The VOYAGE of the BEAGLE

by Charles Darwin,

abridged and edited by Millicent E. Selsam

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INTRODUCTION TO CHAPTER ONE

December 27, 183l—March 1832
England to Brazil

CHARLES DARWIN arrived at Plymouth on October 24, 1831, expecting to sail on the Beagle November 4. He had spent six busy weeks preparing for the voyage. He had consulted with Professor Henslow at Cambridge. He had bought a pair of pistols, and collected a three-year supply of clothing. He had assembled a collection of books on travel and the natural sciences and various instruments for scientific research.

Darwin was most impatient because he regarded leaving England on the Beagle as the start of his "second life." But instead of departing on the expected date, they were held up by bad weather for nearly two more months. Forty-five years later Darwin wrote in his Autobiography that "these two months at Plymouth were the most miserable which I ever spent." He was gloomy at the thought of leaving his family and friends for so long a time. The weather was miserably depressing. To make matters worse, he suffered from palpitations of the heart and was convinced that he had heart disease. But, being "resolved to go at all hazards," he carefully avoided running any risk of having a doctor tell him that he was not fit for such a trip.

In spite of his worries, Darwin was keenly aware both of the responsibilities he had and of his own limitations. He used this dreary waiting period to study and to try to develop a serious method of work—something he had never thought about previously. This trip, he believed, would give him a great opportunity of improving himself—an opportunity that, he said, "I threw away whilst at Cambridge."

Darwin found the Beagle "most beautiful" and elegantly fitted out with mahogany. It was a three-masted square-rigger, anned with cannon. It was to carry seventy-four persons, including a squad of marines, an artist, a missionary for Tierra del Fuego, Darwin as naturalist, and three Fuegians whom Captain Fitzroy had seized as hostages on his previous trip and was now returning home. As the Beagle was only one hundred feet long and had to carry enormous supplies for its planned three-year voyage, everyone was cramped for space. Darwin, however, was given a very small cabin under the forecastle for the specimens he was expected to collect. He used to say later that the absolute necessity of tidiness in the cramped space of the Beagle helped to give him his methodical habits of work.

Finally on December 27, with a favorable wind, the Beagle lifted anchor. In ten days they were sixteen hundred miles southwest of Plymouth. Darwin was dreadfully seasick for the first two weeks, as he was to be much of the time they were at sea for the coming five years. Out of port only three days, he wrote that he had often thought he would repent the trip but had had no idea "with what fervor I should do so."

On January 10, in the warmer waters off North Africa, Darwin started to drag his specially contrived bag for collecting small sea animals. For the next four days he was busy and excited at the exquisite forms and colors of the organisms. From this time he was always happy, indeed exuberant, so long as he had specimens of any new rock or living thing to examine, catalogue, and describe. Exactly one month after the first examination of his sea animals, he wrote to his father that he thought, if he could judge so soon, that he would "be able to do some original work in Natural History."

His feelings about his first day on land, in the Cape Verde Islands off the west coast of Africa, were recorded in his Diary. He told of how glorious it was to walk on volcanic rock, to

hear notes of unknown birds, and to see “new insects fluttering about still newer flowers.” He compared himself with a blind man just given eyes. The next three days seemed infinitely long because he was so constantly engaged with objects of new and vivid interest. His collections increased so fast he became worried lest nobody in England would examine them.

His excitement increased until finally he walked ashore at Bahia in Brazil. He wrote, “The mind is a chaos of delight out of which a world of future and more quiet pleasure will arise. I am at present fit only to read Humboldt; he like another sun illumines everything I behold.” He reported too that he had collected such a number of beautiful flowers as to make a florist go wild. To see Brazilian scenery, he said, was like “nothing more nor less than a view in the Arabian Nights.”

Darwin’s most important discovery on this part of his trip was neither in the world of geology nor zoology. It was the discovery of his own nature. He had always loved to shoot and collect, but now these activities had a new meaning. Upon shooting a large lizard, he noted how pleasant it was to have a duty to do precisely what had for years given him so much pleasure.

This first chapter reveals something of the zest and excitement of the long, often weary, and ever productive months and years to come. Chance had chosen him for this trip, but the trip was to give him ambition and a determination to find out all that was humanly possible about the earth’s surface and all the living things on it.

CHAPTER ONE

After having been twice driven back by heavy-south-western gales, Her Majesty’s ship Beagle, a ten-gun brig, under the command of Captain Fitzroy, 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 l830—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 il-lumine the Peak of Tenerifle, whilst the lower parts were veiled in fieecy 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 Verde archipelago.

The neighborhood 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 tableland, 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 coconut 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 afterward 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 neighborhood of Porto Praya was clothed with trees, the reckless destruction of which has caused here, as at St. Helena and at some of the Canary Islands, almost entire sterility. The broad, fiat-bottomed valleys, many of which serve during a few days only in the season as watercourses, 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 colored, 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 harbor was filled up, was the principal place in the island: it now presents a melancholy but very picturesque appearance. . . . .

We returned to the vénda [inn] 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. . . . 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 center 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 traveling had made so little impres-

sion 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 afterward 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.

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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 afforded 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 colored 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 vintéms [small coins], which were received with screams of laughter, and we left them redoubling the noise of their song.

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ST. PAUL'S ROCKS

In crossing the Atlantic, we hove to, during the morning of February 16, close to the island of St. Paul's. This cluster of rocks . . . 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. . . .

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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 waterfowl. 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 quite correct; I fear it destroys

10 FIGURE

11 FIGURE

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.

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BAHIA, BRAZIL
February 29. Theday 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 clime, 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.

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April—July 1832
Rio de Janeiro, Brazil

TWO QUESTIONS were to create a certain tension between Darwin and Captain Fitzroy throughout the ensuing years. The first was that of slavery, which Darwin loathed more intensely the more he saw of it. He had come by this attitude naturally. Both of Charles' grandfathers, Erasmus Darwin and Josiah Wedgwood, had been liberal men who hated slavery and who had passed on this tradition to their families. The issue of slavery had already come between Captain Fitzroy and Darwin before Darwin's observation, at the beginning of this chapter, on the Negro woman who threw herself from a cliff to save herself from being captured as a slave. At Bahia, they had another real tussle over slavery. Fitzroy, back on the Beagle from a visit on shore, praised slavery and told how he had just visited a great slaveowner who called in many of his slaves and asked them "if they were happy and wanted to be free." They all said yes to the first question and no to the second. Thereupon Darwin asked Fitzroy, "perhaps with a sneer" as he later wrote, whether their answer in their master's presence was worth anything. This made the Captain so angry he exclaimed that they couldn't live together any longer. Some hours later he cooled off and the quarrel was laid aside. Afterwards Darwin wrote, "The difficulty of living on good terms with a Captain of a Man-of-War is much increased by its being almost mutinous to answer him as one would anyone else."
The second issue between them was that of Christian ortho-

doxy in relation to the age of the earth. This question already divided them before they finished with the exploration on the west coast of South America. Fitzroy believed in a literal interpretation of the Bible and longed for the day, “sooner or later,” when “the truth of every statement contained in that record would be proved.” Darwin, following Lyell and his own investigations, was led to deny this and to give the earth a great age.

In all his observations on insects, frogs, and other creatures in this chapter, Darwin is describing not simply their structure, organs, and the like, but their way of life—the adaptation of creatures to their environment. He compares and contrasts their kinds, numbers, and habitats with those of similar creatures in England.

During this period, while Darwin was on shore and the Beagle was cruising the coast for soundings, three of the crew died of a fever contracted on a hunting trip up a Brazilian river. These were not to be the last casualties of a strenuous and dangerous trip. Darwin was extremely sensitive to these losses, and grieved over the fate of his less fortunate shipmates, but at no time does the idea of personal danger seem to have affected him or dampened his determination.

CHAPTER TWO

(FIGURE)

April 4 to july 5, 1832. A few days after our arrival I be-
A came 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 8. 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 colors were intense, and the prevailing tint a dark blue; the sky and the calm waters of the bay vied with each other in splendor. 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 9. 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 orchidea:

[orchids] 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°. The beautiful view of the distant wooded hills, reflected in the perfectly calm water of an extensive lagoon, quite refreshed us. As the vénda 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 afterward 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 veranda, in which tables and benches are placed. The bedrooms 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 vénda 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 senh6r to do us the favor to give us 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 favor 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 [flour made from the cassava plant]. It not infrequently 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 N ovos, 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 vénda, being asked if he knew anything of a whip which one of the party had lost, grufily answered, “How should I know? Why did you not take care of it? I suppose the dogs have eaten it.”

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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. Traveling onward, 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 volcanoes 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 labor 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 afterward 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 afterward we rode the horse without any ill effects.

BRAZILIAN ESTATES

April 1 3. After three days’ traveling we arrived at Socégo, the estate of Senh6r Manuel Figuireda, 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 center 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 [manioc or cassava] 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 fazénda in consequence of having drunk some of it. . . .

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 rooms 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 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 fazéndas 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 labor of two days

is sufficient to support a man and his family for the whole week.

April 14. Leaving Socégo, we rode to another estate on the Rio Mac:-'1e, 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°, 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 vapor, 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 eyewitness 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 endeavoring 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.

A TROPICAL FOREST

April 18. In returning we spent two days at Socégo, 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 dimension. Senh6r 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 amid 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 [a woody climbing plant] 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 1 9. Leaving Socégo, 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 De6s. This is one of the principal lines of road in Brazil, yet it was in so bad a state that no wheel 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.

BOTOFOGO BAY

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 [flat worms], 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 colored 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.

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I first visited the forest in which these Planaria 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 neighboring 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 practicing this art as a game of play, and from their skill in hitting an upright stick, they promise 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 Tagouaroundi cat.

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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°. 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 [mountain], 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 [click beetles], and various marine animals . . . which I have observed, the light has been of a well-marked green color.

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On several occasions I enjoyed some short but most pleasant excursions in the neighboring 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 breadfruit, the jaca, and the mango vied with each other in the magnificence of their foliage. The landscape in the neighborhood 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 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 coconut, the many kinds of palm, the orange, and the breadfruit tree?

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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 [lily] 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 hummingbird 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

(FIGURE)

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 eflect frequently recalled to my mind the gayest scenery of the opera house or the great theaters. 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 odor, 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. .

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A person, on first entering a tropical forest, is astonished at the labors 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-colored 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. . . .

Certain wasp-like insects, which construct in the comers of the verandas clay cells for their larvae, are very numerous in the neighborhood 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 paralyzed 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 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 suflicient 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 maneuvering, inflicted two stings on the underside 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.

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July 1832
Maldonado, Uruguay

FROM JULY 1832 until May 1834, the Beagle was up and down the eastern coast of South America from Rio de Janeiro to Tierra del Fuego and made two trips to the‘ Falkland Islands. On August 2, Darwin was reminded that he was on a man-of-war when, on entering the harbor of Buenos Aires, they were fired at by a guardship. When later they were informed that they could not land on account of a quarantine, they loaded their guns and aimed them for a broadside. On leaving the harbor they hailed the guardship with the announcement that if she dared fire a shot when they returned they would give her their broadside.

In this chapter Darwin speaks of the nearly perfect collection of mammals, birds, and reptiles he gathered. In his Diary he described something of his method. With a few coins, he enlisted all the boys in the town in his service, "and few days pass in which they do not bring me some curious creature." He also roamed the countryside himself, shooting whatever specimens he could and inspecting a series of mousetraps he had set out for small rodents. One day he described himself as returning like "Noah's ark with animals of all sorts." His routine was: one day of shooting and collecting from his traps, the next spent preserving the animals collected.

Darwin seems to have provided a significant amount of fresh meat for those on the Beagle, for he frequently tells of the deer, ostriches, agouti (a rodent peculiar to South America), and

armadillos he shot for the ship's larder. Ostriches, he says, taste like beef, armadillos like duck. He describes agouti as the best meat he ever tasted. The day before Christmas 1833 he shot a large guanaco (the wild ancestor of the llama) and wrote that "we shall have fresh meat for all hands on Christmas day." He seems never to have used the lasso or the bolas for hunting, as the gauchos did. He must have practiced some, however, because one incident in this chapter describes how his bolas got wound around the hind legs of his own horse! He never ceased admiring the skill of the gauchos, the South American equivalent of the cowboys of the United States, in their use of these two hunting devices.

CHAPTER THREE

JULY 5, 1832. In the morning we got under way, and stood out of the splendid harbor of Rio de Janeiro. In our passage to the Plata [River] 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 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 oflicer on watch reported he could hear

the cattle bellowing on shore. On a second night we witnessed a splendid scene of natural fireworks; the masthead and yard-arm ends shone with St. Elmo's light [an electrical discharge], 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 discolored, 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 26. We anchored at Montevideo. 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

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. . . .

I stayed ten weeks at Maldonado, in which time a nearly perfect collection of the animals, birds, and reptiles was pro-

cured. 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 sabers; a precaution which I thought rather unnecessary, but the first piece of news we heard was that, the day before, a traveler from Montevideo 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 Mohammedan religion, and, knowing me to be a heretic, he probably came to the conclusion that all heretics 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 Asia. Banda Oriental [Southern Uruguay] would not be flattered by the comparison, but such were my feelings at the time.

VILLAGE OF LAS MINAS

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 inhabitated that during the whole day we scarcely met a single person. Las Minas

is much smaller than Maldonado. It is seated on a little plain, and is surrounded by low rocky mountains. It is of the usual symmetrical forms, and, with its whitewashed church standing in the center, 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 mustaches, and long black hair curling down their backs. With their brightly colored 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 while 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) [a relative of the African ostrich]. 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 astem.

At night we came to the house of Don Juan Fuentes, a rich landed properietor, 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 boor 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 large herds of cattle was driven in toward 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,

39 FIGURE

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 sefioritas all sat together in one corner of the room, and did not sup with the men.

LAZO AND BOLAS

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 rawhide. 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 center. 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 practiced 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 farthest 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 (N othura 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. . . .

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ZOOLOGY OF MALDONADO

During our stay at Maldonado I collected several quad-rupeds, 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 C ervus camjrestris. 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 toward a herd, the deer frequently, out of curiosity, approach to reconnoiter 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 exceed-.- ingly 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.

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The order Rodentia [order of gnawing mammals] is here very numerous in species: of mice alone I obtained no less than eight kinds. The largest gnawing animal in the world, the Hydrochaerus capybara (the water hog), is here also common. One which I shot at Montevideo 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. When viewed at a distance, from their manner of walking and color they resemble pigs; but when seated on their haunches and attentively watching any object with one eye, they reassume the appearance of their congeners [other species of same genus], 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 this 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. . . .

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 is diflicult 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: 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. . . .

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Birds of many kinds are extremely abundant on the un-\-dulating grassy plains around Maldonado. There are several species of a family allied in structure and manners to our starling: one of these (M olothrus niger) is remarkable from its habits. Several may often be seen standing 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 his, the noise being very peculiar, resembling that of bubbles or air passing rapidly from a small orifice under water, so as to produce an acute sound. . . .

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The number, tameness, and disgusting habits of the carrion-feeding hawks of South America make them pre-eminently striking to anyone accustomed only to the birds of Northern Europe. . . . 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. . . . These false eagles most rarely kill any living bird or animal; and their vulture-like, necrophagous [carrion-feeding] habits are very evident to anyone who has fallen asleep on the desolate plains of Patagonia, for when he awakes 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 recognized by everyone 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. . .

