both the inferior orifices, and the other, in consequence, none. In the course of twenty-five days from the operation, the more perfect half could not have been distinguished from any other specimen. The other had increased much in size; and towards its posterior end, a clear space was formed in the parenchymatous mass, in which a rudimentary cup-shaped mouth could clearly be distinguished; on the under surface, however, no corresponding slit was yet open. If the increased heat of the weather, as we approached the equator, had not destroyed all the individuals, there can be no doubt that this last step would have completed its structure. Although so well-known an experiment, it was

interesting to watch the gradual production of every essential organ, out of the simple extremity of another animal. It is extremely difficult to preserve these Planariae; as soon as the cessation of life allows the ordinary laws of change to act, their entire bodies become soft and fluid, with a rapidity which I have never seen equalled.

I first visited the forest in which these Planariae were found, in company with an old Portuguese priest who took me out to hunt with him. The sport consisted in turning into the cover a few dogs, and then patiently waiting to fire at any animal which might appear. We were accompanied by the son of a neighbouring farmer -- a good specimen of a wild Brazilian youth. He was dressed in a tattered old shirt and trousers, and had his head uncovered: he carried an old-fashioned gun and a large knife. The habit of carrying the knife is universal; and in traversing a thick wood it is almost necessary, on account of the creeping plants. The frequent occurrence of murder may be partly attributed to this habit. The Brazilians are so dexterous with the knife, that they can throw it to some distance with precision, and with sufficient force to cause a fatal wound. I have seen a number of little boys practising this art as a game of play and from their skill in hitting an upright stick, they promised well for more earnest attempts. My companion, the day before, had shot two large bearded monkeys. These animals have prehensile tails, the extremity of which, even after death, can support the whole weight of the body. One of them thus remained fast to a branch, and it was necessary to cut down a large tree to procure it. This was soon effected, and down came tree and monkey with an awful crash. Our day's sport, besides the monkey, was confined to sundry small green parrots and a few toucans. I profited, however, by my acquaintance with the Portuguese padre, for on another occasion he gave me a fine specimen of the Yagouaroundsi cat.

Every one has heard of the beauty of the scenery near Botofogo. The house in which I lived was seated close beneath the well-known mountain of the Corcovado. It has been remarked, with much truth, that abruptly conical hills are characteristic of the formation which Humboldt designates as gneiss-granite. Nothing can be more striking than the effect of these huge rounded masses of naked rock rising out of the most luxuriant vegetation.

I was often interested by watching the clouds, which, rolling in from seaward, formed a bank just beneath the highest point of the Corcovado. This mountain, like most others, when thus partly veiled, appeared to rise to a far prouder elevation than its real height of 2300 feet. Mr. Daniell has observed, in his meteorological essays, that a cloud sometimes appears fixed on a mountain summit, while the wind continues to blow over it. The same phenomenon here presented a slightly different appearance. In this case the cloud was clearly seen to curl over, and rapidly pass by the summit, and yet was neither diminished nor increased in size. The sun was setting, and a gentle southerly breeze, striking against the southern side of the rock, mingled its current with the colder air above; and the vapour was thus condensed; but as the light wreaths of cloud passed over the ridge, and came within the influence of the warmer atmosphere of the northern sloping bank, they were immediately re-dissolved.

The climate, during the months of May and June, or the beginning of winter, was delightful. The mean temperature, from observations taken at nine o'clock, both morning and evening, was only 72 degs. It often rained heavily, but the drying southerly winds soon again rendered the walks pleasant. One morning, in the course of six hours, 1.6 inches of rain fell. As this storm passed over the forests which surround the Corcovado, the sound produced by the drops pattering on the countless multitude of leaves was very remarkable, it could be heard at the distance of a quarter of a mile, and was like the rushing of a great body of water. After the hotter days, it was delicious to sit quietly in the garden and watch the evening pass into night. Nature, in these climes, chooses her vocalists from more humble performers than in Europe. A small frog, of the genus *Hyla*, sits

on a blade of grass about an inch above the surface of the water, and sends forth a pleasing chirp: when several are together they sing in harmony on different notes. I had some difficulty in catching a specimen of this frog. The genus *Hyla* has its toes terminated by small suckers; and I found this animal could crawl up a pane of glass, when placed absolutely perpendicular. Various cicadae and crickets, at the same time, keep up a ceaseless shrill cry, but which, softened by the distance, is not unpleasant. Every evening after dark this great concert commenced; and often have I sat listening to it, until my attention has been drawn away by some curious passing insect.

At these times the fireflies are seen flitting about from hedge to hedge. On a dark night the light can be seen at about two hundred paces distant. It is remarkable that in all the different kinds of glowworms, shining elaters, and various marine animals (such as the crustacea, medusae, nereidae, a coralline of the genus *Clytia*, and *Pyrosma*), which I have observed, the light has been of a well-marked green colour. All the fireflies, which I caught here, belonged to the Lampyridae (in which family the English glowworm is included), and the greater number of specimens were of *Lampyrus occidentalis*. [4] I found that this insect emitted the most brilliant flashes when irritated: in the intervals, the abdominal rings were obscured. The flash was almost co-instantaneous in the two rings, but it was just perceptible first in the anterior one. The shining matter was fluid and very adhesive: little spots, where the skin had been torn, continued bright with a slight scintillation, whilst the uninjured parts were obscured. When the insect was decapitated the rings remained uninterruptedly bright, but not so brilliant as before: local irritation with a needle always increased the vividness of the light. The rings in one instance retained their luminous property nearly twenty-four hours after the death of the insect. From these facts it would appear probable, that the animal has only the power of concealing or extinguishing the light for short intervals, and that at other times the display is involuntary. On the muddy and wet gravel-walks I found the larvae of this lampyrus in great numbers: they resembled in general form the female of the English glowworm. These larvae possessed but feeble luminous powers; very differently from their parents, on the slightest touch they feigned death and ceased to shine; nor did irritation excite any fresh display. I kept several of them alive for some time: their tails are very singular organs, for they act, by a well-fitted contrivance, as suckers or organs of attachment, and likewise as reservoirs for saliva, or some such fluid. I repeatedly fed them on raw meat; and I invariably observed, that every now and then the extremity of the tail was applied to the mouth, and a drop of fluid exuded on the meat, which was then in the act of being consumed. The tail, notwithstanding so much practice, does not seem to be able to find its way to the mouth; at least the neck was always touched first, and apparently as a guide.

When we were at Bahia, an elater or beetle (*Pyrophorus luminosus*, Illig.) seemed the most common luminous insect. The light in this case was also rendered more brilliant by irritation. I amused myself one day by observing the springing powers of this insect, which have not, as it appears to me, been properly described. [5] The elater, when placed on its back and preparing to spring, moved its head and thorax backwards, so that the pectoral spine was drawn out, and rested on the edge of its sheath. The same backward movement being continued, the spine, by the full action of the muscles, was bent like a spring; and the insect at this moment rested on the extremity of its head and wing-cases. The effort being suddenly relaxed, the head and thorax flew up, and in consequence, the base of the wing-cases struck the supporting surface with such force, that the insect by the reaction was jerked upwards to the height of one or two inches. The projecting points of the thorax, and the sheath of the spine, served to steady the whole body during the spring. In the descriptions which I have read, sufficient stress does not appear to have been laid on the elasticity of the spine: so sudden a spring could not be the result of simple muscular contraction, without the aid of some mechanical contrivance.

On several occasions I enjoyed some short but most pleasant excursions in the neighbouring country. One day I went to the Botanic Garden, where many plants, well known for their great utility, might be seen growing. The leaves of the camphor, pepper, cinnamon, and clove trees were delightfully aromatic; and the bread-fruit, the jaca, and the mango, vied with each other in the magnificence of their foliage. The landscape in the neighbourhood of Bahia almost takes its character from the two latter trees. Before seeing them, I had no idea that any trees could cast so black a shade on the ground. Both of them bear to the evergreen vegetation of these climates the same kind of relation which laurels and hollies in England do to the lighter green of the deciduous trees. It may be observed, that the houses within the tropics are surrounded by the most beautiful forms of vegetation, because many of them are at the same time most useful to man. Who can doubt that these qualities are united in the banana, the cocoa-nut, the many kinds of palm, the orange, and the bread-fruit tree?