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July — August 1833
Argentina: Rio Negro to Bahia Blanca

EARLY IN THIS CHAPTER Darwin reveals his ever-increasing interest in tlgygay living things are-adapted _t,o.unus,gal,__envir_onments. He is amazed at finding animals living in a lake full of saltfsf He describes the special little world of animals adapted to life in the briny waters of this lake. After seeing this, he is led to exclaim, “Well may we affirm that every part of the world is habitable!”

Little escapes Darwin’s attention, and nothing he sees escapes his interest. He had long since written to one of his sisters of his eagerness to get to the southern part of this continent, where the geography is little known. “I long,” he said, “to put my foot where man has never trod before.” He never really does this, but he is beginning a series of horseback trips that are going to take him several thousand miles in the next few years through little explored country. He “geologizes,” and collects every living thing he can. At the same time he is__i_nten§e_ly_ ‘interested
inlhepeople he meets, primarily in terms of
the_,,_r__e_l_atior@h_eir
mode of life to their cultural background and the_ir,_phys_ical environment. The wildest savages and the most cultivated humans win his attention. He even mentions the Spanish ladies of Buenos Aires and his amusement at “riding about and admiring these angels gliding down the streets.”

But the changes in the earth’s crust and the endless variety of plant and animal forms command Darwin’s energies. He didn’t know which he was more interested in until long after

he returned to England. Whereas the first edition of his journal of Researches was “Into the Geology and Natural History” of the countries visited, the second edition was “Into the Natural History and the Geology” of the same. Evidently, natural history eventually won out over geology. Yet even before his trip to Bahia Blanca, he had commented in a letter home that he was learning so much about animals “that if I gain no other end, I shall never want an object of employment and amusement for the rest of my life.”

Actually the only animals he ever really worked on in the forty-five years after his return to England were earthworms and bamacles. The eight years he spent examining, dissecting, and classifying bamacles led his children to assume that barnacles were part of the ordinary routine of any normal father of a family. One of them, hearing of a neighbor whose mornings were sometimes spent in idleness, asked, “But when does he do his bamacles?”

He is making another discovery. Every letter home contains a request for books,-especially on travel, biology, and geology. He calls books “those most valuable of all valuable things” and chides those at home for not appreciating them enough. Throughout the voyage, Darwin devoured every book he could lay his hands on that was related to his experiences.

CHAPTER FOUR

(FIGURE)

July 24, 1833. The Beagle sailed from Maldonado, and on the 3rd of August she arrived off the mouth of the Rio Negro. This is the principal river on the whole line of coast between the Strait of Magellan and the Plata. It enters the sea about three hundred miles south of the estuary of the Plata. About fifty years ago, under the old Spanish govemment, a small colony was established here ; and it is still the most southern position (lat. 41°) on this eastern coast of America inhabited by civilized man.

The country near the mouth of the river is wretched in the extreme; on the south side a long line of perpendicular cliffs commences which exposes a section of the geological nature of the country. The strata are of sandstone, and one layer was remarkable from being composed of a firmly cemented con-

glomerate of pumice pebbles, which must have traveled more than four hundred miles from the Andes. The surface is everywhere covered up by a thick bed of gravel, which extends far and wide over the open plain. Water is extremely scarce and, where found, is almost invariably brackish. The vegetation is scanty; and although there are bushes of many kinds, all are armed with formidable thorns, which seem to warn the stranger not to enter on these inhospitable regions.

The settlement is situated eighteen miles up the river. The road follows the foot of the sloping cliff which forms the northern boundary of the great valley in which the Rio Negro flows. On the way we passed the ruins of some fine “estancias” which a few years since had been destroyed by the Indians. . . .

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The town is indifferently called El Carmenor Patagones. It is built on the face of a cliff which fronts the river, and many of the houses are excavated even in the sandstone. The river is about two or three hundred yards wide, and is deep and rapid. The many islands, with their willow trees, and the flat headlands, seen one behind the other on the northern boundary of the broad green valley, form, by the aid of a bright sun, a view almost picturesque. The number of inhabitants does not exceed a few hundreds. These Spanish colonies do not, like our British ones, carry within themselves the elements of growth. Many Indians of pure blood reside here: the tribe of the cacique [chief] Lucanee constantly have their toldos [huts] on the outskirts of the town. The local government partly supplies them with provisions by giving them all the old worn-out horses, and they earn a little by making horse rugs and other articles of riding gear. These Indians are considered civilized, but what their character may have gained by a lesser degree of

ferocity is almost counterbalanced by their entire immorality. Some of the younger men are, however, improving;t\hey' are willing to labor, and, a short time since, a party went on a sealing voyage and behaved very well. They were now enjoying the fruits of their labor, by being dressed in very gay, clean clothes and by being very idle. The taste they showed in their dress was admirable; if you could have turned one of these young Indians into a statue of bronze, his drapery would have been perfectly graceful.

A SALT LAKE

One day I rode to a large salt lake, or salina, which is distant fifteen miles from the town. During the winter it consists of a shallow lake of brine, which in summer is converted into a field of snow-white salt. The layer near the margin is from four to five inches thick, but toward the center its thickness increases. This lake was two and a half miles long and one broad. Others occur in the neighborhood many times larger, and with a floor of salt two and three feet in thickness even when under water during the winter. One of these brilliantly white and level expanses in the midst of the brown and desolate plain offers an extraordinary spectacle. A large quantity of salt is annually drawn from the salina, and great piles, some hundred tons in weight, were lying ready for exportation. The season for working the salinas forms the harvest of Patagones, for on it the prosperity of the place depends. Nearly the whole population encamps on the bank of the river, and the people are employed in drawing out the salt in bullock wagons. . . .

Parts of the lake seen from a short distance appeared of a reddish color, and this perhaps was owing to some infusorial animalcula [protozoa]. The mud in many places was thrown up

by numbers of some kind of worm, or annelidous animal. How surprising it is that any creatures should be able to exist in brine, and that they should be crawling among crystals of sulphate of soda and lime! And what becomes of these worms when, during the long summer, the surface is hardened into a solid layer of salt? Flamingos in considerable numbers inhabit this lake, and breed here; throughout Patagonia, in Northern Chile, and at the Galapagos Islands I met with these birds wherever there were lakes of brine. I saw them here wading about in search of food—probably for the worms which burrow in the mud; and these latter probably feed on infusoria or confervae [green algae]. Thus we have a little living world within itself, adapted to these inland lakes of brine. . . . Well may we affirm that every part of the world is habitable! Whether lakes of brine, or those subterranean ones hidden beneath volcanic mountains —warm mineral springs—the wide expanse and depths of the ocean—the upper regions of the atmosphere, and even the surface of perpetual snow—all support organic beings.

OVERLAND TO BAHIA BLANCA

To the northward of the Rio Negro, between it and the inhabited country rgag_Buenos Aires, the Spaniards have only one small settlement, recently established at Bahia Blanca. The dgmi_a straight line to Buenos Aires is very nearly five hundred British miles. The wandering tribes of horse Indians, which have always occupied the greater part ofrthis country, having of late much harassed the outlying estancias, the government at Buenos Aires equipped some time since an army under the command of General Rosas for the purpose of exterminating them. The troops were now encamped on the banks of the Colorado, a river lying about eighty miles northward of the

Rio Negro. When General Rosas left Buenos Aires, he struck in a direct line across the unexplored plains: and as the country was thus pretty well cleared of Indians, he left behind him, at wide intervals, a small party of soldiers with a troop of horses (a posta) , so as to be enabled to keep up a communication with the capital. As the Beagle intended to call at Bahia Blanca, I determined to proceed there by land; and ultimately I extended my plan to travel the whole way by the postas to Buenos Aires.

August 11. Mr. Harris, an Englishman residing at Patagones, a guide, and five gauchos, who were proceeding to the army on business, were my companions on the journey. The Colorado, as I have already said, is nearly eighty miles distant, and as we traveled slowly, we were two days and a half on the road. The whole line of country deserves scarcely a better name than that of a desert. Water is found only in two small wells; it is called fresh, but even at this time of the year, during the rainy season, it was quite brackish. In the summer this must be a distressing passage, for now it was sufficiently desolate. The valley of the Rio Negro, broad as it is, has merely been excavated out of the sandstone plain; for immediately above the bank on which the town stands, a level country commences which is interrupted only by a few trifling valleys and depressions. Everywhere the landscape wears the same sterile aspect; a dry gravelly soil supports tufts of brown withered grass and low scattered bushes armed with thorns.

Shortly after passing the first spring we came in sight of a famous tree which the Indians reverence as the altar of Walleechu. It is situated on a high part of the plain, and hence is a landmark visible at a great distance. As soon as a tribe of Indians come in sight of it, they offer their adorations by loud

shouts. The tree itself is low, much branched, and thorny: just above the root it has a diameter of about three feet. It stands by itself without any neighbor, and was indeed the first tree we saw; afterward we met with a few others of the same kind, but they were far more common. Being winter, the tree had no leaves, but in their place numberless threads by which the various offerings, such as cigars, bread, meat, pieces of cloth, etc., had been suspended. Poor Indians, not having anything better, only pull a thread out of their ponchos and fasten it to the tree. Richer Indians are accustomed to pour spirits and maté into a certain hole, and likewise to smoke upward, thinking thus to afford all possible gratification to Walleechu. To complete the scene, the tree was surrounded by the bleached bones of horses which had been slaughtered as sacrifices. All Indians of every age and sex make their offerings; they then think that their horses will not tire, and that they themselves shall be prosperous. The gaucho who told me this said that in the time of peace he had witnessed this scene, and that he and others used to wait till the Indians had passed by, for ‘the sake of stealing from Walleechu the offerings.

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About two leagues beyond this curious tree we halted for the night. At this instant an unfortunate cow was spied by the lynx-eyed gauchos, who set off in full chase and in a few minutes dragged her in with their lazos and slaughtered her. We here had the four necessaries of life “en el campo”—pasture for the horses, water (only a muddy puddle), meat, and firewood. The gauchos were in high spirits at finding all these luxuries; and we soon set to work at the poor cow. This was the first night which I passed under the open sky, with the gear of the recado for my bed. There is high enjoyment in the inde-

pendence of the gaucho life—to be able at any moment to pull up your horse and say, “Here we will pass the night.” The death-like stillness of the plain, the dogs keeping watch, the gypsy group of gauchos making their beds round the fire have left in my mind a strongly marked picture of this first night, which will never be forgotten.

The next day the country continued similar to that above described. It is inhabited by few birds or animals of any kind. Occasionally a deer or a guanaco [wild llama] may be seen, but the agouti (Cavia Patagonica) is the commonest quadruped. This animal here represents our hares. It differs, however, from that genus in many essential respects; for instance, it has only three toes behind. It is also nearly twice the size, weighing from twenty to twenty-five pounds. The agouti is a true friend of the desert; it is a common feature in the landscape to see two or three hopping quickly one after the other in a straight line across these wild plains. . . .

RIO COLORADO

The next morning, aw approached the Rio Colorado, the appearance of the country changed; we soon came on a plain covered with turf, which, from its flowers, tall clover, and little owls, regmbled the Pampas. We passed also a muddy swamp of considerable extent, which in summer dries and becomes incrusted with various salts, and hence is called a salitral. It was covered by low, succulent plants of the same kind with those growing on the seashore. The Colorado, at the pass where we crossed it, is only about sixty yards wide; generally it must be nearly double that width. Its course is very tortuous, being marked by willow trees and beds of reeds: in a direct line the distance to the mouth of the river is said to be nine leagues,

but by water twenty-five. We were delayed crossing in the canoe by some immense troops of mares, which were swimming the river in order to follow a division of troops into the interior. A more ludicrous spectacle I never beheld than the hundreds and hundreds of heads, all directed one way, with pointed ears and distended, snorting nostrils, appearing just above the water like a great shoal of some amphibious animal.

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We stayed two days at the Colorado; I had little to do, for the surrounding country was a swamp, which in summer (December), wig: the snow melts on the Cordillera, is overflg_wccLby the river_. My chief amusement was watching the Indian families as they came to buy little articles at the rancho where we stayed. It was supposed that General Rosas had about six hundred Indian allies. The men were a tall, fine race, yet ' it was afterward easy to see in the Fuegian savage the same countenance rendered hideous by cold, want of food, and less civilization. Some authors, in defining the primary races of mankind, have separated these Indians into two classes; but this is certainly incorrect. Among the young women, or chinas, some deserve to be called even beautiful. Their hair was coarse, but bright and black, and they wore it in two plaits hanging down to the waist. They had a high color, and eyes

that glistened with brilliancy; their legs, feet, and arms were small and elegantly formed; their ankles and sometimes their waists were ornamented by broad bracelets of blue beads. Nothing could be more interesting than some of the family groups. A mother with one or two daughters would often come to our rancho mounted on the same horse. They ride like men, but with their knees tucked up much higher. This habit perhaps arises from their being accustomed, when traveling,

to ride the loaded horses. The duty of the v__/orn,en__is to load and
unload the horses; to make the tents for the night; in short,
to be, like the wives of all savages, useful slaves._ The men
fight, hunt, take care of the horses, and make the riding gear.

(FIGURE)

One of their chief indoor occupations is to knock two stones
together till they become round, in order to make the bolas.
With this important weapon the Indian catches his game,
and also his horse, which roams free over the plain. In fighting,
his first attempt is to throw down the horse of his adversary
with the bolas and, when entangled by the fall, to kill him with
the chuzo [spear]. If the balls only catch the neck or body
of an animal, they are often carried away and lost. As the mak-

ing the stones round is the labor of two days, the manufacture
of the balls is a very common employment. Several of the men
and women had their faces painted red, but I never saw the
horizontal bands which are so common among the Fuegians.
Their chief pride consists in having everything made of silver;
I have seen a cacique with his spurs, stirrups, handle of his
knife, and bridle made of this metal: the head stall and reins,
being of wire, were not thicker than whipcord; and to see a
fiery steed wheeling about under the command of so light a
chain gave to the horsemanship a remarkable character of
elegance.

In the morning we started for Bahia Blanca, which we
reached in two days. Leaving the regular encampment, we
passed by the toldos of the Indians. These are round like ovens,
and covered with hides; by the mouth of each, a tapering
chuzo was stuck in the ground. The toldos were divided into
separate groups, which belonged to the different caciques'
tribes, and the groups were again divided into smaller ones,
according to the relationship of the owners. . . .

Having ridden about twenty-five miles, we came to a broad
belt of sand dunes which stretches as far as the eye can reach,
to the east and west. The sand hillocks resting on the clay allow
small pools of water to collect, and thus afford in this dry
country an invaluable supply of fresh water. . . . Having
crossed the sandy tract, we arrived in the evening at one of
the post houses, and, as the fresh horses were grazing at a
distance, we determined to pass the night there.

The house was situated at the base of a ridge between one
and two hundred feet high—a most remarkable feature in this
country. This posta was commanded by a Negro lieutenant born

in Africa; to his credit be it said there was not a rancho between the Colorado and Buenos Aires in nearly such neat order as his. He had a little room for strangers, and a small corral for the horses, all made of sticks and reeds; he had also dug a ditch round his house, as a defense in case of being attacked. This would, however, have been of little avail if the Indians had come; but his chief comfort seemed to rest in the thought of selling his life dearly. A short time before, a body of Indians had traveled past in the night; if they had been aware of the posta, our black friend and his four soldiers would assuredly have been slaughtered. I did not anywhere meet a more civil and obliging man than this Negro; it was therefore the more painful to see that he would not sit down and eat with us.

In the morning we sent for the horses very early and started for another exhilarating gallop. We passed the Cabeza del Buey, an old name given to the head of a large marsh which extends from Bahia Blanca. Here we changed horses, and passed through some leagues of swamps and saline marshes. Changing horses for the last time, we again began wading through the mud. My animal fell, and I was well soused in black mire—a very disagreeable accident when ones does not possess a change of clothes. Some miles from the fort we met a man who told us that a great gun had been fired, which is a signal that Indians are near. We immediately left the road and followed the edge of a marsh, which, when chased, offers the best mode of escape. We were glad to arrive within the walls, when we found all the alarm was about nothing, for the Indians turned out to be friendly ones who wished to join General Rosas.

We passed the night in Punta Alta [near Bahia Blanca], and I employed myself in searching for fossil bones; this point being a perfect catacomb for monsters of extinct races. The evening was perfectly calm and clear; the extreme monotony of the view gave it an interest even in the midst of mud banks and gulls, sand hillocks and solitary vultures. In riding back in the morning we came across a very fresh track of a puma, but did not succeed in finding it. We saw also a couple of zorillos, or skunks—odious animals which are far from uncommon. In general appearance the zorillo resembles a polecat, but it is rather larger and much thicker in proportion. Conscious of its power, it roams by day about the open plain and fears neither dog nor man. If a dog is urged to the attack, its courage is instantly checked by a few drops of the fetid oil, which brings on violent sickness and running at the nose. Whatever is once polluted by it is forever useless. Azara says the smell can be perceived at a league distant; more than once when entering the harbor of Montevideo, the wind being off shore, we have perceived the odor on board the Beagle. Certain it is that every animal most willingly makes room for the zorillo.

August—September 1833
Bahia Blanca

IN BAHIA BLANCA, on the coast of Argentina, was the scene of " Darwin's major work as an excavator of the remains of large prehistoric animals. The beach at Punta Alta, near Bahia Blanca, contained the fossils of gigantic animals that once had lived on the South American continent. They resembled certain of the species Darwin could see around him. But these fossil animals were strangely different in many ways. The megatherium bones he dug up were those of a giant ground sloth which was twenty feet long and much larger than an elephant. But the live sloths Darwin found in South America were the tree sloths, only a few feet long and living among the branches of trees. Another fossil, a Toxodon, was a creature as large as an elephant. Darwin thought it combined characteristics of rats and mice, hoofed animals, and certain sea mammals. He wondered at how so many different orders of present-day mammals were blended together in this one fossil. The evidence that animals had changed was there before his eyes. Some animals had become extinct, and were known only from fossil remains. Others, different but related, were alive. These fossils confirmed for him the thesis that "existing animals have a close relation in form with extinct species." The animal kingdom could not be the fixed system most of the scientists of his day thought it to be, for animal life had been different in the past and yet was linked with the present. Darwin made two visits to this area, one in 1832 and another

—the visit described here—in 1833. Between these two visits he seems to have thought seriously of leaving the voyage and returning home. His original agreement with Captain Fitzroy gave him complete freedom to leave whenever he desired. He complained in a letter to a sister that he was "thoroughly tired of these countries: a live Megatherium would hardly support my patience." He went on to say that if it was not for the numberless invertebrate animals which abound in the intertropical ocean, and if it were not for geology, he would in a short time "make a bolt across the Atlantic to good old Shropshire."

At the same time he was looking forward to "the glorious prospect of the future, when, passing the Strait of Magellan, we have in truth the world before us. Think of the Andes," he wrote, "the islands of the South Seas, and New South Wales. How many magnificent & characteristic views, how many & curious tribes of men we shall see,—what fine opportunities for geology and for studying the infinite host of living beings: —is not this a prospect to keep up the most flagging spirit? If I was to throw it away, I don't think I should ever rest quiet in my grave; I certainly should be a ghost & haunt the British Museum."

One of the chief grievances which plagued him throughout' the whole voyage was having no companion who was really interested in the things that excited him, no one with whom he could discuss them. He wrote of this in his long letters to Professor Henslow, to whom he owed the original invitation. Wickham, the first mate, with whom Darwin was on friendly terms, nevertheless referred to Darwin's "d . . . . d stuff" as a "bedevilment" of the ship, and Captain Fitzroy wrote of "our smiles at the apparent rubbish which he frequently brought on board" when Darwin was digging up the huge fossils at Punta Alta.

The fossils he sent home were studied by the Professor Richard Owen he keeps referring to in this chapter.

CHAPTER FIVE

THE Beagle arrived here on the 24th of August, and a week afterwards sailed for the Plata. With Captain Fitzroy's consent I was left behind, to travel by land to Buenos Aires. I will here add some observations which were made during this visit and on a previous occasion, when the Beagle was employed in surveying the harbor.

The plain, at the distance of a few miles from the coast, belongs to the great Pampean formation, which consists in part of a reddish clay, and in part of a highly calcareous marly [limestone with clay] rock. Nearer the coast there are some plains formed from the wreck of the upper plain, and from mud, gravel, and sand thrown up by the sea during the slow elevation of the land, of which elevation we have evidence in upraised beds of recent shells, and in rounded pebbles of

pumice scattered over the country. At Punta Alta we have a section of one of these later-formed little plains, which is highly interesting from the number and extraordinary character of the remains of gigantic land animals embedded in it. They have been fully described by Professor Owen in the Zoology of the voyage of the Beagle, and are deposited in the College of Surgeons. I will here give only a brief outline of their nature.

FOSSILS AT PUNTA ALTA

First, parts of three heads and other bones of the megatherium, the huge dimensions of which are expressed by its name. Secondly, the megalonyx, a great allied animal. Thirdly, the scelidotherium, also an allied animal, of which I obtained a nearly perfect skeleton. It must have been as large as a rhinoceros: in the structure of its head it comes nearest to the Cape anteater, but in some other respects it approaches to the armadillos. Fourthly, the Mylodon Darwinii, a closely related genus of little inferior size. Fifthly, another gigantic edental [mammals that include sloths, armadillos, and ant-eaters] quadruped. Sixthly, a large animal with an osseous coat in compartments, very like that of an armadillo. Seventhly, an extinct kind of horse. Eighthly, a tooth of a pachydermatous [thick-skinned, hoofed animals including elephants, hippopotamuses, rhinoceroses, etc.] animal, probably the same with the macrauchenia, a huge beast with a long neck like a camel. Lastly, the Toxodon, perhaps one of the strangest animals ever discovered : in size it equaled an elephant or megatherium, but the structure of its teeth proves indisputably that it was intimately related to the gnawers, the order which at the present day includes most of the smallest quadrupeds; in many details

it is allied to the Pachydermata; judging from the position of its eyes, ears, and nostrils, it was probably aquatic, like the dugong a.nd manatee, to which it is also allied. How wonderfully are the different orders, at the present time so well separated, blended together in different points of the structure of the Toxodon!

The remains of these nine great quadrupeds and many detached bones were found embedded on the beach within the space of about 200 yards square. It is a remarkable circumstance that so many different species should be found together; and it proves how numerous in kind the ancient inhabitants of this country must have been. . . .

The great size of the bones of the megatheroid animals, including the megatherium, megalonyx, scelidotherium, and mylodon, is truly wonderful. The habits of life of these animals were a complete puzzle to naturalists until Professor Owen lately solved the problem with remarkable ingenuity. The teeth indicate, by their simple structure, that these megatheroid animals lived on vegetable food, and probably on the leaves and small twigs of trees; their ponderous forms and great strong curved claws seem so little adapted for locomotion that some eminent naturalists have actually believed that, like the sloths, to which they are intimately related, they subsisted by climbing back downward on trees and feeding on the leaves. It was a bold, not to say preposterous, idea to conceive even antediluvian trees with branches strong enough to bear animals as large as elephants. Professor Owen, with far more probability, believes that, instead of climbing on the trees, they pulled the branches down to them, and tore up the smaller ones by the roots, and so fed on the leaves. The colossal breadth and weight of their hinder quarters, which can hardly be imagined without having been seen, become, on this view, of obvious service, instead of being an incumbrance: their apparent clumsiness disappears. With their great tails and their huge heels firmly fixed like a tripod on the ground, they could freely exert the full force of their most powerful arms and great claws. Strongly rooted indeed must that tree have been which could have resisted such force! The mylodon, moreover, was furnished with a long extensile tongue like that of the giraffe, which, by one of those beautiful provisions of nature, thus reaches with the aid of its long neck its leafy food. I may remark that in Abyssinia the elephant, according to Bruce, when it cannot reach with its proboscis the branches, deeply scores with its tusks the trunk of the tree, up and down and all round, till it is sufficiently weakened to be broken down.

THE SOUTH AMERICAN OSTRICH

I will now give an account of the habits of one of the more interesting birds which is common on the wild plains of Northern Patagonia [southern half of Argentina]—the South American ostrich. The ordinary habits of the ostrich are familiar to everyone. They live on vegetable matter, such as roots and grass; but at Bahia Blanca I have repeatedly seen three or four come down at low water to the extensive mud banks which are then dry, for the sake, as the gauchos say, of feeding on small fish. Although the ostrich in its habits is so shy, wary, and solitary, and although so fleet in its pace, it is caught without much difficulty by the Indian or gaucho armed with the bolas. When several horsemen appear in a semicircle, it

becomes confounded and does not know which way to escape. They generally prefer running against the wind; yet at the first start they expand their wings, and like a vessel make all sail. On one fine hot day I saw several ostriches enter a bed of tall rushes, where they squatted concealed till quite closely approached. It is not generally known that ostriches readily take to the water. Mr. King informs me that at the Bay of San Bias, and at Port Valdes in Patagonia, he saw these birds swimming several times from island to island. They ran into the water both when driven down to a point, and likewise of their own accord when not frightened: the distance crossed was about two hundred yards. When swimming, very little of their bodies appears above water; their necks are extended a little forward, and their progress is slow. On two occasions I saw some ostriches swimming across the Santa Cruz River, where its course was about four hundred yards wide and the stream rapid. . . .

The inhabitants of the country readily distinguish, even at a distance, the cock bird from the hen. The former is larger and darker-colored, and has a bigger head. The ostrich, I believe the cock, emits a singular, deep-toned, hissing note: when first I heard it, standing in the midst of some sand hillocks, I thought it was made by some wild beast, for it is a sound that one cannot tell whence it comes or from how far distant. When we were at Bahia Blanca in the months of September and October, the eggs, in extraordinary numbers, were found all over the country. They lie either scattered and single, in which case they are never hatched, and are called by the Spaniards huachos; or they are collected together into a shallow excavation, which forms the nest. Out of the four nests which I saw, three contained twenty-two eggs each and the fourth

twenty-seven. In one day's hunting on horseback sixty-four eggs were found; forty-four of these were in two nests, and the remaining twenty, scattered huachos. The gauchos unanimously affirm, and there is no reason to doubt their statement, that the male bird alone hatches the eggs and for some time afterwards accompanies the young. The cock when on the nest lies very close; I have myself almost ridden over one. It is asserted that at such times they are occasionally fierce and even dangerous, and they have been known to attack a man on horseback, trying to kick and leap on him. . . .

The gauchos unanimously affirm that several females lay in one nest. I have been positively told that four or five hen birds have been watched to go in the middle of the day, one after the other, to the same nest. I may add, also, that it is believed in Africa that two or more females lay in one nest. . . .

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REPTILES

Of reptiles there are many kinds; one snake (a Trigonocephalus, or C ophias) , from the size of the poison channel in its fangs, must be very deadly. Cuvier, in opposition to some other naturalists, makes this a sub-genus of the rattlesnake, and intermediate between it and the viper. In confirmation of this opinion, I observed a fact which appears to me very curious and instructive, as showing how every character, even though it may be in some degree independent of structure, has a tendency to vary by slow degrees. The extremity of the tail of this snake is terminated by a point, which is very slightly enlarged; and as the animal glides along, it constantly vibrates the last inch; and this part, striking against the dry grass and brushwood, produces a rattling noise which can be dis-

tinctly heard at the distance of six feet. As often as the animal was irritated or surprised, its tail was shaken; and the vibrations were extremely rapid. Even as long as the body retained its irritability, a tendency to this habitual movement was evident. This Trigonocephalus has, therefore, in some respects the structure of a viper, with the habits of a rattlesnake; the noise, however, being produced by a simpler device. The expression of this snake's face was hideous and fierce; the pupils consisted of a vertical slit in a mottled and coppery iris; the jaws were broad at the base, and the nose terminated in a triangular projection. I do not think I ever saw anything more ugly, excepting, perhaps, some of the vampire bats. I imagine this repulsive aspect originates from the features being placed in positions, with respect to each other, somewhat proportional to those of the human face; and thus we obtain a scale of hideousness.

Amongst the Batrachian reptiles I found only one little toad (Phryniscus nigricans) , which was most singular from its color. If we imagine, first, that it had been steeped in the blackest ink and then, when dry, allowed to crawl over a board freshly painted with the brightest vermilion so as to color the soles of its feet and parts of its stomach, a good idea of its appearance will be gained. If it had been an unnamed species, surely it ought to have been called Diabolicus, for it is a fit toad to preach in the ear of Eve. Instead of being nocturnal in its habits, as other toads are, and living in damp obscure recesses, it crawls during the heat of the day about the dry sand hillocks and arid plains, where not a single drop of water can be found. It must necessarily depend on the dew for its moisture; and this probably is absorbed by the skin, for it is known that these reptiles possess great powers of cutaneous absorption. At Mal-

(FIGURE)

donado, I found one in a situation nearly as dry as at Bahia Blanca and, thinking to give it a great treat, carried it to a pool of water; not only was the little animal unable to swim, but I think without help it would soon have been drowned.

Of lizards there are many kinds, but only one (Proctotretus multimaculatus) remarkable from its habits. It lives on the bare sand near the seacoast, and from its mottled color, the brownish scales being speckled with white, yellowish red, and dirty blue, can hardly be distinguished from the surrounding surface. When frightened, it attempts to avoid discovery by feigning death, with outstretched legs, depressed body, and closed eyes; if further molested, it buries itself with great quickness in the loose sand. This lizard, from its flattened body and short legs, cannot run quickly.

September 1833

Bahia Blanca to Buenos Aires

DARW1N'S HORSEBACK ride from Bahia Blanca to Buenos Aires was his biggest inland journey to date. At his destination on September 20, he wrote home that it was "a long journey,—between 500 and 600 miles through a district till very lately never penetrated except by the Indians, and never by an Englishman."

There is no reason to doubt Darwin's claim, neither is there reason to question the danger from the Indians he talks about. A war to the finish was being waged against them by General Rosas of the Buenos Aires government. And there were other dangers, too. His gaucho guide told him that an innkeeper one night had confidentially proposed to him that they cut Darwin's throat. The jaguars, animals almost as big as tigers, were dangerous too.

But Darwin was not only a genuine adventurer. He had amazing ability to adapt himself to his environment. He liked people of all kinds, except slaveowners, from the gauchos of Argentina to the aborigines of Australia. And he had extraor- [J dinary ability at adjusting himself to the lives different peoples led. In the same letter quoted above, he wrote: "I am becoming quite a Gaucho, drink my Maté (an aromatic drink made from a local variety of tea), and smoke my cigar, and then lie down and sleep as comfortably with the Heavens for canopy as in a feather bed. It is such a fine healthy life; on

horseback all day, eating nothing but meat, and sleeping in a bracing air, one wakes as fresh as a lark."