During this day I was particularly struck with a remark of Humboldt's, who often alludes to "the thin vapour which, without changing the transparency of the air, renders its tints more harmonious, and softens its effects." This is an appearance which I have never observed in the temperate zones. The atmosphere, seen through a short space of half or three-quarters of a mile, was perfectly lucid, but at a greater distance all colours were blended into a most beautiful haze, of a pale French grey, mingled with a little blue. The condition of the atmosphere between the morning and about noon, when the effect was most evident, had undergone little change, excepting in its dryness. In the interval, the difference between the dew point and temperature had increased from 7.5 to 17 degs.

On another occasion I started early and walked to the Gavia, or topsail mountain. The air was delightfully cool and fragrant; and the drops of dew still glittered on the leaves of the large liliaceous plants, which shaded the streamlets of clear water. Sitting down on a block of granite, it was delightful to watch the various insects and birds as they flew past. The humming-bird seems particularly fond of such shady retired spots. Whenever I saw these little creatures buzzing round a flower, with their wings vibrating so rapidly as to be scarcely visible, I was reminded of the sphinx moths: their movements and habits are indeed in many respects very similar.

Following a pathway, I entered a noble forest, and from a height of five or six hundred feet, one of those splendid views was presented, which are so common on every side of Rio. At this elevation the landscape attains its most brilliant tint; and every form, every shade, so completely surpasses in magnificence all that the European has ever beheld in his own country, that he knows not how to express his feelings. The general effect frequently recalled to my mind the gayest scenery of the Opera-house or the great theatres. I never returned from these excursions empty-handed. This day I found a specimen of a curious fungus, called *Hymenophallus*. Most people know the English *Phallus*, which in autumn taints the air with its odious smell: this, however, as the entomologist is aware, is, to some of our beetles a delightful fragrance. So was it here; for a *Strongylus*, attracted by the odour, alighted on the fungus as I carried it in my hand. We here see in two distant countries a similar relation between plants and insects of the same families, though the species of both are different. When man is the agent in introducing into a country a new species, this relation is often broken: as one instance of this I may mention, that the leaves of the cabbages and lettuces, which in England afford food to such a multitude of slugs and caterpillars, in the gardens near Rio are untouched.

During our stay at Brazil I made a large collection of insects. A few general observations on the comparative importance of the different orders may be interesting to the English entomologist. The large and brilliantly coloured *Lepidoptera* bespeak the zone they inhabit, far more plainly

than any other race of animals. I allude only to the butterflies; for the moths, contrary to what might have been expected from the rankness of the vegetation, certainly appeared in much fewer numbers than in our own temperate regions. I was much surprised at the habits of *Papilio feronia*. This butterfly is not uncommon, and generally frequents the orange-groves. Although a high flier, yet it very frequently alights on the trunks of trees. On these occasions its head is invariably placed downwards; and its wings are expanded in a horizontal plane, instead of being folded vertically, as is commonly the case. This is the only butterfly which I have ever seen, that uses its legs for running. Not being aware of this fact, the insect, more than once, as I cautiously approached with my forceps, shuffled on one side just as the instrument was on the point of closing, and thus escaped. But a far more singular fact is the power which this species possesses of making a noise. [6] Several times when a pair, probably male and female, were chasing each other in an irregular course, they passed within a few yards of me; and I distinctly heard a clicking noise, similar to that produced by a toothed wheel passing under a spring catch. The noise was continued at short intervals, and could be distinguished at about twenty yards' distance: I am certain there is no error in the observation.

I was disappointed in the general aspect of the Coleoptera. The number of minute and obscurely coloured beetles is exceedingly great. [7] The cabinets of Europe can, as yet, boast only of the larger species from tropical climates. It is sufficient to disturb the composure of an entomologist's mind, to look forward to the future dimensions of a complete catalogue. The carnivorous beetles, or Carabidae, appear in extremely few numbers within the tropics: this is the more remarkable when compared to the case of the carnivorous quadrupeds, which are so abundant in hot countries. I was struck with this observation both on entering Brazil, and when I saw the many elegant and active forms of the Harpalidae re-appearing on the temperate plains of La Plata. Do the very numerous spiders and rapacious Hymenoptera supply the place of the carnivorous beetles? The carrion-feeders and Brachelytra are very uncommon; on the other hand, the Rhyncophora and Chrysomelidae, all of which depend on the vegetable world for subsistence, are present in astonishing numbers. I do not here refer to the number of different species, but to that of the individual insects; for on this it is that the most striking character in the entomology of different countries depends. The orders Orthoptera and Hemiptera are particularly numerous; as likewise is the stinging division of the Hymenoptera the bees, perhaps, being excepted. A person, on first entering a tropical forest, is astonished at the labours of the ants: well-beaten paths branch off in every direction, on which an army of never-failing foragers may be seen, some going forth, and others returning, burdened with pieces of green leaf, often larger than their own bodies.

A small dark-coloured ant sometimes migrates in countless numbers. One day, at Bahia, my attention was drawn by observing many spiders, cockroaches, and other insects, and some lizards, rushing in the greatest agitation across a bare piece of ground. A little way behind, every stalk and leaf was blackened by a small ant. The swarm having crossed the bare space, divided itself, and descended an old wall. By this means many insects were fairly enclosed; and the efforts which the poor little creatures made to extricate themselves from such a death were wonderful. When the ants came to the road they changed their course, and in narrow files reascended the wall. Having placed a small stone so as to intercept one of the lines, the whole body attacked it, and then immediately retired. Shortly afterwards another body came to the charge, and again having failed to make any impression, this line of march was entirely given up. By going an inch round, the file might have avoided the stone, and this doubtless would have happened, if it had been originally there: but having been attacked, the lion-hearted little warriors scorned the idea of yielding.

Certain wasp-like insects, which construct in the corners of the verandahs clay cells for their larvae, are very numerous in the neighbourhood of Rio. These cells they stuff full of half-dead spiders and caterpillars, which they seem wonderfully to know how to sting to that degree as to leave them paralysed but alive, until their eggs are hatched; and the larvae feed on the horrid mass of powerless, half-killed victims -- a sight which has been described by an enthusiastic naturalist [8] as curious and pleasing! I was much interested one day by watching a deadly contest between a *Pepsis* and a large spider of the genus *Lycosa*. The wasp made a sudden dash at its prey, and then flew away: the spider was evidently wounded, for, trying to escape, it rolled down a little slope, but had still strength sufficient to crawl into a thick tuft of grass. The wasp soon returned, and seemed surprised at not immediately finding its victim. It then commenced as regular a hunt as ever hound did after fox; making short semicircular casts, and all the time rapidly vibrating its wings and antennae. The spider, though well concealed, was soon discovered, and the wasp, evidently still afraid of its adversary's jaws, after much manoeuvring, inflicted two stings on the under side of its thorax. At last, carefully examining with its antennae the now motionless spider, it proceeded to drag away the body. But I stopped both tyrant and prey. [9]

The number of spiders, in proportion to other insects, is here compared with England very much larger; perhaps more so than with any other division of the articulate animals. The variety of species among the jumping spiders appears almost infinite. The genus, or rather family, of *Epeira*, is here characterized by many singular forms; some species have pointed coriaceous shells, others enlarged and spiny tibiae. Every path in the forest is barricaded with the strong yellow web of a species, belonging to the same division with the *Epeira clavipes* of Fabricius, which was formerly said by Sloane to make, in the West Indies, webs so strong as to catch birds. A small and pretty kind of spider, with very long fore-legs, and which appears to belong to an undescribed genus, lives as a parasite on almost every one of these webs. I suppose it is too insignificant to be noticed by the great *Epeira*, and is therefore allowed to prey on the minute insects, which, adhering to the lines, would otherwise be wasted. When frightened, this little spider either feigns death by extending its front legs, or suddenly drops from the web. A large *Epeira* of the same division with *Epeira tuberculata* and *conica* is extremely common, especially in dry situations. Its web, which is generally placed among the great leaves of the common agave, is sometimes strengthened near the centre by a pair or even four zigzag ribbons, which connect two adjoining rays. When any large insect, as a grasshopper or wasp, is caught, the spider, by a dexterous movement, makes it revolve very rapidly, and at the same time emitting a band of threads from its spinners, soon envelops its prey in a case like the cocoon of a silkworm. The spider now examines the powerless victim, and gives the fatal bite on the hinder part of its thorax; then retreating, patiently waits till the poison has taken effect. The virulence of this poison may be judged of from the fact that in half a minute I opened the mesh, and found a large wasp quite lifeless. This *Epeira* always stands with its head downwards near the centre of the web. When disturbed, it acts differently according to circumstances: if there is a thicket below, it suddenly falls down; and I have distinctly seen the thread from the spinners lengthened by the animal while yet stationary, as preparatory to its fall. If the ground is clear beneath, the *Epeira* seldom falls, but moves quickly through a central passage from one to the other side. When still further disturbed, it practises a most curious manoeuvre: standing in the middle, it violently jerks the web, which it attached to elastic twigs, till at last the whole acquires such a rapid vibratory movement, that even the outline of the spider's body becomes indistinct.

It is well known that most of the British spiders, when a large insect is caught in their webs, endeavour to cut the lines and liberate their prey, to save their nets from being entirely spoiled. I once, however, saw in a hot-house in Shropshire a large female wasp caught in the irregular web of a quite small spider; and this spider, instead of cutting the web, most perseveringly continued

to entangle the body, and especially the wings, of its prey. The wasp at first aimed in vain repeated thrusts with its sting at its little antagonist. Pitying the wasp, after allowing it to struggle for more than an hour, I killed it and put it back into the web. The spider soon returned; and an hour afterwards I was much surprised to find it with its jaws buried in the orifice, through which the sting is protruded by the living wasp. I drove the spider away two or three times, but for the next twenty-four hours I always found it again sucking at the same place. The spider became much distended by the juices of its prey, which was many times larger than itself.

I may here just mention, that I found, near St. Fe Bajada, many large black spiders, with ruby-coloured marks on their backs, having gregarious habits. The webs were placed vertically, as is invariably the case with the genus *Epeira*: they were separated from each other by a space of about two feet, but were all attached to certain common lines, which were of great length, and extended to all parts of the community. In this manner the tops of some large bushes were encompassed by the united nets. Azara [10] has described a gregarious spider in Paraguay, which Walckenaer thinks must be a *Theridion*, but probably it is an *Epeira*, and perhaps even the same species with mine. I cannot, however, recollect seeing a central nest as large as a hat, in which, during autumn, when the spiders die, Azara says the eggs are deposited. As all the spiders which I saw were of the same size, they must have been nearly of the same age. This gregarious habit, in so typical a genus as *Epeira*, among insects, which are so bloodthirsty and solitary that even the two sexes attack each other, is a very singular fact.

In a lofty valley of the Cordillera, near Mendoza, I found another spider with a singularly-formed web. Strong lines radiated in a vertical plane from a common centre, where the insect had its station; but only two of the rays were connected by a symmetrical mesh-work; so that the net, instead of being, as is generally the case, circular, consisted of a wedge-shaped segment. All the webs were similarly constructed.

[1] Venda, the Portuguese name for an inn.

[2] *Annales des Sciences Naturelles* for 1833.

[3] I have described and named these species in the *Annals of Nat. Hist.*, vol. xiv. p. 241.

[4] I am greatly indebted to Mr. Waterhouse for his kindness in naming for me this and many other insects, and giving me much valuable assistance.

[5] Kirby's *Entomology*, vol. ii. p. 317.

[6] Mr. Doubleday has lately described (before the Entomological Society, March 3rd, 1845) a peculiar structure in the wings of this butterfly, which seems to be the means of its making its noise. He says, "It is remarkable for having a sort of drum at the base of the fore wings, between the costal nervure and the subcostal. These two nervures, moreover, have a peculiar screw-like diaphragm or vessel in the interior." I find in Langsdorff's travels (in the years 1803-7, p. 74) it is said, that in the island of St. Catherine's on the coast of Brazil, a butterfly called *Februa Hoffmanssegi*, makes a noise, when flying away, like a rattle.

[7] I may mention, as a common instance of one day's (June 23rd) collecting, when I was not attending particularly to the Coleoptera, that I caught sixty-eight species of that order. Among these, there were only two of the Carabidae, four Brachelytra, fifteen Rhyncophora, and fourteen of the Chrysomelidae. Thirty-seven species of Arachnidae, which I brought home, will be

sufficient to prove that I was not paying overmuch attention to the generally favoured order of Coleoptera.

[8] In a MS. in the British Museum by Mr. Abbott, who made his observations in Georgia; see Mr. A. White's paper in the "Annals of Nat. Hist.," vol. vii. p. 472. Lieut. Hutton has described a sphex with similar habits in India, in the "Journal of the Asiatic Society," vol. i. p. 555.

[9] Don Felix Azara (vol. i. p. 175), mentioning a hymenopterous insect, probably of the same genus, says he saw it dragging a dead spider through tall grass, in a straight line to its nest, which was one hundred and sixty-three paces distant. He adds that the wasp, in order to find the road, every now and then made "demi-tours d'environ trois palmes."

[10] Azara's Voyage, vol. i. p. 213

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Chapter 3 - Maldonado

<Imagine: * >Monte Video <Imagine: * > Excursion to R. Polanco <Imagine: * > Lazo and Bolas <Imagine: * > Partridges <Imagine: * > Absence of Trees <Imagine: * > Deer <Imagine: * > Capybara, or River Hog <Imagine: * > Tucutuco <Imagine: * > Molothrus, cuckoo-like habits <Imagine: * > Tyrant-flycatcher <Imagine: * > Mocking-bird <Imagine: * > Carrion Hawks <Imagine: * > Tubes formed by Lightning <Imagine: * > House struck.

July 5th, 1832 -- In the morning we got under way, and stood out of the splendid harbour of Rio de Janeiro. In our passage to the Plata, we saw nothing particular, excepting on one day a great shoal of porpoises, many hundreds in number. The whole sea was in places furrowed by them; and a most extraordinary spectacle was presented, as hundreds, proceeding together by jumps, in which their whole bodies were exposed, thus cut the water. When the ship was running nine knots an hour, these animals could cross and recross the bows with the greatest of ease, and then dash away right ahead. As soon as we entered the estuary of the Plata, the weather was very unsettled. One dark night we were surrounded by numerous seals and penguins, which made such strange noises, that the officer on watch reported he could hear the cattle bellowing on shore. On a second night we witnessed a splendid scene of natural fireworks; the mast-head and yard-arm-ends shone with St. Elmo's light; and the form of the vane could almost be traced, as if it had been rubbed with phosphorus. The sea was so highly luminous, that the tracks of the penguins were marked by a fiery wake, and the darkness of the sky was momentarily illuminated by the most vivid lightning.

When within the mouth of the river, I was interested by observing how slowly the waters of the sea and river mixed. The latter, muddy and discoloured, from its less specific gravity, floated on

the surface of the salt water. This was curiously exhibited in the wake of the vessel, where a line of blue water was seen mingling in little eddies, with the adjoining fluid.

July 26th. -- We anchored at Monte Video. The Beagle was employed in surveying the extreme southern and eastern coasts of America, south of the Plata, during the two succeeding years. To prevent useless repetitions, I will extract those parts of my journal which refer to the same districts without always attending to the order in which we visited them.

MALDONADO is situated on the northern bank of the Plata, and not very far from the mouth of the estuary. It is a most quiet, forlorn, little town; built, as is universally the case in these countries, with the streets running at right angles to each other, and having in the middle a large plaza or square, which, from its size, renders the scantiness of the population more evident. It possesses scarcely any trade; the exports being confined to a few hides and living cattle. The inhabitants are chiefly landowners, together with a few shopkeepers and the necessary tradesmen, such as blacksmiths and carpenters, who do nearly all the business for a circuit of fifty miles round. The town is separated from the river by a band of sand-hillocks, about a mile broad: it is surrounded, on all other sides, by an open slightly-undulating country, covered by one uniform layer of fine green turf, on which countless herds of cattle, sheep, and horses graze. There is very little land cultivated even close to the town. A few hedges, made of cacti and agave, mark out where some wheat or Indian corn has been planted. The features of the country are very similar along the whole northern bank of the Plata. The only difference is, that here the granitic hills are a little bolder. The scenery is very uninteresting; there is scarcely a house, an enclosed piece of ground, or even a tree, to give it an air of cheerfulness. Yet, after being imprisoned for some time in a ship, there is a charm in the unconfined feeling of walking over boundless plains of turf. Moreover, if your view is limited to a small space, many objects possess beauty. Some of the smaller birds are brilliantly coloured; and the bright green sward, browsed short by the cattle, is ornamented by dwarf flowers, among which a plant, looking like the daisy, claimed the place of an old friend. What would a florist say to whole tracts, so thickly covered by the *Verbena melindres*, as, even at a distance, to appear of the most gaudy scarlet?