Darwin comments in this chapter on his passport describing him as "El Naturalista Don Carlos" (the naturalist Don Charles). His father once had called him a "rat catcher." On the Beagle he was known as anything from the "Philosopher" to "our flycatcher." Darwin now enjoys being described as a naturalist partly because he suspects that most of the people who inspect his passport have no idea what a naturalist is.

Darwin's powers of observation and description are increasing by leaps and bounds. Whether the subject is the gaucho method of hunting ostriches or the habits of the teru-tero birds, he sensitively records the details. His account of how grass changes when cattle graze on it shows his ability to theorize. But most significant of all in this chapter is his account of the ways in which the plants and animals of Argentina have changed since 1535, when the first Spanish colonists landed. His observations on how the introduction of domestic animals has changed the animal population of this vast country convince him that whole species can die out and others can replace them in a relatively short space of time. The cardoon, a large prickly European plant introduced here, has spread so that no native plant can live in the area it has invaded. Later on Darwin used such evidence to support his records of the speed with which certain species could increase if they were not checked by unfavorable conditions.

CHAPTER SIX

SEPTEMBER 8. I hired a gaucho to accompany me on my ride to Buenos Aires, though with some difficulty, as the father of one man was afraid to let him go, and another, who seemed willing, was described to me as so fearful that I was afraid to take him, for I was told that even if he saw an ostrich at a distance he would mistake it for an Indian and would fly like the wind away. The distance to Buenos Aires is about four hundred miles, and nearly the whole way through an uninhabited country. We started early in the morning; ascending a few hundred feet from the basin of green turf on which Bahia Blanca stands, we entered on a wide desolate plain. It consists of a crumbling argillaceo-calcareous [clayey-limestone] rock, which, from the dry nature of the climate, supports only scattered tufts of withered grass, without a single bush or tree to

break the monotonous uniformity. The weather was fine, but the atmosphere remarkably hazy; I thought the appearance foreboded a gale, but the gauchos said it was owing to the plain, at some great distance in the interior, being on fire. After a long gallop, having changed horses twice, we reached the Rio Sauce: it is a deep, rapid little stream, not above twenty-five feet wide. The second posta on the road to Buenos Aires stands on its banks; a little above there is a ford for horses, where the water does not reach to the horses' belly; but from that point, in its course to the sea, it is quite impassable, and hence makes a most useful barrier against the Indians.

THE THIRD POSTA

September 12 and 13. I stayed at this posta two days, waiting for a troop of soldiers which General Rosas had the kindness to send to inform me would shortly travel to Buenos Aires; and he advised me to take the opportunity of the escort. . . .

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In the morning we all sallied forth to hunt, and although we had not much success, there were some animated chases. Soon after starting, the party separated, and so arranged their plans that at a certain time of the day (in guessing which they show much skill) they should all meet from different points of the compass on a plain piece of ground, and thus drive together the wild animals. One day I went out hunting at Bahia Blanca, but the men there merely rode in a crescent, each being about a quarter of a mile apart from the other. A fine male ostrich, being turned by the headmost riders, tried to escape on one side. The gauchos pursued at a reckless

pace, twisting their horses about with the most admirable command, and each man whirling the balls round his head. At length the foremost threw them, revolving through the air: in an instant the ostrich rolled over and over, its legs fairly lashed together by the thong. . . .

…..

When we returned to the posta, we found two of the party returned who had been hunting by themselves. They had killed a puma, and had found an ostrich's nest with twenty-seven eggs in it. Each of these is said to equal in weight eleven hen's eggs; so that we obtained from this one nest as much food as 297 hen's eggs would have given.

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September 15. Rose very early in the morning, and shortly after passed the posta where the Indians had murdered the five soldiers. The officer had eighteen chuzo [spear] wounds in his body. By the middle of the day, after a hard gallop, we reached the fifth posta: on account of some difficulty in procuring horses, we stayed there the night. As this point was the most exposed on the whole line, twenty-one soldiers were stationed here; at sunset they returned from hunting, bringing with them seven deer, three ostriches, and many armadillos and partridges. When riding through the country, it is a common ' practice to set fire to the plain; and hence at night, as on this occasion, the horizon was illuminated in several places by brilliant conflagrations. This is done partly for the sake of puzzling any stray Indians, but chiefly for improving the pasture. In grassy plains unoccupied by the larger ruminating quadrupeds, it seems necessary to remove the superfluous vegetation by fire, so as to render the new year's growth serviceable.

The rancho at this place did not boast even of a roof, but merely consisted of a ring of thistle stalks, to break the force

of the wind. It was situated on the borders of an extensive but shallow lake swarming with wild fowl, among which the black-necked swan was conspicuous.

The kind of plover which appears as if mounted on stilts (Himantopus nigricollis) is here common in flocks of considcrablc size. It has been wrongfully accused of inelegance; when wading about in shallow water, which is its favorite resort, its gait is far from awkward. These birds in a flock utter a noise that singularly resembles the cry of a pack of small dogs in full chase: waking in the night, I have more than once been for a moment startled at the distant sound. The teru-tero (Vanellus cayanus) is another bird which often disturbs the stillness of the night. In appearance and habits it resembles in many respects our peewits [lapwings] ; its wings, however, are armed with sharp spurs like those on the legs of the common cock. As our peewit takes its name from the sound of its voice, so does the teru-tero. While riding over the grassy plains, one is constantly pursued by these birds, which appear to hate mankind, and I am sure deserve to be hated for their never-ceasing, unvaried, harsh screams. To the sportsman they are most annoying, by telling every other bird and animal of his approach; to the traveler in the country they may possibly, as Molina says, do good by warning him of the midnight robber. During the breeding season, they attempt, like our peewits, by feigning to be wounded, to draw away from their nests dogs and other enemies. The eggs of this bird are esteemed a great delicacy.

TO THE SEVENTH POSTA

September 16. To the seventh posta at the foot of the Sierra Tapalguen. The country was quite level, with a coarse herbage

and a soft peaty soil. The hovel was here remarkably neat, the posts and rafters being made of about a dozen dry thistle stalks bound together with thongs of hide; and by the support of these Ionic-like columns, the roof and sides were thatched with reeds. We were here told a fact which I would not have credited if I had not had partly ocular proof of it; namely, during the previous night, hail as large as small apples, and extremely hard, had fallen with such violence as to kill a considerable number of the wild animals. One of the men had already found thirteen deer (Cervus campestris) lying dead, and I saw their fresh hides; another of the party, a few minutes after my arrival, brought in seven more. Now I well know that one man without dogs could hardly have killed seven deer in a week. The men believed they had seen about fifteen dead ostriches (part of one of which we had for dinner) ; and they said that several were running about, evidently blind in one eye. Numbers of smaller birds, as ducks, hawks, and partridges, were killed. I saw one of the latter with a black mark on its back, as if it had been struck with a paving stone. A fence of thistle stalks round the hovel was nearly broken down, and my informer, putting his head out to see what was the matter, received a severe cut, and now wore a bandage. The storm was?‘ said to have been of limited extent: we certainly saw from our last night’s bivouac a dense cloud and lightning in this direction. It is marvelous how such strong animals as deer could thus have been killed; but I have no doubt, from the evidence I have given, that the story is not in the least exaggerated. . . . We did not reach the posta on the Rio Tapalguen till after it was dark. At supper, from something which was said, I was suddenly struck with horror at thinking that I was eating one of the favorite dishes of the country, namely, a half-formed

calf, long before its proper time of birth. It turned out to be puma; the meat is very white, and remarkably like veal in taste. . . . The gauchos differ in their opinion whether the jaguar is good eating, but are unanimous in saying that cat is excellent.

FRIENDLY INDIANS

September 1 7. We followed the course of the Rio Tapalguen through a very fertile country to the ninth posta. Tapalguen itself, or the town of Tapalguen, if it may be so called, consists of a perfectly level plain studded over, as far as the eye can reach, with the toldos, or oven-shaped huts of the Indians. The families of the friendly Indians, who were fighting on the side of Rosas, resided here. We met and passed many young Indian women, riding by two or three together on the same horse: they, as well as many of the young men, were strikingly handsome—their fine ruddy complexions being the picture of health. Besides the toldos, there were three ranchos; one inhabited by the commandant, and the two others by Spaniards with small shops.

We were here able to buy some biscuit. I had now been several days without tasting anything besides meat: I did not at all dislike this new regimen; but I felt as if it would only have agreed with me with hard exercise. I have heard that patients in England, when desired to confine themselves exclusively to an animal diet, even with the hope of life before their eyes, have hardly been able to endure it. Yet the gaucho in the Pampas, for months together, touches nothing but beef. . . . It is perhaps from their meat regimen that the gauchos, like other carnivorous animals, can abstain long from food. I was told that at Tandeel some troops voluntarily pur-

sued a party of Indians for three days without eating or drinking.

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September 19. Passed the Guardia del Monte. This is a nice scattered little town with many gardens full of peach and quince trees. The plain here looked like that around Buenos Aires, the turf being short and bright green, with beds of clover and thistles, and with vizcacha [rabbit-like animal] holes. I was very much struck with the marked change in the aspect of the country after having crossed the Salado. From a coarse herbage we pass onto a carpet of fine green verdure. I at first attributed this to some change in the nature of the soil, but the inhabitants assured me that here, as well as in Banda Oriental, where there is as great a difference between the country around Montevideo and the thinly inhabited savannas of Colonia, the whole was to be attributed to the manuring and grazing of the cattle. Exactly the same fact has been observed in the prairies of North America, where coarse grass between five and six feet high, when grazed by cattle, changes into common pastureland. I am not botanist enough to say whether the change here is owing to the introduction of new species, to the altered growth of the same, or to a difference in their proportional numbers. . . .

INTRODUCTION OF NEW SPECIES

Near the Guardia we find the southern limit of two European plants, now become extraordinarily common. The fennel in great profusion covers the ditch banks in the neighborhood of Buenos Aires, Montevideo, and other towns. But the cardoon (Cynara cardunculus) has a far wider range: it occurs in these latitudes on both sides of the Cordillera, across the continent.

I saw it in unfrequented spots in Chile, Entre Rios, and Banda Oriental. In the latter country alone very many (probably several hundred) square miles are covered by one mass of these prickly plants, and are impenetrable by man or beast. Over the undulating plains where these great beds occur nothing else can now live. Before their introduction, however, the surface must have supported, as in other parts, a rank herbage. I doubt whether any case is on record of an invasion on so grand a scale of one plant over the aborigines. As I have already said, I nowhere saw the cardoon south of the Salado; but it is probable that, in proportion as that country becomes inhabited, the cardoon will extend its limits. The case is different with

FIGURE

the giant thistle (with variegated leaves) of the Pampas, for I met with it in the valley of the Sauce. According to the principles so well laid down by Mr. Lyell, few countries have undergone more remarkable changes since the year 1535, when the first colonist of La Plata landed with seventy-two horses. The countless herds of horses, cattle, and sheep not only have altered the whole aspect of the vegetation, but they have almost banished the guanaco, deer, and ostrich. Numberless other changes must likewise have taken place; the wild pig in some parts probably replaces the peccari; packs of wild dogs may be heard howling on the wooded banks of the less frequented streams; and the common cat, altered into a large and fierce animal, inhabits rocky hills. The increase in numbers of the carrion vulture, since the introduction of the domestic animals, must have been infinitely great; and we have given reasons for believing that they have extended their southern range. No doubt many plants besides the cardoon and fennel are naturalized: thus the islands near the mouth of the Parané are thickly clothed with peach and orange trees, springing from seeds carried there by the waters of the river.

While changing horses at the Guardia several people questioned us much about the army—I never saw anything like the enthusiasm for Rosas, and for the success of the "most just of all wars, because against barbarians." This expression, it must be confessed, is very natural, for, till lately, neither man, woman, nor horse was safe from the attacks of the Indians. We had a long day's ride over the same rich green plain, abounding with various flocks, and with here and there a solitary estancia, and its one ombu tree. In the evening it rained heavily: on arriving at a post house we were told by the owner that if we had not a regular passport we must pass on, for there

were so many robbers he would trust no one. When he read, however, my passport, which began with "El Naturalista Don Carlos," his respect and civility were as unbounded as his suspicions had been before. What a naturalist might be, neither he nor his countrymen, I suspect, had any idea; but probably my title lost nothing of its value from that cause.

September 20. We arrived by the middle of the day at Buenos Aires. The outskirts of the city looked quite pretty, with the agave hedges and groves of olive, peach, and willow trees, all just throwing out their fresh green leaves. I rode to the house of Mr. Lumb, an English merchant, to whose kindness and hospitality, during my stay in the country, I was greatly indebted.

September -— October 1833
Buenos Aires to Santa Fe' and Return

ON OCTOBER 23, at the end of this trip between Buenos Aires and Santa Fé, Darwin wrote home that he thought it "quite magnificent" to reflect that he had ridden nearly eight hundred miles, the greater part through country most imperfectly known. He was including, of course, his trip from Bahia Blanca to Buenos Aires, related in the preceding chapter.

At the opening of this chapter Darwin questions a peculiar habit of the vizcacha, a gnawing animal that somewhat resembles a large rabbit. He asks: "for what purpose" does this animal drag every hard object to the mouth of its burrow? In asking this question, and in saying there must be "some good reason" for this habit, Darwin certainly does not mean that the animal has a conscious purpose. He is searching for an explanation of the function this habit performs in the life history of the animal, and wondering whether in some way itvd helps, or has formerly helped, the species to survive.

Across the Parana River, at Santa Fé Bajada, Darwin finds another great collection of fossils. He is constantly thrilled at finding such remains, which, he says, "tell their story of former times with almost a living tongue." But Darwin recognizes that they tell different people a different story. He records that once a gaucho said to him, "I do not think it strange, sefior, that these animals are here, since the devil does strange things. But I do not understand how you should know all their names."

A fossil tooth of a horse interests him greatly because it was

not yet generally known that horses had lived and disappeared in South America long before they were reintroduced by the Spanish colonists. Here is an animal that had become completely extinct at one time in the history of South America and yet ages later, after being introduced again, flourished so that countless herds overrun the continent!

Darwin also finds the teeth of a fossil elephant called the mastodon. The fossil remains of the horse and elephant lead him to make some important observations about the geographical distribution of animals. He is thinking in sweeping terms when he follows the elephant and horse from Siberia across the now submerged land in Bering Strait to North America and thence down to South America. Thus he accounts for the fact that the animals of North and South America formerly were closely related. At a later time, he says, the two continents split into two separate zoological provinces because barriers arose between them that animals could not cross.

Other scientists before and after Darwin collected information on the geographical distribution of plants and animals all over the earth. But Darwin's theory of evolution first illuminated the whole subject of why animals and plants were distributed as they were, and how they had changed on a constantly changing earth.

CHAPTER SEVEN

(FIGURE)

SEPTEM BER 27. In the evening I set out on an excursion to Santa Fé, which is situated nearly three hundred English miles from Buenos Aires, on the banks of the Parana. . . .

September 28. We passed the small town of Luxan, where there is a wooden bridge over the river—a most unusual convenience in this country. We passed also Areco. The plains appeared level, but were not so in fact, for in various places the horizon was distant. The estancias are here wide apart; for there is little good pasture, owing to the land being covered by beds either of an acrid clover or of the great thistle. The latter were at this time of the year two-thirds grown; in some parts they were as high as the horse's back, but in others they had not yet sprung up, and the ground was bare and dusty as on a

turnpike road. The clumps were of the most brilliant green, and they made a pleasing miniature likeness of broken forest land. When the thistles are full-grown, the great beds are impenetrable, except by a few tracks as intricate as those in a labyrinth. These are only known to the robbers, who at this season inhabit them and sally forth at night to rob and cut throats with impunity. Upon asking at a house whether robbers were numerous, I was answered, "The thistles are not up yet" —the meaning of which reply was not at first very obvious. There is little interest in passing over these tracts, for they are inhabited by few animals or birds, excepting the vizcacha and its friend the little owl.