I stayed ten weeks at Maldonado, in which time a nearly perfect collection of the animals, birds, and reptiles, was procured. Before making any observations respecting them, I will give an account of a little excursion I made as far as the river Polanco, which is about seventy miles distant, in a northerly direction. I may mention, as a proof how cheap everything is in this country, that I paid only two dollars a day, or eight shillings, for two men, together with a troop of about a dozen riding-horses. My companions were well armed with pistols and sabres; a precaution which I thought rather unnecessary but the first piece of news we heard was, that, the day before, a traveller from Monte Video had been found dead on the road, with his throat cut. This happened close to a cross, the record of a former murder.

On the first night we slept at a retired little country-house; and there I soon found out that I possessed two or three articles, especially a pocket compass, which created unbounded astonishment. In every house I was asked to show the compass, and by its aid, together with a map, to point out the direction of various places. It excited the liveliest admiration that I, a perfect stranger, should know the road (for direction and road are synonymous in this open country) to places where I had never been. At one house a young woman, who was ill in bed, sent to entreat me to come and show her the compass. If their surprise was great, mine was greater, to find such ignorance among people who possessed their thousands of cattle, and "estancias" of great extent. It can only be accounted for by the circumstance that this retired part of the country is seldom visited by foreigners. I was asked whether the earth or sun moved; whether it was hotter

or colder to the north; where Spain was, and many other such questions. The greater number of the inhabitants had an indistinct idea that England, London, and North America, were different names for the same place; but the better informed well knew that London and North America were separate countries close together, and that England was a large town in London! I carried with me some promethean matches, which I ignited by biting; it was thought so wonderful that a man should strike fire with his teeth, that it was usual to collect the whole family to see it: I was once offered a dollar for a single one. Washing my face in the morning caused much speculation at the village of Las Minas; a superior tradesman closely cross-questioned me about so singular a practice; and likewise why on board we wore our beards; for he had heard from my guide that we did so. He eyed me with much suspicion; perhaps he had heard of ablutions in the Mahomedan religion, and knowing me to be a heretick, probably he came to the conclusion that all hereticks were Turks. It is the general custom in this country to ask for a night's lodging at the first convenient house. The astonishment at the compass, and my other feats of jugglery, was to a certain degree advantageous, as with that, and the long stories my guides told of my breaking stones, knowing venomous from harmless snakes, collecting insects, etc., I repaid them for their hospitality. I am writing as if I had been among the inhabitants of central Africa: Banda Oriental would not be flattered by the comparison; but such were my feelings at the time.

The next day we rode to the village of Las Minas. The country was rather more hilly, but otherwise continued the same; an inhabitant of the Pampas no doubt would have considered it as truly Alpine. The country is so thinly inhabited, that during the whole day we scarcely met a single person. Las Minas is much smaller even than Maldonado. It is seated on a little plain, and is surrounded by low rocky mountains. It is of the usual symmetrical form, and with its whitewashed church standing in the centre, had rather a pretty appearance. The outskirting houses rose out of the plain like isolated beings, without the accompaniment of gardens or courtyards. This is generally the case in the country, and all the houses have, in consequence an uncomfortable aspect. At night we stopped at a pulperia, or drinking-shop. During the evening a great number of Gauchos came in to drink spirits and smoke cigars: their appearance is very striking; they are generally tall and handsome, but with a proud and dissolute expression of countenance. They frequently wear their moustaches and long black hair curling down their backs. With their brightly coloured garments, great spurs clanking about their heels, and knives stuck as daggers (and often so used) at their waists, they look a very different race of men from what might be expected from their name of Gauchos, or simple countrymen. Their politeness is excessive; they never drink their spirits without expecting you to taste it; but whilst making their exceedingly graceful bow, they seem quite as ready, if occasion offered, to cut your throat.

On the third day we pursued rather an irregular course, as I was employed in examining some beds of marble. On the fine plains of turf we saw many ostriches (*Struthio rhea*). Some of the flocks contained as many as twenty or thirty birds. These, when standing on any little eminence, and seen against the clear sky, presented a very noble appearance. I never met with such tame ostriches in any other part of the country: it was easy to gallop up within a short distance of them; but then, expanding their wings, they made all sail right before the wind, and soon left the horse astern.

At night we came to the house of Don Juan Fuentes, a rich landed proprietor, but not personally known to either of my companions. On approaching the house of a stranger, it is usual to follow several little points of etiquette: riding up slowly to the door, the salutation of Ave Maria is given, and until somebody comes out and asks you to alight, it is not customary even to get off your horse: the formal answer of the owner is, "sin pecado concebida" -- that is, conceived without sin. Having entered the house, some general conversation is kept up for a few minutes, till permission

is asked to pass the night there. This is granted as a matter of course. The stranger then takes his meals with the family, and a room is assigned him, where with the horsecloths belonging to his recado (or saddle of the Pampas) he makes his bed. It is curious how similar circumstances produce such similar results in manners. At the Cape of Good Hope the same hospitality, and very nearly the same points of etiquette, are universally observed. The difference, however, between the character of the Spaniard and that of the Dutch boer is shown, by the former never asking his guest a single question beyond the strictest rule of politeness, whilst the honest Dutchman demands where he has been, where he is going, what is his business, and even how many brothers sisters, or children he may happen to have.

Shortly after our arrival at Don Juan's, one of the largest herds of cattle was driven in towards the house, and three beasts were picked out to be slaughtered for the supply of the establishment. These half-wild cattle are very active; and knowing full well the fatal lazo, they led the horses a long and laborious chase. After witnessing the rude wealth displayed in the number of cattle, men, and horses, Don Juan's miserable house was quite curious. The floor consisted of hardened mud, and the windows were without glass; the sitting-room boasted only of a few of the roughest chairs and stools, with a couple of tables. The supper, although several strangers were present, consisted of two huge piles, one of roast beef, the other of boiled, with some pieces of pumpkin: besides this latter there was no other vegetable, and not even a morsel of bread. For drinking, a large earthenware jug of water served the whole party. Yet this man was the owner of several square miles of land, of which nearly every acre would produce corn, and, with a little trouble, all the common vegetables. The evening was spent in smoking, with a little impromptu singing, accompanied by the guitar. The signoritas all sat together in one corner of the room, and did not sup with the men.

So many works have been written about these countries, that it is almost superfluous to describe either the lazo or the bolas. The lazo consists of a very strong, but thin, well-plaited rope, made of raw hide. One end is attached to the broad surcingle, which fastens together the complicated gear of the recado, or saddle used in the Pampas; the other is terminated by a small ring of iron or brass, by which a noose can be formed. The Gaucho, when he is going to use the lazo, keeps a small coil in his bridle-hand, and in the other holds the running noose which is made very large, generally having a diameter of about eight feet. This he whirls round his head, and by the dexterous movement of his wrist keeps the noose open; then, throwing it, he causes it to fall on any particular spot he chooses. The lazo, when not used, is tied up in a small coil to the after part of the recado. The bolas, or balls, are of two kinds: the simplest, which is chiefly used for catching ostriches, consists of two round stones, covered with leather, and united by a thin plaited thong, about eight feet long. The other kind differs only in having three balls united by the thongs to a common centre. The Gaucho holds the smallest of the three in his hand, and whirls the other two round and round his head; then, taking aim, sends them like chain shot revolving through the air. The balls no sooner strike any object, than, winding round it, they cross each other, and become firmly hitched. The size and weight of the balls vary, according to the purpose for which they are made: when of stone, although not larger than an apple, they are sent with such force as sometimes to break the leg even of a horse. I have seen the balls made of wood, and as large as a turnip, for the sake of catching these animals without injuring them. The balls are sometimes made of iron, and these can be hurled to the greatest distance. The main difficulty in using either lazo or bolas is to ride so well as to be able at full speed, and while suddenly turning about, to whirl them so steadily round the head, as to take aim: on foot any person would soon learn the art. One day, as I was amusing myself by galloping and whirling the balls round my head, by accident the free one struck a bush, and its revolving motion being thus destroyed, it immediately fell to the ground, and, like magic, caught one hind leg of my horse; the other ball was then jerked

out of my hand, and the horse fairly secured. Luckily he was an old practised animal, and knew what it meant; otherwise he would probably have kicked till he had thrown himself down. The Gauchos roared with laughter; they cried out that they had seen every sort of animal caught, but had never before seen a man caught by himself.

During the two succeeding days, I reached the furthest point which I was anxious to examine. The country wore the same aspect, till at last the fine green turf became more wearisome than a dusty turnpike road. We everywhere saw great numbers of partridges (*Nothura major*). These birds do not go in coveys, nor do they conceal themselves like the English kind. It appears a very silly bird. A man on horseback by riding round and round in a circle, or rather in a spire, so as to approach closer each time, may knock on the head as many as he pleases. The more common method is to catch them with a running noose, or little lazo, made of the stem of an ostrich's feather, fastened to the end of a long stick. A boy on a quiet old horse will frequently thus catch thirty or forty in a day. In Arctic North America [1] the Indians catch the Varying Hare by walking spirally round and round it, when on its form: the middle of the day is reckoned the best time, when the sun is high, and the shadow of the hunter not very long.

On our return to Maldonado, we followed rather a different line of road. Near Pan de Azucar, a landmark well known to all those who have sailed up the Plata, I stayed a day at the house of a most hospitable old Spaniard. Early in the morning we ascended the Sierra de las Animas. By the aid of the rising sun the scenery was almost picturesque. To the westward the view extended over an immense level plain as far as the Mount, at Monte Video, and to the eastward, over the mammillated country of Maldonado. On the summit of the mountain there were several small heaps of stones, which evidently had lain there for many years. My companion assured me that they were the work of the Indians in the old time. The heaps were similar, but on a much smaller scale, to those so commonly found on the mountains of Wales. The desire to signalize any event, on the highest point of the neighbouring land, seems an universal passion with mankind. At the present day, not a single Indian, either civilized or wild, exists in this part of the province; nor am I aware that the former inhabitants have left behind them any more permanent records than these insignificant piles on the summit of the Sierra de las Animas.

The general, and almost entire absence of trees in Banda Oriental is remarkable. Some of the rocky hills are partly covered by thickets, and on the banks of the larger streams, especially to the north of Las Minas, willow-trees are not uncommon. Near the Arroyo Tapes I heard of a wood of palms; and one of these trees, of considerable size, I saw near the Pan de Azucar, in lat. 35 degs. These, and the trees planted by the Spaniards, offer the only exceptions to the general scarcity of wood. Among the introduced kinds may be enumerated poplars, olives, peach, and other fruit trees: the peaches succeed so well, that they afford the main supply of firewood to the city of Buenos Ayres. Extremely level countries, such as the Pampas, seldom appear favourable to the growth of trees. This may possibly be attributed either to the force of the winds, or the kind of drainage. In the nature of the land, however, around Maldonado, no such reason is apparent; the rocky mountains afford protected situations; enjoying various kinds of soil; streamlets of water are common at the bottoms of nearly every valley; and the clayey nature of the earth seems adapted to retain moisture. It has been inferred with much probability, that the presence of woodland is generally determined [2] by the annual amount of moisture; yet in this province abundant and heavy rain falls during the winter; and the summer, though dry, is not so in any excessive degree. [3] We see nearly the whole of Australia covered by lofty trees, yet that country possesses a far more arid climate. Hence we must look to some other and unknown cause.

Confining our view to South America, we should certainly be tempted to believe that trees flourished only under a very humid climate; for the limit of the forest-land follows, in a most remarkable manner, that of the damp winds. In the southern part of the continent, where the western gales, charged with moisture from the Pacific, prevail, every island on the broken west coast, from lat. 38 degs. to the extreme point of Tierra del Fuego, is densely covered by impenetrable forests. On the eastern side of the Cordillera, over the same extent of latitude, where a blue sky and a fine climate prove that the atmosphere has been deprived of its moisture by passing over the mountains, the arid plains of Patagonia support a most scanty vegetation. In the more northern parts of the continent, within the limits of the constant south-eastern trade-wind, the eastern side is ornamented by magnificent forests; whilst the western coast, from lat. 4 degs. S. to lat. 32 degs. S., may be described as a desert; on this western coast, northward of lat. 4 degs. S., where the trade-wind loses its regularity, and heavy torrents of rain fall periodically, the shores of the Pacific, so utterly desert in Peru, assume near Cape Blanco the character of luxuriance so celebrated at Guyaquil and Panama. Hence in the southern and northern parts of the continent, the forest and desert lands occupy reversed positions with respect to the Cordillera, and these positions are apparently determined by the direction of the prevalent winds. In the middle of the continent there is a broad intermediate band, including central Chile and the provinces of La Plata, where the rain-bringing winds have not to pass over lofty mountains, and where the land is neither a desert nor covered by forests. But even the rule, if confined to South America, of trees flourishing only in a climate rendered humid by rain-bearing winds, has a strongly marked exception in the case of the Falkland Islands. These islands, situated in the same latitude with Tierra del Fuego and only between two and three hundred miles distant from it, having a nearly similar climate, with a geological formation almost identical, with favourable situations and the same kind of peaty soil, yet can boast of few plants deserving even the title of bushes; whilst in Tierra del Fuego it is impossible to find an acre of land not covered by the densest forest. In this case, both the direction of the heavy gales of wind and of the currents of the sea are favourable to the transport of seeds from Tierra del Fuego, as is shown by the canoes and trunks of trees drifted from that country, and frequently thrown on the shores of the Western Falkland. Hence perhaps it is, that there are many plants in common to the two countries but with respect to the trees of Tierra del Fuego, even attempts made to transplant them have failed.

During our stay at Maldonado I collected several quadrupeds, eighty kinds of birds, and many reptiles, including nine species of snakes. Of the indigenous mammalia, the only one now left of any size, which is common, is the *Cervus campestris*. This deer is exceedingly abundant, often in small herds, throughout the countries bordering the Plata and in Northern Patagonia. If a person crawling close along the ground, slowly advances towards a herd, the deer frequently, out of curiosity, approach to reconnoitre him. I have by this means, killed from one spot, three out of the same herd. Although so tame and inquisitive, yet when approached on horseback, they are exceedingly wary. In this country nobody goes on foot, and the deer knows man as its enemy only when he is mounted and armed with the bolas. At Bahia Blanca, a recent establishment in Northern Patagonia, I was surprised to find how little the deer cared for the noise of a gun: one day I fired ten times from within eighty yards at one animal; and it was much more startled at the ball cutting up the ground than at the report of the rifle. My powder being exhausted, I was obliged to get up (to my shame as a sportsman be it spoken, though well able to kill birds on the wing) and halloo till the deer ran away.

The most curious fact with respect to this animal, is the overpoweringly strong and offensive odour which proceeds from the buck. It is quite indescribable: several times whilst skinning the specimen which is now mounted at the Zoological Museum, I was almost overcome by nausea. I

tied up the skin in a silk pocket-handkerchief, and so carried it home: this handkerchief, after being well washed, I continually used, and it was of course as repeatedly washed; yet every time, for a space of one year and seven months, when first unfolded, I distinctly perceived the odour. This appears an astonishing instance of the permanence of some matter, which nevertheless in its nature must be most subtle and volatile. Frequently, when passing at the distance of half a mile to leeward of a herd, I have perceived the whole air tainted with the effluvia. I believe the smell from the buck is most powerful at the period when its horns are perfect, or free from the hairy skin. When in this state the meat is, of course, quite uneatable; but the Gauchos assert, that if buried for some time in fresh earth, the taint is removed. I have somewhere read that the islanders in the north of Scotland treat the rank carcasses of the fish-eating birds in the same manner.