THE VIZCACHA

The vizcacha is well known to form a prominent feature in the zoology of the Pampas. It is found as far south as the Rio Negro, in lat. 41°, but not beyond. . . .

The vizcacha has one very singular habit: namely, dragging every hard object to the mouth of its burrow; around each group of holes many bones of cattle, stones, thistle stalks, hard lumps of earth, dry dung, etc., are collected into an irregular heap, which frequently amounts to as much as a wheelbarrow would contain. I was credibly informed that a gentleman, when riding on a dark night, dropped his watch; he returned in the morning, and by searching the neighborhood of every vizcacha hole on the line of road, as he expected, he soon found it. This habit of picking up whatever may be lying on the ground anywhere near its habitation must cost much trouble. For what purpose it is done, I am quite unable to form even the most remote conjecture: it cannot be for defense, because the rubbish is chiefly placed above the mouth of the

burrow, which enters the ground at a very small inclination. No doubt there must exist some good reason, but the inhabitants of the country are quite ignorant of it. . . .

October 1. We started by moonlight, and arrived at the Rio Tercero by sunrise. This river is also called the Saladillo, and it deserves the name, for the water is brackish. I stayed here the greater part of the day, searching for fossil bones. Besides a perfect tooth of the Toxodon and many scattered bones, I found two immense skeletons near each other, projecting in bold relief from the perpendicular clifl of the Parana. They were, however, so completely decayed that I could only bring away small fragments of one of the great molar teeth; but these are sufficient to show that the remains belonged to a mastodon, probably to the same species with that which formerly must have inhabited the Cordillera in Upper Peru in such great numbers. The men who took me in the canoe said they had long known of these skeletons, and had often wondered how they had got there: the necessity of a theory being felt, they came to the conclusion that, like the vizcacha, the mastodon was formerly a burrowing animal! In the evening we rode

(FIGURE)

another stage, and crossed the Monge, another brackish stream, bearing the dregs of the washings of the Pampas.

October 2. We passed through Corunda, which, from the luxuriance of its gardens, was one of the prettiest villages I saw. From this point to Santa Fé the road is not very safe. The western side of the Parana northward ceases to be inhabited; and hence the Indians sometimes come down thus far and waylay travelers. The nature of the country also favors this, for instead of a grassy plain, there is an open woodland composed of low prickly mimosas. We passed some houses that had been ransacked and since deserted; we saw also a spectacle, which my guides viewed with high satisfaction: it was the skeleton of an Indian with the dried skin hanging on the bones, suspended to the branch of a tree.

SANTA FE

In the morning we arrived at Santa Fé. I was surprised to 7' observe how great a change of climate a difference of only three degrees of latitude between this place and Buenos Aires had caused. This was evident from the dress and complexion of the men—from the increased size of the ombu trees—the number of new cacti and other plants—and especially from the birds. In the course of an hour I remarked half a dozen birds which I had never seen at Buenos Aires. Considering that there is no natural boundary between the two places, and that the character of the country is nearly similar, the difference was much greater than I should have expected.

October 3 and 4. I was confined for these two days to my bed by a headache. A good-natured old woman, who attended me, wished me to try many odd remedies. A common practice is to bind an orange leaf or a bit of black plaster to each temple;

and a still more general plan is to split a bean into halves, moisten them, and place one on each temple, where they will easily adhere. It is not thought proper ever to remove the beans or plaster, but to allow them to drop off; and sometimes, if a man with patches on his head is asked what is the matter, he will answer, "I had a headache the day before yesterday."

Many of the remedies used by the people of the country are ludicrously strange, but too disgusting to be mentioned. One of the least nasty is to kill and cut open two puppies and bind them on each side of a broken limb. Little hairless dogs are in great request to sleep at the feet of invalids.

Santa Fé is a quiet little town, and is kept clean and in good order. The governor, Lopez, was a common soldier at the time of the revolution, but has now been seventeen years in power. This stability of government is owing to his tyrannical habits, for tyranny seems as yet better adapted to these countries than republicanism. The governor's favorite occupation is hunting Indians; a short time since he slaughtered forty-eight, and sold the children at the rate of three or four pounds apiece.

October 5. We crossed the Parana to Santa Fé Bajada, a town on the opposite shore. The passage took some hours, as the river here consisted of a labyrinth of small streams, separated by low wooded islands. I had a letter of introduction to an old Catalonian Spaniard, who treated me with the most uncommon hospitality. . . .

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I was delayed here five days, and employed myself in examining the geology of the surrounding country, which was very interesting. We here see, at the bottom of the cliffs, beds containing sharks' teeth and seashells of extinct species, passing above into an indurated marl [hardened limestone clay] and from that into the red clayey earth of the Pampas, with its

calcareous concretions [lumps of limestone] and the bones of terrestrial quadrupeds. . . .

FOSSIL HISTORY OF SOUTH AMERICA

In the Pampean deposit at the Bajada I found the osseous armor of a gigantic armadillo-like animal, the inside of which, when the earth was removed, was like a great cauldron; I found also teeth of the Toxodon and mastodon, and one tooth of a horse, in the same stained and decayed state. This latter tooth greatly interested me, and I took scrupulous care in ascertaining that it had been imbedded contemporaneously with the other remains, for I was not then aware that among the fossils from Bahia Blanca there was a horse's tooth hidden in the matrix: nor was it then known with certainty that the remains of horses are common in North America. Mr. Lyell has lately brought from the United States a tooth of a horse; and it is an interesting fact that Professor Owen could find in no species, either fossil or recent, a slight but peculiar curvature characterizing it, until he thought of comparing it with my specimen found here: he has named this American horse Equus curvidens. Certainly it is a marvelous fact in the history of the mammalia that in South America a native horse should have lived and disappeared, to be succeeded in after ages by the countless herds descended from the few introduced with the Spanish colonists!

The existence in South America of a fossil horse, of the mastodon, possibly of an elephant, and of a hollow-homed ruminant, discovered by Messrs. Lund and Clausen in the caves of Brazil, are highly interesting facts with respect to the geograph-
5) ical distribution of animals. At the present time, if we divide 'L America, not by the Isthmus of Panama, but by the southern

part of Mexico in lat. 20°, where the great tableland presents an obstacle to the migration of species by affecting the climate and by forming, with the exception of some valleys and of a fringe of low land on the coast, a broad barrier, we shall then have the two zoological provinces of North and South America strongly contrasted with each other. Some few species alone have passed the barrier, and may be considered as wanderers from the south, such as the puma, opossum, kinkajou, and peccari.

South America is characterized by possessing many peculiar gnawers, a family of monkeys, the llama, peccari, tapir, opossums, and, especially, several genera of Edentata, the order which includes the sloths, anteaters, and armadillos. North America, on the other hand, is characterized (putting on one side a few wandering species) by numerous peculiar gnawers, and by four genera (the ox, sheep, goat, and antelope) of hollow-horned ruminants, of which great division South America is not known to possess a single species. Formerly, but within the period when most of the now existing shells were living, North America possessed, besides hollow-horned ruminants, the elephant, mastodon, horse, and three genera of Edentata, namely, the megatherium, megalonyx, and mylodon. Within nearly this same period (as proved by the shells at Bahia Blanca) South America possessed, as we have just seen, a mastodon, horse, hollow-homed ruminant, and the same three genera (as well as several others) of the Edentata.

Hence it is evident that North and South America, in having within a late geological period these several genera in common, were much more closely related in the character of their terrestrial inhabitants than they now are. The more I reflect on this case, the more interesting it appears: I know of no other

instance where we can almost mark the period and manner of the splitting up of one great region into two well-characterized zoological provinces. The geologist, who is fully impressed with the vast oscillations of level which have affected the earth's crust within late periods, will not fear to speculate on the recent elevation of the Mexican platform, or, more probably, on the recent submergence of land in the West Indian archipelago, as the cause of the present zoological separation of North and South America. The South American character of the West Indian mammals seems to indicate that this archipelago was formerly united to the southern continent, and that it has subsequently been an area of subsidence.

When America, and especially North America, possessed its elephants, mastodons, horse, and hollow-horned ruminants, it was much more closely related in its zoological characters to the temperate parts of Europe and Asia than it now is. As the remains of these genera are found on both sides of Bering Strait and on the plains of Siberia, we are led to look to the north-western side of North America as the former point of communication between the Old and so-called New World. And as so many species, both living and extinct, of these same genera inhabit and have inhabited the Old World, it seems most probable that the North American elephants, mastodons, horse, and hollow-horned ruminants migrated, on land since submerged near Bering Strait, from Siberia into North America, and thence, on land since submerged in the West Indies, into South America, where for a time they mingled with the forms characteristic of that southern continent, and have since become extinct.

93 FIGURE

DOWN THE PARANA RIVER

October 1 2. I had intended to push my excursion further, but, not being quite well, I was compelled to return by a balandra, or one-masted vessel of about a hundred tons' burden, which was bound to Buenos Aires. As the weather was not fair, we moored early in the day to a branch of a tree on one of the islands. The Parana is full of islands, which undergo a constant round of decay and renovation. In the memory of the master several large ones had disappeared, and others again had been formed and protected by vegetation. They are composed of muddy sand, without even the smallest pebble, and were then about four feet above the level of the river; but during the periodical floods they are inundated. They all present one character; numerous willows and a few other trees are bound together by a great variety of creeping plants, thus forming a thick jungle. These thickets afford a retreat for capybaras and jaguars. The fear of the latter animal quite destroyed all pleasure in scrambling through the woods. This evening I had not proceeded a hundred yards before, finding indubitable signs of the recent presence of the tiger, I was obliged to come back. On every island there were tracks; and as on the former excursion "el rastro [track] de los Indios" had been the subject of conversation, so in this was "el rastro del tigre."

The wooded banks of the great rivers appear to be the favorite haunts of the jaguar; but south of the Plata I was told that they frequented the reeds bordering lakes: wherever they are, they seem to require water. Their common prey is the capybara, so that it is generally said where capybaras are numerous there is little danger from the jaguar. . .

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Owing to bad weather we remained two days at our moorings. Our only amusement was catching fish for our dinner: there were several kinds, and all good eating. A fish called the "armado" (a Silurus [catfish family]) is remarkable from a harsh grating noise which it makes when caught by hook and line, and which can be distinctly heard when the fish is beneath the water. This same fish has the power of firmly catching hold of any object, such as the blade of an oar or the fishing line, with the strong spine both of its pectoral and dorsal fin. In the evening the weather was quite tropical, the thermometer standing at 79°. Numbers of fireflies were hovering about, and the mosquitoes were very troublesome. I exposed my hand for five minutes, and it was soon black with them; I do not suppose there could have been less than fifty, all busy sucking.

October 1 5 . We got under way and passed Punta Gorda, where there is a colony of tame Indians from the province of Missiones. We sailed rapidly down the current, but before sunset, from a silly fear of bad weather, we brought-to in a narrow arm of the river. I took the boat and rowed some distance up this creek. It was very narrow, winding, and deep; on each side a wall thirty or forty feet high, formed by trees entwined with creepers, gave to the canal a singularly gloomy appearance. I here saw a very extraordinary bird, called the scissor-beak [black skimmer] (Rhynchops nigra). It has short legs, web feet, extremely long-pointed wings, and is of about the size of a tern. The beak is flattened laterally; that is, in a plane at right angles to that of a spoonbill or duck. It is as flat and elastic as an ivory paper cutter, and the lower mandible, differently from every other bird, is an inch and a half longer than the upper. In a lake near Maldonado, from which the water had been nearly drained, and which, in consequence, swarmed with small fry, I saw sev-

eral of these birds, generally in small flocks, flying rapidly backward and forward close to the surface of the lake. They kept their bills wide open, and the lower mandible half buried in the water. Thus skimming the surface, they plowed it in their course: the water was quite smooth, and it formed a most curious spectacle to behold a flock, each bird leaving its narrow wake on the mirror-like surface. In their flight they frequently twist about with extreme quickness, and dexterously manage with their projecting lower mandible to plow up small fish, which are secured by the upper and shorter half of their scissor-like bills. This fact I repeatedly saw, as, like swallows, they continued to fly backward and forward close before me. Occasionally when leaving the surface of the water their flight was wild, irregular, and rapid; they then uttered loud harsh cries. When these birds are fishing, the advantage of the long primary feathers of their wings, in keeping them dry, is very evident. When thus employed, their forms resemble the symbol by which many artists represent marine birds. Their tails are much used in steering their irregular course.

October 20. Being arrived at the mouth of the Parana, and as I was very anxious to reach Buenos Aires, I went on shore at Las Conchas, with the intention of riding there. Upon landing, I found to my great surprise that I was to a certain degree a prisoner. A violent revolution having broken out, all the ports were laid under an embargo. I could not return to my vessel, and as for going by land to the city, it was out of the question. After a long conversation with the commandant, I obtained permission to go the next day to General Rolor, who commanded a division of the rebels on this side the capital. In the morning I rode to the encampment. The general, officers, and

soldiers all appeared, and I believe really were, great villains. The general, the very evening before he left the city, voluntarily went to the governor and, with his hand to his heart, pledged his word of honor that he at least would remain faithful to the last. The general told me that the city was in a state of close blockade, and that all he could do was to give me a passport to the commander-in-chief of the rebels at Quilmes. We had therefore to take a great sweep round the city, and it was with much difficulty that we procured horses. My reception at the encampment was quite civil, but I was told it was quite impossible that I could be allowed to enter the city. I was very anxious about this, as I anticipated the Beagle's departure from the Rio Plata earlier than it took place. Having mentioned, however, General Rosas's obliging kindness to me when at the Colorado, magic itself could not have altered circumstances quicker than did this conversation. I was instantly told that, though they could not give me a passport, if I chose to leave my guide and horses I might pass their sentinels. I was too glad to accept of this, and an officer was sent with me to give directions that I should not be stopped at the bridge. The road for the space of a league was quite deserted. I met one party of soldiers, who were satisfied by gravely looking at an old passport; and at length I was not a little pleased to find myself within the city.

November 1833 —January 1834
Uruguay and Patagonia

AS WE HAVE SEEN, most of the geologists of Darwin's time believed that violent world-wide catastrophes had, at intervals in the earth's history, destroyed all living things. But Charles Lyell had already presented Darwin with a different point of view in his Principles of Geology. Darwin read this book avidly and agreed with its principle that natural forces such as could now be observed had been in operation for unlimited periods of time in the earth's history. These natural forces—such as the slow rising and sinking of continents, the more rapid action of volcanoes and earthquakes, the erosion by rivers and tides and wind—were continually changing the face of the earth.

In Patagonia, Darwin sees for himself evidence of the way'? these natural forces have worked over vast stretches of time to wear away and build up the land. Along the coast he sees many signs of its having been lifted up from the sea, and remarks about the history of geological change that is revealed there! His mind is "stupefied in thinking over the long, absolutely necessary, lapse of years" it must have taken for masses of rock to fall and be dashed into smaller pieces and rolled and rounded into the pebbles he sees before him in a fifty-foot-thick layer on the coast.