The order Rodentia is here very numerous in species: of mice alone I obtained no less than eight kinds. [4] The largest gnawing animal in the world, the *Hydrochaeris capybara* (the water-hog), is here also common. One which I shot at Monte Video weighed ninety-eight pounds: its length from the end of the snout to the stump-like tail, was three feet two inches; and its girth three feet eight. These great Rodents occasionally frequent the islands in the mouth of the Plata, where the water is quite salt, but are far more abundant on the borders of fresh-water lakes and rivers. Near Maldonado three or four generally live together. In the daytime they either lie among the aquatic plants, or openly feed on the turf plain. [5] When viewed at a distance, from their manner of walking and colour they resemble pigs: but when seated on their haunches, and attentively watching any object with one eye, they reassume the appearance of their congeners, cavies and rabbits. Both the front and side view of their head has quite a ludicrous aspect, from the great depth of their jaw. These animals, at Maldonado, were very tame; by cautiously walking, I approached within three yards of four old ones. This tameness may probably be accounted for, by the Jaguar having been banished for some years, and by the Gaucho not thinking it worth his while to hunt them. As I approached nearer and nearer they frequently made their peculiar noise, which is a low abrupt grunt, not having much actual sound, but rather arising from the sudden expulsion of air: the only noise I know at all like it, is the first hoarse bark of a large dog. Having watched the four from almost within arm's length (and they me) for several minutes, they rushed into the water at full gallop with the greatest impetuosity, and emitted at the same time their bark. After diving a short distance they came again to the surface, but only just showed the upper part of their heads. When the female is swimming in the water, and has young ones, they are said to sit on her back. These animals are easily killed in numbers; but their skins are of trifling value, and the meat is very indifferent. On the islands in the Rio Parana they are exceedingly abundant, and afford the ordinary prey to the Jaguar.

The Tucutuco (*Ctenomys Brasiliensis*) is a curious small animal, which may be briefly described as a Gnawer, with the habits of a mole. It is extremely numerous in some parts of the country, but it is difficult to be procured, and never, I believe, comes out of the ground. It throws up at the mouth of its burrows hillocks of earth like those of the mole, but smaller. Considerable tracts of country are so completely undermined by these animals, that horses in passing over, sink above their fetlocks. The tucutucos appear, to a certain degree, to be gregarious: the man who procured the specimens for me had caught six together, and he said this was a common occurrence. They are nocturnal in their habits; and their principal food is the roots of plants, which are the object of their extensive and superficial burrows. This animal is universally known by a very peculiar noise which it makes when beneath the ground. A person, the first time he hears it, is much surprised; for it is not easy to tell whence it comes, nor is it possible to guess what kind of creature utters it. The noise consists in a short, but not rough, nasal grunt, which is monotonously repeated about four times in quick succession: [6] the name Tucutuco is given in imitation of the sound. Where this animal is abundant, it may be heard at all times of the day, and sometimes directly beneath

one's feet. When kept in a room, the tucutucos move both slowly and clumsily, which appears owing to the outward action of their hind legs; and they are quite incapable, from the socket of the thigh-bone not having a certain ligament, of jumping even the smallest vertical height. They are very stupid in making any attempt to escape; when angry or frightened they utter the tucutuco. Of those I kept alive several, even the first day, became quite tame, not attempting to bite or to run away; others were a little wilder.

The man who caught them asserted that very many are invariably found blind. A specimen which I preserved in spirits was in this state; Mr. Reid considers it to be the effect of inflammation in the nictitating membrane. When the animal was alive I placed my finger within half an inch of its head, and not the slightest notice was taken: it made its way, however, about the room nearly as well as the others. Considering the strictly subterranean habits of the tucutuco, the blindness, though so common, cannot be a very serious evil; yet it appears strange that any animal should possess an organ frequently subject to be injured. Lamarck would have been delighted with this fact, had he known it, when speculating [7] (probably with more truth than usual with him) on the gradually acquired blindness of the *Asphalax*, a Gnawer living under ground, and of the *Proteus*, a reptile living in dark caverns filled with water; in both of which animals the eye is in an almost rudimentary state, and is covered by a tendinous membrane and skin. In the common mole the eye is extraordinarily small but perfect, though many anatomists doubt whether it is connected with the true optic nerve; its vision must certainly be imperfect, though probably useful to the animal when it leaves its burrow. In the tucutuco, which I believe never comes to the surface of the ground, the eye is rather larger, but often rendered blind and useless, though without apparently causing any inconvenience to the animal; no doubt Lamarck would have said that the tucutuco is now passing into the state of the *Asphalax* and *Proteus*.

Birds of many kinds are extremely abundant on the undulating, grassy plains around Maldonado. There are several species of a family allied in structure and manners to our Starling: one of these (*Molothrus niger*) is remarkable from its habits. Several may often be seen standing together on the back of a cow or horse; and while perched on a hedge, pluming themselves in the sun, they sometimes attempt to sing, or rather to hiss; the noise being very peculiar, resembling that of bubbles of air passing rapidly from a small orifice under water, so as to produce an acute sound. According to Azara, this bird, like the cuckoo, deposits its eggs in other birds' nests. I was several times told by the country people that there certainly is some bird having this habit; and my assistant in collecting, who is a very accurate person, found a nest of the sparrow of this country (*Zonotrichia matutina*), with one egg in it larger than the others, and of a different colour and shape. In North America there is another species of *Molothrus* (*M. pecoris*), which has a similar cuckoo-like habit, and which is most closely allied in every respect to the species from the Plata, even in such trifling peculiarities as standing on the backs of cattle; it differs only in being a little smaller, and in its plumage and eggs being of a slightly different shade of colour. This close agreement in structure and habits, in representative species coming from opposite quarters of a great continent, always strikes one as interesting, though of common occurrence.

Mr. Swainson has well remarked, [8] that with the exception of the *Molothrus pecoris*, to which must be added the *M. niger*, the cuckoos are the only birds which can be called truly parasitical; namely, such as "fasten themselves, as it were, on another living animal, whose animal heat brings their young into life, whose food they live upon, and whose death would cause theirs during the period of infancy." It is remarkable that some of the species, but not all, both of the Cuckoo and *Molothrus*, should agree in this one strange habit of their parasitical propagation, whilst opposed to each other in almost every other habit: the *molothrus*, like our starling, is eminently sociable, and lives on the open plains without art or disguise: the cuckoo, as every one

knows, is a singularly shy bird; it frequents the most retired thickets, and feeds on fruit and caterpillars. In structure also these two genera are widely removed from each other. Many theories, even phrenological theories, have been advanced to explain the origin of the cuckoo laying its eggs in other birds' nests. M. Prevost alone, I think, has thrown light by his observations [9] on this puzzle: he finds that the female cuckoo, which, according to most observers, lays at least from four to six eggs, must pair with the male each time after laying only one or two eggs. Now, if the cuckoo was obliged to sit on her own eggs, she would either have to sit on all together, and therefore leave those first laid so long, that they probably would become addled; or she would have to hatch separately each egg, or two eggs, as soon as laid: but as the cuckoo stays a shorter time in this country than any other migratory bird, she certainly would not have time enough for the successive hatchings. Hence we can perceive in the fact of the cuckoo pairing several times, and laying her eggs at intervals, the cause of her depositing her eggs in other birds' nests, and leaving them to the care of foster-parents. I am strongly inclined to believe that this view is correct, from having been independently led (as we shall hereafter see) to an analogous conclusion with regard to the South American ostrich, the females of which are parasitical, if I may so express it, on each other; each female laying several eggs in the nests of several other females, and the male ostrich undertaking all the cares of incubation, like the strange foster-parents with the cuckoo.

I will mention only two other birds, which are very common, and render themselves prominent from their habits. The *Saurophagus sulphuratus* is typical of the great American tribe of tyrant-flycatchers. In its structure it closely approaches the true shrikes, but in its habits may be compared to many birds. I have frequently observed it, hunting a field, hovering over one spot like a hawk, and then proceeding on to another. When seen thus suspended in the air, it might very readily at a short distance be mistaken for one of the Rapacious order; its stoop, however, is very inferior in force and rapidity to that of a hawk. At other times the *Saurophagus* haunts the neighbourhood of water, and there, like a kingfisher, remaining stationary, it catches any small fish which may come near the margin. These birds are not unfrequently kept either in cages or in courtyards, with their wings cut. They soon become tame, and are very amusing from their cunning odd manners, which were described to me as being similar to those of the common magpie. Their flight is undulatory, for the weight of the head and bill appears too great for the body. In the evening the *Saurophagus* takes its stand on a bush, often by the roadside, and continually repeats without a change a shrill and rather agreeable cry, which somewhat resembles articulate words: the Spaniards say it is like the words "Bien te veo" (I see you well), and accordingly have given it this name.