At Port San Julian he finds a remarkable fossil about the size of a camel and in some ways resembling the llama, the elephant, the horse, and the rhinoceros. Again he ponders the relationship of an extinct animal to its living relatives. He says, "This

wonderful relationship in the same continent between the dead and the living will, I do not doubt, hereafter throw more light on the appearance of organic beings on our earth, and their disappearance from it, than any other class of facts."

He speculates about the past history of South America when it swarmed with the great monsters whose fossil remains he is finding, and wonders what forces could have caused them to die out. "Certainly no fact in the long history of the world is so startling as the wide and repeated exterminations of its inhabitants." He rejects the explanation of catastrophes because everything in the geology of Patagonia points to its having been shaped by slow and gradual changes. He goes on to consider the possibilities. Could it have been changes in temperature? Ice ages? Drought? Failure of food supply? He finally concludes that we are much too ignorant of the everyday existence of every animal to know what check is constantly preventing its too rapid increase.

Here Darwin comes close to his principle of Natural Selection which he expounded in the Origin of Species many years later. Darwin wrote this particular part of the chapter some years after his return from the voyage when he prepared the revised second edition. It was written after he read a work by an English clergyman, Thomas E. Malthus, entitled An Essay on the Principles of Population. From Malthus, Darwin borrowed the principle of geometric increase in population numbers. He applied it to the animal world. Animals tend to increase by a geometrical ratio. That is, two parents, let us say, have eight offspring; these have thirty-two; these in turn increase to one hundred and twenty-eight. If all these descendants were to stay alive, while the food supply stayed relatively constant, there would be a struggle for existence in the animal world. When Darwin added to this Malthusian principle the concept that only the fittest animals would survive in such a struggle, he completed his theory of Natural Selection.

CHAPTER EIGHT

HAVING been delayed for nearly a fortnight in the city, I was glad to escape on board a packet bound for Monttevideo. A town in a state of blockade must always be a disagreeable place of residence; in this case, moreover, there were constant apprehensions from robbers within. The sentinels were the worst of all, for, from their office and from having arms in their hands, they robbed with a degree of authority which other men could not imitate.

Our passage was a very long and tedious one. The Plata looks like a noble estuary on the map, but is in truth a poor affair. A wide expanse of muddy water has neither grandeur nor beauty. At one time of the day, the two shores, both of which are extremely low, could just be distinguished from the deck. On arriving at Montevideo I found that the Beagle would

not sail for some time, so I prepared for a short excursion in this part of Banda Oriental. Everything which I have said about the country near Maldonado is applicable to Montevideo; but the land, with the one exception of the Green Mount, 450 feet high, from which it takes its name, is far more level. Very little of the undulating grassy plain is enclosed; but near the town there are a few hedge banks, covered with- agaves, cacti, and fennel.

November 14. We left Montevideo in the afternoon. I intended to proceed to Colonia del Sacramiento, situated on the northern bank of the Plata and opposite to Buenos Aires, and thence, following up the Uruguay, to the village of Mercedes on the Rio Negro (one of the many rivers of this name in South America), and from this point to return direct to Montevideo. We slept at the house of my guide at Canelones. In the morning we rose early, in the hopes of being able to ride a good distance, but it was a vain attempt, for all the rivers were flooded. We passed in boats the streams of Canelones, Santa Lucia, and San José, and thus lost much time. On a former excursion I crossed the Lucia near its mouth, and I was surprised to observe how easily our horses, although not used to swim, passed over a width of at least six hundred yards. On mentioning this at Montevideo, I was told that, a vessel containing some mountebanks and their horses being wrecked in the Plata, one horse swam seven miles to the shore. In the course of the day I was amused by the dexterity with which a gaucho forced a restive horse to swim a river. He stripped off his clothes and, jumping on its back, rode into the water till it was out of its depth; then slipping off over the crupper, he caught hold of the tail, and as often as the horse turned round, the man frightened it back by splashing water in its face. As soon as the horse

touched the bottom on the other side, the man pulled himself on, and was firmly seated, bridle in hand, before the horse gained the bank. A naked man on a naked horse is a fine spectacle; I had no idea how well the two animals suited each other. The tail of a horse is a very useful appendage; I have passed a river in a boat with four people in it, which was ferried across in the same way as the gaucho. If a man and horse have to cross a broad river, the best plan is for the man to catch hold of the pommel or mane and help himself with the other arm.

November 18. Rode with my host to his estancia, at the Arroyo de San Juan. In the evening we took a ride round the estate: it contained two square leagues and a half, and was situated in what is called a rincon; that is, one side was fronted by the Plata, and the two others guarded by impassable brooks. There was an excellent port for little vessels, and an abundance of small wood, which is valuable as supplying fuel to Buenos Aires. I was curious to know the value of so complete an estancia. Of cattle there were 3,000, and it would well support three or four times that number; of mares 800, together with 150 broken-in horses, and 600 sheep. There was plenty of water and limestone, a rough house, excellent corrals, and a peach orchard. For all this he had been offered £2,000, and he only wanted £500 additional, and probably would sell for less. The chief trouble with an estancia is driving the cattle twice a week to a central spot, in order to make them tame, and to count them. This latter operation would be thought difficult where there are ten or fifteen thousand head together. It is managed on the principle that the cattle invariably divide themselves into little troops of from forty to one hundred. Each troop is recognized by a few peculiarly marked animals, and its number is known:

so that, one being lost out of ten thousand, it is perceived by its absence from one of the tropillas. During a stormy night the cattle all mingle together, but the next morning the tropillas separate as before; so that each animal must know its fellow out of ten thousand others.

N IATA CATTLE

On two occasions I met with in this province some oxen of a very curious breed called nata or niata. They appear externally to hold nearly the same relation to other cattle which bull or pug dogs do to other dogs. Their forehead is very short and broad, with the nasal end turned up, and the upper lip much drawn back; their lower jaws project beyond the upper, and have a corresponding upward curve; hence their teeth are always exposed. Their nostrils are seated high up and are very open; their eyes project outward. When walking they carry their heads low, on a short neck; and their hinder legs are rather longer compared with the front legs than is usual. Their bare teeth, their short heads, and upturned nostrils give them the most ludicrous self-condense air of defiance imaginable. When the pasture is tolerably long the niata cattle feed with the tongue and palate as well as common cattle; but during the great droughts, when so many animals perish, the niata breed is under a great disadvantage and would be exterminated if not attended to; for the common cattle, like horses, are able just to keep alive by browsing with their lips on twigs of trees and reeds; this the niatas cannot so well do, as their lips do not join, and hence they are found to perish before the common cattle. This strikes me as a good illustration of how little we are able to judge from the ordinary habits of life on what

circumstances, occurring only at long intervals, the rarity or extinction of a species may be determined.

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ON THE ROAD TO MERCEDES

November 19. In the evening we proceeded on our road towards Mercedes on the Rio Negro. At night we asked permission to sleep at an estancia at which we happened to arrive. It was a very large estate, being ten leagues square, and the owner is one of the greatest landowners in the country. His nephew had charge of it, and with him there was a captain in the army, who the other day ran away from Buenos Aires. Considering their station, their conversation was rather amusing. They expressed, as was usual, unbounded astonishment at the globe being round, and could scarcely credit that a hole would, if deep enough, come out on the other side. They had, however, heard of a country where there were six months light and six of darkness, and where the inhabitants were very tall and thin! They were curious about the price and condition of horses and cattle in England. Upon finding out we did not catch our animals with the lazo, they cried out, “Ah, then, you use nothing but the bolas”: the idea of an enclosed country was quite new to them. The captain at last said, he had one question to ask me, which he should be very much obliged if I would answer with all truth. I trembled to think how deeply scientific it would be: it was, “whether the ladies of Buenos Aires were not the handsomest in the world.” I replied, like a renegade, “Charmingly so.” He added, “I have one other question: do ladies in any other part of the world wear such

large combs?” I solemnly assured him that they did not. They were absolutely delighted. The captain exclaimed, “Look there! a man who has seen half the world says it is the case; we always thought so, but now we know it.” My excellent judgment in combs and beauty procured me a most hospitable reception; the captain forced me to take his bed, and he would sleep on his recado.

November 21 . Started at sunrise, and rode slowly during the whole day. The geological nature of this part of the province was different from the rest, and closely resembled that of the Pampas. In consequence, there were immense beds of the thistle, as well as of the cardoon: the whole country, indeed, may be called one great bed of these plants. The two sorts grow separate, each plant in company with its own kind. The cardoon is as high as a horse’s back, but the Pampas thistle is often higher than the crown of the rider’s head. To leave the road for a yard is out of the question; and the road itself is partly, and in some cases entirely, closed. Pasture, of course, there is none; if cattle or horses once enter the bed, they are for the time completely lost. Hence it is very hazardous to attempt to drive cattle at this season of the year, for when jaded enough to face the thistles, they rush among them and are seen no more. In these districts there are very few estancias, and these few are situated in the neighborhood of damp valleys, where fortunately neither of these overwhelming plants can exist. As night came on before we arrived at our journey’s end, we slept at a miserable little hovel inhabited by the poorest people. The extreme though rather formal courtesy of our host and hostess, considering their grade of life, was quite delightful.

SOME GIANT BONES

November 26. I set out on my return in a direct line for Montevideo. Having heard of some giant's bones at a neighboring farmhouse on the Sarandis, a small stream entering the Rio Negro, I rode there accompanied by my host, and purchased for the value of eighteen pence the head of the Toxodon. When found it was quite perfect; but the boys knocked out some of the teeth with stones, and then set up the head as a mark to throw at. By a most fortunate chance I found a perfect tooth, which exactly fitted one of the sockets in this skull, embedded by itself on the banks of the Rio Tercero, at the distance of about one hundred and eighty miles from this place. I found remains of this extraordinary animal at two other places, so that it must formerly have been common. I found here, also, some large portions of the armor of a gigantic armadillo-like animal, and part of the great head of a mylodon. The bones of this head are so fresh that they contain seven per cent of animal matter; and when placed in a spirit lamp, they burn with a small flame. The number of the remains embedded in the grand estuary deposit which forms the Pampas and covers the granitic rocks of Banda Oriental must be extraordinarily great. I believe a straight line drawn in any direction through the Pampas would cut through some skeleton or bones. Besides those which I found during my short excursions, I heard of many others, and the origin of such names as "the stream of the animal," "the hill of the giant," is obvious. At other times I heard of the marvelous property of certain rivers which had the power of changing small bones into large; or, as some maintained, the bones themselves -grew. As far as I am aware, not one of these animals perished, as was formerly supposed, in the marshes or

muddy river beds of the present land, but their bones have been exposed by the streams intersecting the subaqueous deposit in which they were originally embedded. We may conclude that the whole area of the Pampas is one wide sepulcher of these extinct gigantic quadrupeds.

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TO PORT DESIRE

December 6. The Beagle sailed from the Rio Plata, never again to enter its muddy stream. Our course was directed to Port Desire, on the coast of Patagonia. Before proceeding any further, I will here put together a few observations made at sea. Several times when the ship has been some miles off the mouth of the Plata, and at other times when off the shores of Northern Patagonia, we have been surrounded by insects. One evening, when we were about ten miles from the Bay of San Blas, vast numbers of butterflies, in bands or flocks of countless myriads, extended as far as the eye could range. Even by the aid of a telescope it was not possible to see the space free from butterflies. The seamen cried out "it was snowing butterflies," and such in fact was the appearance. More species than one were present, but the main part belonged to a kind very similar to, but not identical with, the common English Colias edusa. Some moths and hymenoptera accompanied the butterflies; and a fine beetle (Calosoma) flew on board. Other instances are known of this beetle having been caught far out at sea ; and this is the more remarkable, as the great number of the Carabidae seldom or never take wing. The day had been fine and calm, and the one previous to it equally so, with light and variable airs. Hence we cannot suppose that the insects were blown off the land, but we must conclude that they voluntarily

took flight. The great bands of the Colias seem at first to afford an instance like those on record of the migrations of another butterfly, Vanessa cardui; but the presence of other insects makes the case distinct, and even less intelligible. Before sunset a strong breeze sprung up from the north, and this must have caused tens of thousands of the butterflies and other insects to have perished.

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While sailing a little south of the Plata on one very dark night, the sea presented a wonderful and most beautiful spectacle. There was a fresh breeze, and every part of the surface, which during the day is seen as foam, now glowed with a pale light. The vessel drove before her bows two billows of liquid phosphorus, and in her wake she was followed by a milky train. As far as the eye reached, the crest of every wave was bright, and the sky above the horizon, from the reflected glare of these livid flames, was not so utterly obscure as over the vault of the heavens.

On two occasions I have observed the sea luminous at considerable depths beneath the surface. Near the mouth of the Plata some circular and oval patches, from two to four yards in diameter, and with defined outlines, shone with a steady but pale light, while the surrounding water only gave out a few sparks. The appearance resembled the reflection of the moon, or some luminous body, for the edges were sinuous from the undulations of the surface. The ship, which drew thirteen feet of water, passed over without disturbing these patches. therefore we must suppose that some animals were congregated together at a greater depth than the bottom of the vessel.

December 23. We arrived at Port Desire, situated in lat. 47°, on the coast of Patagonia. The creek runs for about twenty miles inland, with an irregular width. The Beagle anchored a few miles within the entrance, in front of the ruins of an old Spanish settlement.

the same evening I went on shore. The first landing in any new country is very interesting, and especially when, as in this case, the whole aspect bears the stamp of a marked and individual character. At the height of between two and three hundred feet above some masses of porphyry a wide plain extends which is truly characteristic of Patagonia. The surface is quite level, and is composed of well-rounded shingle mixed with a whitish earth. Here and there scattered tufts of brown wiry grass are supported, and, still more rarely, some low thorny bushes. The weather is dry and pleasant, and the fine blue sky is but seldom obscured. When standing in the middle of one of these desert plains and looking towards the interior, the view is generally bounded by the escarpment of another plain, rather higher, but equally level and desolate; and in every other direction the horizon is indistinct from the trembling mirage which seems to rise from the heated surface.

In such a country the fate of the Spanish settlement was soon decided; the dryness of the climate during the greater part of the year and the occasional hostile attacks of the wandering Indians compelled the colonists to desert their half-finished buildings. The style, however, in which they were commenced shows the strong and liberal hand of Spain in the old time. The result of all the attempts to colonize this side of America south of 41° have been miserable. Port Famine expresses by its name the lingering and extreme sufferings of several hundred wretched people, of whom one alone survived

to relate their misfortunes. At St. Joseph's Bay, on the coast of Patagonia, a small settlement was made, but during one Sunday the Indians made an attack and massacred the whole party, excepting two men, who remained captives during many years. At the Rio Negro I conversed with one of these men, now in extreme old age.

ZOOLOGY of PATAGONIA

The zoology of Patagonia is as limited as its flora. On the arid plains a few black beetles (Heteromera) might be seen slowly crawling about, and occasionally a lizard darted from side to side. Of birds we have three carrion hawks, and in the valleys a few finches and insect-feeders. An ibis (theristicus melanops—a species said to be found in central Africa) is not uncommon on the most desert parts: in their stomachs I found grasshoppers, cicadas, small lizards, and even scorpions. At one time of the year these birds go in flocks, at another in pairs; their cry is very loud and singular, like the neighing of the guanaco.