A mocking-bird (*Mimus orpheus*), called by the inhabitants *Calandria*, is remarkable, from possessing a song far superior to that of any other bird in the country: indeed, it is nearly the only bird in South America which I have observed to take its stand for the purpose of singing. The song may be compared to that of the Sedge warbler, but is more powerful; some harsh notes and some very high ones, being mingled with a pleasant warbling. It is heard only during the spring. At other times its cry is harsh and far from harmonious. Near Maldonado these birds were tame and bold; they constantly attended the country houses in numbers, to pick the meat which was hung up on the posts or walls: if any other small bird joined the feast, the *Calandria* soon chased it away. On the wide uninhabited plains of Patagonia another closely allied species, *O. Patagonica* of d'Orbigny, which frequents the valleys clothed with spiny bushes, is a wilder bird, and has a slightly different tone of voice. It appears to me a curious circumstance, as showing the fine shades of difference in habits, that judging from this latter respect alone, when I first saw this second species, I thought it was different from the Maldonado kind. Having afterwards procured a specimen, and comparing the two without particular care, they appeared so very similar, that I

changed my opinion; but now Mr. Gould says that they are certainly distinct; a conclusion in conformity with the trifling difference of habit, of which, of course, he was not aware.

The number, tameness, and disgusting habits of the carrion-feeding hawks of South America make them pre-eminently striking to any one accustomed only to the birds of Northern Europe. In this list may be included four species of the Caracara or Polyborus, the Turkey buzzard, the Gallinazo, and the Condor. The Caracaras are, from their structure, placed among the eagles: we shall soon see how ill they become so high a rank. In their habits they well supply the place of our carrion-crows, magpies, and ravens; a tribe of birds widely distributed over the rest of the world, but entirely absent in South America. To begin with the Polyborus Brasiliensis: this is a common bird, and has a wide geographical range; it is most numerous on the grassy savannahs of La Plata (where it goes by the name of Carrancha), and is far from unfrequent throughout the sterile plains of Patagonia. In the desert between the rivers Negro and Colorado, numbers constantly attend the line of road to devour the carcasses of the exhausted animals which chance to perish from fatigue and thirst. Although thus common in these dry and open countries, and likewise on the arid shores of the Pacific, it is nevertheless found inhabiting the damp impervious forests of West Patagonia and Tierra del Fuego. The Carranchas, together with the Chimango, constantly attend in numbers the estancias and slaughtering-houses. If an animal dies on the plain the Gallinazo commences the feast, and then the two species of Polyborus pick the bones clean. These birds, although thus commonly feeding together, are far from being friends. When the Carrancha is quietly seated on the branch of a tree or on the ground, the Chimango often continues for a long time flying backwards and forwards, up and down, in a semicircle, trying each time at the bottom of the curve to strike its larger relative. The Carrancha takes little notice, except by bobbing its head. Although the Carranchas frequently assemble in numbers, they are not gregarious; for in desert places they may be seen solitary, or more commonly by pairs.

The Carranchas are said to be very crafty, and to steal great numbers of eggs. They attempt, also, together with the Chimango, to pick off the scabs from the sore backs of horses and mules. The poor animal, on the one hand, with its ears down and its back arched; and, on the other, the hovering bird, eyeing at the distance of a yard the disgusting morsel, form a picture, which has been described by Captain Head with his own peculiar spirit and accuracy. These false eagles most rarely kill any living bird or animal; and their vulture-like, necrophagous habits are very evident to any one who has fallen asleep on the desolate plains of Patagonia, for when he wakes, he will see, on each surrounding hillock, one of these birds patiently watching him with an evil eye: it is a feature in the landscape of these countries, which will be recognised by every one who has wandered over them. If a party of men go out hunting with dogs and horses, they will be accompanied, during the day, by several of these attendants. After feeding, the uncovered craw protrudes; at such times, and indeed generally, the Carrancha is an inactive, tame, and cowardly bird. Its flight is heavy and slow, like that of an English rook. It seldom soars; but I have twice seen one at a great height gliding through the air with much ease. It runs (in contradistinction to hopping), but not quite so quickly as some of its congeners. At times the Carrancha is noisy, but is not generally so: its cry is loud, very harsh and peculiar, and may be likened to the sound of the Spanish guttural g, followed by a rough double r r; when uttering this cry it elevates its head higher and higher, till at last, with its beak wide open, the crown almost touches the lower part of the back. This fact, which has been doubted, is quite true; I have seen them several times with their heads backwards in a completely inverted position. To these observations I may add, on the high authority of Azara, that the Carrancha feeds on worms, shells, slugs, grasshoppers, and frogs; that it destroys young lambs by tearing the umbilical cord; and that it pursues the Gallinazo, till that bird is compelled to vomit up the carrion it may have recently gorged. Lastly, Azara states that several Carranchas, five or six together, will unite in chase of large birds, even

such as herons. All these facts show that it is a bird of very versatile habits and considerable ingenuity.

The *Polyborus Chimango* is considerably smaller than the last species. It is truly omnivorous, and will eat even bread; and I was assured that it materially injures the potato crops in Chiloe, by stocking up the roots when first planted. Of all the carrion-feeders it is generally the last which leaves the skeleton of a dead animal, and may often be seen within the ribs of a cow or horse, like a bird in a cage. Another species is the *Polyborus Novae Zelandiae*, which is exceedingly common in the Falkland Islands. These birds in many respects resemble in their habits the *Carranchas*. They live on the flesh of dead animals and on marine productions; and on the Ramirez rocks their whole sustenance must depend on the sea. They are extraordinarily tame and fearless, and haunt the neighborhood of houses for offal. If a hunting party kills an animal, a number soon collect and patiently await, standing on the ground on all sides. After eating, their uncovered craws are largely protruded, giving them a disgusting appearance. They readily attack wounded birds: a cormorant in this state having taken to the shore, was immediately seized on by several, and its death hastened by their blows. The *Beagle* was at the Falklands only during the summer, but the officers of the *Adventure*, who were there in the winter, mention many extraordinary instances of the boldness and rapacity of these birds. They actually pounced on a dog that was lying fast asleep close by one of the party; and the sportsmen had difficulty in preventing the wounded geese from being seized before their eyes. It is said that several together (in this respect resembling the *Carranchas*) wait at the mouth of a rabbit-hole, and together seize on the animal when it comes out. They were constantly flying on board the vessel when in the harbour; and it was necessary to keep a good look out to prevent the leather being torn from the rigging, and the meat or game from the stern. These birds are very mischievous and inquisitive; they will pick up almost anything from the ground; a large black glazed hat was carried nearly a mile, as was a pair of the heavy balls used in catching cattle. Mr. Usborne experienced during the survey a more severe loss, in their stealing a small *Kater's* compass in a red morocco leather case, which was never recovered. These birds are, moreover, quarrelsome and very passionate; tearing up the grass with their bills from rage. They are not truly gregarious; they do not soar, and their flight is heavy and clumsy; on the ground they run extremely fast, very much like pheasants. They are noisy, uttering several harsh cries, one of which is like that of the English rook, hence the sealers always call them rooks. It is a curious circumstance that, when crying out, they throw their heads upwards and backwards, after the same manner as the *Carrancha*. They build in the rocky cliffs of the sea-coast, but only on the small adjoining islets, and not on the two main islands: this is a singular precaution in so tame and fearless a bird. The sealers say that the flesh of these birds, when cooked, is quite white, and very good eating; but bold must the man be who attempts such a meal.