The guanaco, or wild llama, is the characteristic quadruped of the plains of Patagonia; it is the South American representative of the camel of the East. It is an elegant animal in a state of nature, with a long slender neck and fine legs. It is very common over the whole of the temperate parts of the continent, as far south as the islands near Cape Horn. It generally lives in small herds of from half a dozen to thirty in each; but on the banks of the Santa Cruz we saw one herd which must have contained at least five hundred.

they are generally wild and extremely wary. Mr. Stokes told me that he one day saw through a glass a herd of these animals which evidently had been frightened and were running away

at full speed, although their distance was so great that he could not distinguish them with his naked eye. The sportsman frequently receives the first notice of their presence by hearing from a long distance their peculiar shrill neighing note of alarm. If he then looks attentively, he will probably see the herd standing in a line on the side of some distant hill. On approaching nearer, a few more squeals are given, and off they set at an apparently slow, but really quick canter, along some narrow beaten track to a neighboring hill. If, however, by chance he abruptly meets a single animal, or several together, they will generally stand motionless and intently gaze at him; then perhaps move on a few yards, turn round, and look again. What is the cause of this difference in their shyness? Do they mistake a man in the distance for their chief enemy, the puma? Or does curiosity overcome their timidity? That they are curious is certain; for if a person lies on the ground and plays strange antics, such as throwing up his feet in the air, they will

(FIGURE)

almost always approach by degrees to reconnoiter him. It was an artifice repeatedly practiced by our sportsmen with success, and it had, moreover, the advantage of allowing several shots to be fired, which were all taken as part of the performance -

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The guanacos have one singular habit, which is to me quite inexplicable; namely, that on successive days they drop their dung in the same defined heap. I saw one of these heaps which was eight feet in diameter, and was composed of a large quantity. This habit is common to all the species of the genus; it is very useful to the Peruvian Indians, who use the dung for fuel, and are thus saved the trouble of collecting it.

the guanacos appear to have favorite spots for lying down to die. On the banks of the Santa Cruz, in certain circumscribed spaces, which were generally bushy and all near the river, the ground was actually white with bones. On one such spot I counted between ten and twenty heads. I particularly examined the bones; they did not appear, as some scattered ones which I had seen, gnawed or broken, as if dragged together by beasts of prey. The animals in most cases must have crawled, before dying, beneath and among the bushes. . . .

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One day the yawl was sent under the command of Mr. Chaffers with three days' provisions to survey the upper part of the harbor. In the morning we searched for some watering places mentioned in an old Spanish chart. We found one creek at which at the head there was a trickling rill (the first we had seen) of brackish water. Here the tide compelled us to wait several hours, and in the interval I walked some miles into the interior. The plain, as usual, consisted of gravel mingled with soil resembling chalk in appearance, but very different from it

in nature. From the softness of these materials it was worn into many gulleys. There was not a tree, and, excepting the guanaco, which stood on the hilltop a watchful sentinel over its herd, scarcely an animal or a bird. All was stillness and desolation. Yet in passing over these scenes, without one bright object near, an ill-defined but strong sense of pleasure is vividly excited. One asked how many ages the plain had thus lasted, and how many more it was doomed thus to continue.

None can reply—all seems eternal now.
the wilderness has a mysterious tongue,
Which teaches awful doubt.

[Shelley, Lines on .Mont Blanc]

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January 9, 1834. Before it was dark the Beagle anchored in the fine spacious harbor of Port San Julian, situated about one hundred and ten miles to the south of Port Desire. We remained here eight days . . .

GEOLOGY of PATAGONIA

The geology of Patagonia is interesting. Differently from Europe, where the tertiary [geological period of the rise of mammals] formations appear to have accumulated in bays, here along hundreds of miles of coast we have one great deposit, including many tertiary shells, all apparently extinct. the most common shell is a massive gigantic oyster, sometimes even a foot in diameter. These beds are covered by others of a peculiar soft white stone, including much gypsum, and resembling chalk, but really of a pumiceous [resembling pumice] nature. It is highly remarkable, from being composed, to at least one-tenth part of its bulk, of infusoria: Professor Ehren-

berg has already ascertained in it thirty oceanic forms. This bed extends for 500 miles along the coast, and probably for a considerably greater distance. At Port San Julian its thickness is more than 800 feet! these white beds are everywhere capped by a mass of gravel, forming probably one of the largest beds of shingle in the world: it certainly extends from near the Rio Colorado to between 600 and 700 nautical miles southward; at Santa Cruz (a river a little south of San Julian), it reaches to the foot of the Cordillera ; halfway up the river, its thickness is more than 200 feet; it probably everywhere extends to this great chain, whence the well-rounded pebbles of porphyry have been derived. We may consider its average breadth as 200 miles, and its average thickness as about 50 feet. If this great bed of pebbles, without including the mud necessarily derived from their attrition, was piled into a mound, it would form a great mountain chain! When we consider that all these pebbles, countless as the grains of sand in the desert, have been derived from the slow falling of masses of rock on the old coast lines and banks of rivers, and that these fragments have been dashed into smaller pieces, and that each of them has since been slowly rolled, rounded, and far transported, the mind is stupefied in thinking over the long, absolutely necessary lapse of years. Yet all this gravel has been transported, and probably rounded, subsequently to the deposition of the white beds, and long subsequently to the underlying beds with the tertiary shells. Everything in this southern continent has been effected on a grand scale: the land, from the Rio Plata to Tierra del Fuego, a distance of 1,200 miles, has been raised in mass (and in Patagonia to a height of between 300 and 400 feet) within the period of the now existing seashells. . . . Nor has Patagonia been affected only by upward movements: the extinct tertiary

shells from Port San Julian and Santa Cruz cannot have lived, according to Professor E. Forbes, in a greater depth of water than from 40 to 250 feet; but they are now covered with sea-deposited strata from 800 to 1,000 feet in thickness: hence the bed of the sea, on which these shells once lived, must have sunk downwards several hundred feet, to allow of the accumulation of the superincumbent strata. What a history of geological changes does the simply constructed coast of Patagonia reveal!

RELATION BETWEEN EXTINCT AND LIVING SPECIES

At Port San Julian, in some red mud capping the gravel on the 90-foot plain, I found half the skeleton of the M acrauchenia Patachonica, a remarkable quadruped, full as large as a camel. It belongs to the same division of the Pachydermata with the rhinoceros, tapir, and paleotherium [extinct relative of rhinoceros and tapir]; but in the structure of the bones of its long neck it shows a clear relation to the camel, or rather to the guanaco and llama. From recent seashells being found on two of the higher step-formed plains, which must have been modeled and upraised before the mud was deposited in which the macrauchenia was entombed, it is certain that this curious quadruped lived long after the sea was inhabited by its present shells. I was at first much surprised how a large quadruped could so lately have subsisted, in lat. 49° 15’, on these wretched gravel plains with their stunted vegetation; but the relationship of the macrauchenia to the guanaco, now an inhabitant of the most sterile parts, partly explains this difficulty.

the relationship, though distant, between the macrauchenia and the guanaco, between the toxodon and the capybara—the closer relationship between the many extinct Edentata and the

living sloths, anteaters, and armadillos now so eminently characteristic of South American zoology—and the still closer relationship between the fossil and living species of C tenomys [tucutuco or mole-rat] and Hydrochaerus [capybara or water hog] are most interesting facts. . . . This wonderful relationship in the same continent between the dead and the living will, I do not doubt, hereafter throw more light on the appearance of organic beings on our earth, and their disappearance from it, than any other class of facts

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CAUSES of EXTINCTION

It is impossible to reflect on the changed state of the American continent without the deepest astonishment. Formerly it must have swarmed with great monsters: now we find mere pygmies, compared with the antecedent, allied races. If Buffon had known of the gigantic sloth and armadillo-like animals and of the lost Pachydermata, he might have said, with a greater semblance of truth, that the creative force in America had lost its power, rather than that it had never possessed great vigor. The greater number, if not all, of these extinct quadrupeds lived at a late period and were the contemporaries of most of the existing seashells. Since they lived, no very great change in the form of the land can have taken place.

What, then, has exterminated so many species and whole genera? the mind at first is irresistibly hurried into the belief of some great catastrophe; but thus to destroy animals, both large and small, in Southern Patagonia, in Brazil, on the Cordillera of Peru, in North America up to Bering Strait, we must shake the entire framework of the globe. An examination, moreover, of the geology of La Plata and Patagonia leads to the belief that all the features of the land result from slow and

gradual changes. . . . It could hardly have been a change of temperature, which at about the same time destroyed the inhabitants of tropical, temperate, and arctic latitudes on both sides of the globe. In North America we positively know from Mr. Lyell that the large quadrupeds lived subsequently to that period when boulders were brought into latitudes at which icebergs now never arrive: from conclusive but indirect reasons we may feel sure that in the southern hemisphere the macrauchenia, also, lived long subsequently to the ice-transporting boulder period. Did man, after his first inroad into South America, destroy, as has been suggested, the unwieldy megatherium and the other Edentata? We must at least look to some other cause for the destruction of the little tucutuco at Bahia Blanca, and of the many fossil mice and other small quadrupeds in Brazil. No one will imagine that a drought, even far severer than those which cause such losses in the province of La Plata, could destroy every individual of every species from Southern Patagonia to Bering Strait. What shall we say of the extinction of the horse? Did those plains fail of pasture, which have since been overrun by thousands and hundreds of thousands of the descendants of the stock introduced by the Spaniards? Have the subsequently introduced species consumed the food of the great antecedent races? Can we believe that the capybara has taken the food of the toxodon, the guanaco of the macrauchenia, the existing small Edentata of their numerous gigantic prototypes? Certainly, no fact in the long history of the world is so startling as the wide and repeated exterminations of its inhabitants.

Nevertheless, if we consider the subject under another point of view, it will appear less perplexing. We do not steadily bear in mind how profoundly ignorant we are of the conditions of

existence of every animal; nor do we always remember that some check is constantly preventing the too rapid increase of every organized being left in a state of nature. The supply of food, on an average, remains constant ; yet the tendency in every animal to increase by propagation is geometrical, and its surprising effects have nowhere been more astonishingly shown than in the case of the European animals run wild during the last few centuries in America. Every animal in a state of nature regularly breeds; yet in a species long established, any great increase in numbers is obviously impossible and must be checked by some means. We are, nevertheless, seldom able with certainty to tell in any given species at what period of life, or at what period of the year, or whether only at long intervals, the check falls; or, again, what is the precise nature of the check. Hence probably it is that we feel so little surprise at one of two species closely allied in habits being rare and the other abundant in the same district; or, again, that one should be abundant in one district, and another, filling the same place in the economy of nature, should be abundant in a neighboring district differing very little in its conditions. If asked how this is, one immediately replies that it is determined by some slight difference in climate, food, or the number of enemies: yet how rarely, if ever, we can point out the precise cause and manner of action of the check! We are, therefore, driven to the conclusion that causes generally quite inappreciable by us determine whether a given species shall be abundant or scanty in numbers.

In the cases where we can trace the extinction of a species through man, either wholly or in one limited district, we know that it becomes rarer and rarer and is then lost: it would be difficult to point out any just distinction between a species

destroyed by man or by the increase of its natural enemies. the evidence of rarity preceding extinction is more striking in the successive tertiary strata, as remarked by several able observers; it has often been found that a shell very common in a tertiary stratum is now most rare, and has even long been thought to be extinct. If then, as appears probable, species first become rare and then extinct—if the too rapid increase of every species, even the most favored, is steadily checked, as we must admit, though how and when it is hard to say—and if we see, without the smallest surprise, though unable to assign the precise reason, one species abundant and another closely allied species rare in the same district—-—why should we feel such great astonishment at the rarity being carried a step further to extinction? An action going on on every side of us, and yet barely appreciable, might surely be carried a little further without exciting our observation. Who would feel any great surprise at hearing that the megalonyx was formerly rare compared with the megatherium, or that one of the fossil monkeys was few in number compared with one of the now living monkeys? And yet in this comparative rarity we should have the plainest evidence of less favorable conditions for their existence. To admit that species generally become rare before they become extinct—to feel no surprise at the comparative rarity of one species with another, and yet to call in some extraordinary agent and to marvel greatly when a species ceases to exist appears to me much the same as to admit that sickness in the individual is the prelude to death—to feel no surprise at sickness—but when the sick man dies to wonder, and to believe that he died through violence.

April 1834: the Santa Cruz River
March 1834-: The Falkland Islands

THE TWENTY-ONE-DAY TRIP up the Santa Cruz River and back,
with three whaleboats and a party of twenty-five, was for Captain Fitzroy simply a journey of exploration. His purpose seems to have been the combined one of mapping the river beyond where any European had ever been, and of climbing to the top of the Andes from the east. They got to within twenty miles of the great snow-covered range and at least saw it in the distance. Darwin wrote home that this trip had given him a "view which has never before been seen by European eyes." But the entry of May 5 makes it clear that, of the twenty-five men, Darwin alone found the trip worth the enormous effort. This was because of his geological observations. He saw that the course of the river had once been a strait joining the Atlantic and Pacific oceans. And again, as in the previous chapter, his head was "almost giddy" as he reflected on the ages of time required for the tides to cut through such vast layers of rock.
the second part of the chapter covers two separate visits to the Falkland Islands. The reader will readily notice the questions Darwin seems to be turning over in his mind about the animals on these islands. Why have the horses grown smaller and weaker? Why have the cattle grown larger? Why do islands have species peculiar to themselves, such as the wolf-like fox which does not live anywhere else on the earth? He also notes that this wolf-fox is decreasing in numbers, and he predicts that this animal will soon perish from the earth. (It was reported, in 1875, to have become extinct.)

He watches the steamer ducks who use their wings as paddles, the penguins who use theirs as fins; and he compares them to ostriches that use their wings as sails. Thus he observes that the same organ can be put to different uses by different animals. This fact in itself might seem unimportant. But is Darwin thinking what all biologists now believe—that the similarity of these wings indicates that they were derived from a common ancestry but developed different uses in the course of their evolution?
The redeeming feature of the dreary months spent in these extreme southern areas is that he has the great satisfaction of finding that his "powers of examining and describing have increased at a great pace."

CHAPTER NINE

APRIL 13, 1834. The Beagle anchored within the mouth
A of the Santa Cruz. This river is situated about sixty
miles south of Port San Julizin. During the lastThe Voyage
Captain Stokes proceeded thirty miles up it, but then, from the
want of provisions, was obliged to return. Excepting what was
discovered at that time, scarcely anything was known about this
large river. Captain Fitzroy now determined to follow its course
as far as time would allow. On the 18th three whaleboats
started, carrying three weeks' provisions; and the party con-
sisted of twenty-five souls—a force which would have been suffi-
cient to have defied a host of Indians. With a strong flood tide
and a fine day, we made a good run, soon drank some of the
fresh water, and were at night nearly above the tidal influence.
the river here assumed a size and appearance which, even

at the highest point we ultimately reached, was scarcely dimin-
ished. It was generally from three to four hundred yards broad,
and in the middle about seventeen feet deep. The rapidity of
the current, which in its whole course runs at the rate of from
four to six knots an hour, is perhaps its most remarkable feature.
the water is of a fine blue color, but with a slightly milky tinge,
and not so transparent as at first sight would have been ex-
pected. It flows over a bed of pebbles, like those which compose
the beach and the surrounding plains. It runs in a winding
course through a valley which extends in a direct line westward.
This valley varies from five to ten miles in breadth; it is
bounded by step-formed terraces, which rise in most parts, one
above the other, to the height of five hundred feet, and have
on the opposite sides a remarkable correspondence.