We have now only to mention the turkey-buzzard (*Vultur aura*), and the *Gallinazo*. The former is found wherever the country is moderately damp, from Cape Horn to North America. Differently from the *Polyborus Brasiliensis* and *Chimango*, it has found its way to the Falkland Islands. The turkey-buzzard is a solitary bird, or at most goes in pairs. It may at once be recognised from a long distance, by its lofty, soaring, and most elegant flight. It is well known to be a true carrion-feeder. On the west coast of Patagonia, among the thickly-wooded islets and broken land, it lives exclusively on what the sea throws up, and on the carcasses of dead seals. Wherever these animals are congregated on the rocks, there the vultures may be seen. The *Gallinazo* (*Cathartes atratus*) has a different range from the last species, as it never occurs southward of lat. 41 degs. Azara states that there exists a tradition that these birds, at the time of the conquest, were not found near Monte Video, but that they subsequently followed the inhabitants from more northern districts. At the present day they are numerous in the valley of the Colorado, which is three

hundred miles due south of Monte Video. It seems probable that this additional migration has happened since the time of Azara. The Gallinazo generally prefers a humid climate, or rather the neighbourhood of fresh water; hence it is extremely abundant in Brazil and La Plata, while it is never found on the desert and arid plains of Northern Patagonia, excepting near some stream. These birds frequent the whole Pampas to the foot of the Cordillera, but I never saw or heard of one in Chile; in Peru they are preserved as scavengers. These vultures certainly may be called gregarious, for they seem to have pleasure in society, and are not solely brought together by the attraction of a common prey. On a fine day a flock may often be observed at a great height, each bird wheeling round and round without closing its wings, in the most graceful evolutions. This is clearly performed for the mere pleasure of the exercise, or perhaps is connected with their matrimonial alliances.

I have now mentioned all the carrion-feeders, excepting the condor, an account of which will be more appropriately introduced when we visit a country more congenial to its habits than the plains of La Plata.

In a broad band of sand-hillocks which separate the Laguna del Potrero from the shores of the Plata, at the distance of a few miles from Maldonado, I found a group of those vitrified, siliceous tubes, which are formed by lightning entering loose sand. These tubes resemble in every particular those from Drigg in Cumberland, described in the Geological Transactions. [10] The sand-hillocks of Maldonado not being protected by vegetation, are constantly changing their position. From this cause the tubes projected above the surface, and numerous fragments lying near, showed that they had formerly been buried to a greater depth. Four sets entered the sand perpendicularly: by working with my hands I traced one of them two feet deep; and some fragments which evidently had belonged to the same tube, when added to the other part, measured five feet three inches. The diameter of the whole tube was nearly equal, and therefore we must suppose that originally it extended to a much greater depth. These dimensions are however small, compared to those of the tubes from Drigg, one of which was traced to a depth of not less than thirty feet.

The internal surface is completely vitrified, glossy, and smooth. A small fragment examined under the microscope appeared, from the number of minute entangled air or perhaps steam bubbles, like an assay fused before the blowpipe. The sand is entirely, or in greater part, siliceous; but some points are of a black colour, and from their glossy surface possess a metallic lustre. The thickness of the wall of the tube varies from a thirtieth to a twentieth of an inch, and occasionally even equals a tenth. On the outside the grains of sand are rounded, and have a slightly glazed appearance: I could not distinguish any signs of crystallization. In a similar manner to that described in the Geological Transactions, the tubes are generally compressed, and have deep longitudinal furrows, so as closely to resemble a shrivelled vegetable stalk, or the bark of the elm or cork tree. Their circumference is about two inches, but in some fragments, which are cylindrical and without any furrows, it is as much as four inches. The compression from the surrounding loose sand, acting while the tube was still softened from the effects of the intense heat, has evidently caused the creases or furrows. Judging from the uncompressed fragments, the measure or bore of the lightning (if such a term may be used) must have been about one inch and a quarter. At Paris, M. Hachette and M. Beudant [11] succeeded in making tubes, in most respects similar to these fulgurites, by passing very strong shocks of galvanism through finely-powdered glass: when salt was added, so as to increase its fusibility, the tubes were larger in every dimension, They failed both with powdered felspar and quartz. One tube, formed with

pounded glass, was very nearly an inch long, namely .982, and had an internal diameter of .019 of an inch. When we hear that the strongest battery in Paris was used, and that its power on a substance of such easy fusibility as glass was to form tubes so diminutive, we must feel greatly astonished at the force of a shock of lightning, which, striking the sand in several places, has formed cylinders, in one instance of at least thirty feet long, and having an internal bore, where not compressed, of full an inch and a half; and this in a material so extraordinarily refractory as quartz!

The tubes, as I have already remarked, enter the sand nearly in a vertical direction. One, however, which was less regular than the others, deviated from a right line, at the most considerable bend, to the amount of thirty-three degrees. From this same tube, two small branches, about a foot apart, were sent off; one pointed downwards, and the other upwards. This latter case is remarkable, as the electric fluid must have turned back at the acute angle of 26 degs., to the line of its main course. Besides the four tubes which I found vertical, and traced beneath the surface, there were several other groups of fragments, the original sites of which without doubt were near. All occurred in a level area of shifting sand, sixty yards by twenty, situated among some high sand-hillocks, and at the distance of about half a mile from a chain of hills four or five hundred feet in height. The most remarkable circumstance, as it appears to me, in this case as well as in that of Drigg, and in one described by M. Ribbentrop in Germany, is the number of tubes found within such limited spaces. At Drigg, within an area of fifteen yards, three were observed, and the same number occurred in Germany. In the case which I have described, certainly more than four existed within the space of the sixty by twenty yards. As it does not appear probable that the tubes are produced by successive distinct shocks, we must believe that the lightning, shortly before entering the ground, divides itself into separate branches.

The neighbourhood of the Rio Plata seems peculiarly subject to electric phenomena. In the year 1793, [12] one of the most destructive thunderstorms perhaps on record happened at Buenos Ayres: thirty-seven places within the city were struck by lightning, and nineteen people killed. From facts stated in several books of travels, I am inclined to suspect that thunderstorms are very common near the mouths of great rivers. Is it not possible that the mixture of large bodies of fresh and salt water may disturb the electrical equilibrium? Even during our occasional visits to this part of South America, we heard of a ship, two churches, and a house having been struck. Both the church and the house I saw shortly afterwards: the house belonged to Mr. Hood, the consul-general at Monte Video. Some of the effects were curious: the paper, for nearly a foot on each side of the line where the bell-wires had run, was blackened. The metal had been fused, and although the room was about fifteen feet high, the globules, dropping on the chairs and furniture, had drilled in them a chain of minute holes. A part of the wall was shattered, as if by gunpowder, and the fragments had been blown off with force sufficient to dent the wall on the opposite side of the room. The frame of a looking-glass was blackened, and the gilding must have been volatilized, for a smelling-bottle, which stood on the chimney-piece, was coated with bright metallic particles, which adhered as firmly as if they had been enamelled.

[1] Hearne's Journey, p. 383.

[2] Maclaren, art. "America," Encyclop. Britann.

[3] Azara says, "Je crois que la quantite annuelle des pluies est, dans toutes ces contrees, plus considerable qu'en Espagne." -- Vol. i. p. 36.

[4] In South America I collected altogether twenty-seven species of mice, and thirteen more are known from the works of Azara and other authors. Those collected by myself have been named and described by Mr. Waterhouse at the meetings of the Zoological Society. I must be allowed to take this opportunity of returning my cordial thanks to Mr. Waterhouse, and to the other gentleman attached to that Society, for their kind and most liberal assistance on all occasions.

[5] In the stomach and duodenum of a capybara which I opened I found a very large quantity of a thin yellowish fluid, in which scarcely a fibre could be distinguished. Mr. Owen informs me that a part of the oesophagus is so constructed that nothing much larger than a crowquill can be passed down. Certainly the broad teeth and strong jaws of this animal are well fitted to grind into pulp the aquatic plants on which it feeds.

[6] At the R. Negro, in Northern Patagonia, there is an animal of the same habits, and probably a closely allied species, but which I never saw. Its noise is different from that of the Maldonado kind; it is repeated only twice instead of three or four times, and is more distinct and sonorous; when heard from a distance it so closely resembles the sound made in cutting down a small tree with an axe, that I have sometimes remained in doubt concerning it.

[7] *Philosoph. Zoolog.*, tom. i. p. 242.

[8] *Magazine of Zoology and Botany*, vol. i. p. 217.

[9] Read before the Academy of Sciences in Paris. *L'Institut*, 1834, p. 418.

[10] *Geolog. Transact.* vol. ii. p. 528. In the *Philosoph. Transact.* (1790, p. 294) Dr. Priestly has described some imperfect siliceous tubes and a melted pebble of quartz, found in digging into the ground, under a tree, where a man had been killed by lightning.

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