TOWING THE BOATS

April 19. Against so strong a current it was, of course, quite
impossible to row or sail; consequently, the three boats were
fastened together head and stem, two hands left in each, and
the rest came on shore to track. As the general arrangements
made by Captain Fitzroy were very good for facilitating the
work of all, and as all had a share in it, I will describe the
system. The party, including everyone, was divided into two
spells, each of which hauled at the tracking line alternately for
an hour and a half. The officers of each boat lived with, ate the
same food, and slept in the same tent with their crew, so that
each boat was quite independent of the others. After sunset the
first level spot where any bushes were growing was chosen for
our night's lodging. Each of the crew took it in turns to be cook.
Immediately the boat was hauled up, the cook made his fire;
two others pitched the tent; the coxswain handed the things

out of the boat; the rest carried them up to the tents and col-
lected firewood. By this order, in half an hour everything was
ready for the night. A watch of two men and an officer was
always kept, whose duty it was to look after the boats, keep up
the fire, and guard against Indians. Each in the party had his
one hour every night.

During this day we tracked but a short distance, for there
were many islets, covered by thorny bushes, and the channels
between them were shallow.

April 20. We passed the islands and set to work. Our regular
day's march, although it was hard enough, carried us on an
average only ten miles in a straight line, and perhaps fifteen or
twenty altogether. Beyond the place where we slept last night,
the country is completely terra incognita, for it was there that
Captain Stokes turned back. We saw in the distance a great
smoke, and found the skeleton of a horse, so we knew that
Indians were in the neighborhood. On the next morning (2lst)
tracks of a party of horse, and marks left by the trailing of the

chuzos, or long spears, were observed on the ground. It was generally thought that the Indians had reconnoitered us during the night. Shortly afterwards we came to a spot where, from the fresh footsteps of men, children, and horses, it was evident that the party had crossed the river.

April 22. The country remained the same, and was extremely uninteresting. The complete similarity of the productions throughout Patagonia is one of its most striking characters. the level plains of arid shingle support the same stunted and dwarf plants, and in the valleys the same thorn-bearing bushes grow. Everywhere we see the same birds and insects. Even the very banks of the river and of the clear streamlets which entered it were scarcely enlivened by a brighter tint of green. The curse

of sterility is on the land, and the water flowing over a bed of pebbles partakes of the same curse. Hence the number of water-fowl is very scanty; for there is nothing to support life in the stream of this barren river.

Patagonia, poor as she is in some respects, can however boast of a greater stock of small rodents than perhaps any other country in the world. Several species of mice are externally characterized by large thin ears and a very fine fur. These little animals swarm among the thickets in the valleys, where they cannot for months together taste a drop of water excepting the dew. They all seem to be cannibals; for no sooner was a mouse caught in one of my traps than it was devoured by others. A small and delicately shaped fox, which is likewise very abundant, probably derives its entire support from these small animals. The guanaco is also in his proper district; herds of fifty or a hundred were common, and, as I have stated, we saw one which must have contained at least five hundred. the puma, with the condor and other carrion hawks in its train, follows and preys upon these animals. The footsteps of the puma were to be seen almost everywhere on the banks of the river, and the remains of several guanacos, with their necks dislocated and bones broken, showed how they had met their death.

April 24. Like the navigators of old when approaching an unknown land, we examined and watched for the most trivial sign of a change. The drifted trunk of a tree or a boulder of primitive rock was hailed with joy, as if we had seen a forest growing on the flanks of the Cordillera. The top, however, of a heavy bank of clouds, which remained almost constantly in one position, was the most promising sign, and eventually turned out a true harbinger. At first the clouds were mistaken for

the mountains themselves, instead of the masses of vapor condensed by their icy summits.

AN ANCIENT STRAIT?

April 26. We this day met with a marked change in the geological structure of the plains. From the first starting I had carefully examined the gravel in the river, and for the last two days had noticed the presence of a few small pebbles of a very cellular basalt. These gradually increased in number and in size, but none was as large as a man’s head. This morning, however, pebbles of the same rock, but more compact, suddenly became abundant, and in the course of half an hour we saw, at the distance of five or six miles, the angular edge of a great basaltic platform. When we arrived at its base we found the stream bubbling among the fallen blocks. For the next twenty-eight miles the river course was encumbered with these basaltic masses. Above that limit immense fragments of primitive rocks, derived from the surrounding boulder forma-

tion, were equally numerous. None of the fragments of any considerable size had been washed more than three or four miles down the river below their parent source: considering the singular rapidity of the great body of water in the Santa Cruz, and that no still reaches occur in any part, this example is a most striking one of the inefficiency of rivers in transporting even moderately sized fragments.

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At the first glance of the basaltic cliffs on the opposite sides of the valley, it was evident that the strata once were united. What power, then, has removed along a whole line of country a solid mass of very hard rock which had an average thickness of nearly three hundred feet and a breadth varying from rather

less than two miles to four miles? the river, though it has so little power in transporting even inconsiderable fragments, yet in the lapse of ages might produce by its gradual erosion an effect of which it is difficult to judge the amount. But in this case, independently of the insignificance of such an agency, good reasons can be assigned for believing that this valley was formerly occupied by an arm of the sea. It is needless in this work to detail the arguments leading to this conclusion, derived from the form and the nature of the step-formed terraces on both sides of the valley, from the manner in which the bottom of the valley near the Andes expands into a great estuary-like plain with sand hillocks on it, and from the occurrence of a few seashells lying in the bed of the river.

(FIGURE)

If I had space I could prove that South America was formerly here cut off by a strait joining the Atlantic and Pacific oceans, like that of Magellan. But it may yet be asked, how has the solid basalt been removed? Geologists formerly would have brought into play the violent action of some overwhelming de'bricle, but in this case such a supposition would have been quite inadmissible because the same step-like plains with existing seashells lying on their surface, which front the long line of the Patagonian coast, sweep up on each side of the valley of Santa Cruz. No possible action of any flood could thus have modeled the land, either within the valley or along the open coast; and by the formation of such step-like plains or terraces the valley itself has been hollowed out. Although we know that there are tides which run within the narrows of the Strait of Magellan at the rate of eight knots an hour, yet we must confess that it makes the head almost giddy to reflect on the number of years, century after century, which the tides, unaided by a heavy surf, must have required to have corroded so vast an area and thickness of solid basaltic lava. Nevertheless, we must believe that the strata, undermined by the waters of this ancient strait, were broken up into huge fragments, and these, lying scattered on the beach, were reduced first to smaller blocks, then to pebbles, and lastly to the most impalpable mud, which the tides drifted far into the Eastern or Western Ocean.

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April 29. From some high land we hailed with joy the white summits of the Cordillera, as they were seen occasionally peeping through their dusky envelope of clouds. During the few succeeding days we continued to get on slowly, for we

found the river course very tortuous and strewed with immense fragments of various ancient slaty rocks and of granite. . .

DESCENDING THE SANTA CRUZ

May 4. Captain Fitzroy determined to take the boats no higher. The river had a winding course and was very rapid, and the appearance of the country offered no temptation to proceed any further. Everywhere we met with the same productions and the same dreary landscape. We were now one hundred and forty miles distant from the Atlantic, and about sixty from the nearest arm of the Pacific. The valley in this upper part expanded into a wide basin, bounded on the north and south by the basaltic platforms, and fronted by the long range of the snow-clad Cordillera. But we viewed these grand mountains with regret, for we were obliged to imagine their nature and productions instead of standing, as we had hoped, on their summits. Besides the useless loss of time which an attempt to ascend the river any higher would have cost us, we had already been for some days on half allowance of bread. This, although really enough for reasonable men, was, after a hard day's march, rather scanty food: a light stomach and an easy digestion are good things to talk about, but very unpleasant in practice.

May 5. Before sunrise we commenced our descent. We shot down the stream with great rapidity, generally at the rate of ten knots an hour. In this one day we effected what had cost us five and a half hard days' labor in ascending. On the 8th we reached the Beagle after our twenty-one days' expedition.

Everyone excepting myself had cause to be dissatisfied; but to me the ascent afforded a most interesting section of the great tertiary formation of Patagonia.

FALKLAND ISLANDS

On March 1, 1833, and again on March 16, 1834, the Beagle anchored in Berkeley Sound, in East Falkland Island. This archipelago is situated in nearly the same latitude with the mouth of the Strait of Magellan; it covers a space of one hundred and twenty by sixty geographical miles, and is little more than half the size of Ireland. After the possession of these miserable islands had been contested by France, Spain, and England, they were left uninhabited. The government of Buenos Aires then sold them to a private individual, but likewise used them, as old Spain had done before, for a penal settlement. England claimed her right, and seized them. The Englishman who was left in charge of the flag was consequently murdered. A British officer was next sent, unsupported by any power: and when we arrived, we found him in charge of a population of which rather more than half were runaway rebels and murderers.

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May 16. I will now describe a short excursion which I made round a part of this island. In the morning I started with six horses and two gauchos: the latter were capital men for the purpose, and well accustomed to living on their own resources. the weather was very boisterous and cold, with heavy hailstorms. We got on, however, pretty well, but, except the geology, nothing could be less interesting than our day's ride. the country is uniformly the same undulating moorland, the

surface being covered by light brown withered grass and a few very small shrubs, all springing out of an elastic peaty soil. In the valleys here and there might be seen a small flock of wild geese, and everywhere the ground was so soft that the snipe were able to feed. Besides these two birds there were few others. There is one main range of hills, nearly two thousand feet in height, and composed of quartz rock, the rugged and barren crests of which gave us some trouble to cross. On the south side we came to the best country for wild cattle; we met, however, no great number, for they had been lately much harassed.

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DECLINE of THE WILD HORSES

During our whole ride we saw only one troop of wild horses. these animals, as well as the cattle, were introduced by the French in 1764, since which time both have greatly increased. It is a curious fact that the horses have never left the eastern end of the island, although there is no natural boundary to prevent them from roaming and that part of the island is not more tempting than the rest. The gauchos whom I asked, though asserting this to be the case, were unable to account for it except from the strong attachment which horses have to any locality to which they are accustomed. Considering that the island does not appear fully stocked, and that there are no beasts of prey, I was particularly curious to know what has checked their originally rapid increase. That in a limited island some check would sooner or later supervene is inevitable, but why has the increase of the horse been checked sooner than that of the cattle? . . . The gauchos

employed here attribute it chiefly to the stallions constantly roaming from place to place and compelling the mares to accompany them, whether or not the young foals are able to follow. . . . Moreover, the dead bodies of full-grown horses are more frequently found, as if more subject to disease or accidents than those of the cattle. From the softness of the ground, their hoofs often grow irregularly to a great length, and this causes lameness. The predominant colors are roan and iron-gray. All the horses bred here, both tame and wild, are rather small-sized, though generally in good condition; and they have lost so much strength that they are unfit to be used in taking wild cattle with the lazo; in consequence, it is necessary to go to the great expense of importing fresh horses from the Plata. At some future period the southern hemisphere probably will have its breed of Falkland ponies, as the northern has its Shetland breed.

The cattle, instead of having degenerated like the horses, seem, as before remarked, to have increased in size, and they are much more numerous than the horses. Captain Sulivan informs me that they vary much less in the general form of their bodies and in the shape of their horns than English cattle. In color they differ much, and it is a remarkable circumstance that in different parts of this one small island different colors predominate.

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THE WOLF-FOX

The only quadruped native to the island is a large wolf-like fox (Canis antarcticus), which is common to both East and West Falkland. I have no doubt it is a peculiar species and confined to this archipelago, because many sealers, gauchos,

and Indians who have visited these islands all maintain that no such animal is found in any part of South America. . . . these wolves are well known from Byron's account of their tameness and curiosity, which the sailors, who ran into the water to avoid them, mistook for fierceness. To this day their manners remain the same. They have been observed to enter a tent and actually pull some meat from beneath the head of a sleeping seaman. The gauchos also have frequently in the evening killed them by holding out a piece of meat in one hand and in the other a knife ready to stick them. As far as I am aware, there is no other instance in any part of the world of so small a mass of broken land, distant from a continent, possessing so large an aboriginal quadruped peculiar to itself. their numbers have rapidly decreased; they are already banished from that half of the island which lies to the eastward of the neck of land between St. Salvador Bay and Berkeley Sound. Within a very few years after these islands shall have become regularly settled, in all probability this fox will be classed, with the dodo, as an animal which has perished from the face of the earth.

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The weather continued so very bad that we determined to make a push and try to reach the vessel before night. From the quantity of rain which had fallen, the surface of the whole country was swampy. I suppose my horse fell at least a dozen times, and sometimes the whole six horses were floundering in the mud together. All the little streams are bordered by soft peat, which makes it very difficult for the horses to leap them without falling. To complete our discomforts, we were obliged to cross the head of a creek of the sea in which the water was as high as our horses' backs; and the little waves, owing to the

violence of the wind, broke over us and made us very wet and cold. Even the iron-framed gauchos professed themselves glad when they reached the settlement after our little excursion.

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BIRDS of THE FALKLANDS

I have little to remark on the zoology of these islands. I have before described the carrion-vulture or Polyborus. There are some other hawks, owls, and a few small land birds. The water-fowl are particularly numerous, and they must formerly, from the accounts of the old navigators, have been much more so. One day I observed a cormorant playing with a fish which it had caught. Eight times successively the bird let its prey go, then dived after it, and, although in deep water, brought it each time to the surface. In the Zoological Gardens I have seen the otter treat a fish in the same manner, much as a cat does a mouse: I do not know of any other instance where dame nature appears so willfully cruel. Another day, having placed myself between a penguin (A ptenodytes demersa) and the water, I was much amused by watching its habits. It was a brave bird, and, till reaching the sea, it regularly fought and drove me backward. Nothing less than heavy blows would have stopped him; every inch he gained he firmly kept, standing close before me erect and determined. When thus opposed, he continually rolled his head from side to side in a very odd manner, as if the power of distinct vision lay only in the anterior and basal part of each eye. This bird is commonly called the jackass penguin, from its habit, while on shore, of throwing its head backwards and making a loud strange noise very like the braying of an ass; but while at sea and undisturbed, its note is very deep and solemn, and is often heard in

the nighttime. In diving, its little wings are used as fins, but on land as front legs. When crawling, it may be said, on four legs through the tussocks or on the side of a grassy cliff, it moves so very quickly that it might easily be mistaken for a quadruped. When at sea and fishing, it comes to the surface for the purpose of breathing with such a spring, and dives again so instantaneously, that I defy anyone at first sight to be sure that it was not a fish leaping for sport.

. . .

In these islands a great logger-headed duck or goose (Anas brachyptera) , which sometimes weighs twenty-two pounds, is very abundant. These birds were in former days called, from their extraordinary manner of paddling and splashing upon the water, race horses; but now they are named, much more appropriately, steamers. Their wings are too small and weak to allow of flight, but by their aid, partly swimming and partly flapping the surface of the water, they move very quickly. The manner is something like that by which the common house-duck escapes when pursued by a dog; but I am nearly sure that the steamer moves its wings alternately, instead of both together, as in other birds. These clumsy logger-headed ducks make such a noise and splashing that the effect is exceedingly curious.

Thus we find in South America three birds which use their wings for other purposes besides flight: the penguin as fins, the steamer as paddles, and the ostrich as sails; and the apteryx of New Zealand, as well as its gigantic extinct prototype the dinornis, possess only rudimentary representatives of wings. the steamer is able to dive only to a very short distance. It feeds entirely on shellfish from the kelp and tidal rocks; hence the beak and head, for the purpose of breaking them, are surprisingly heavy and strong. The head is so strong that I

have scarcely been able to fracture it with my geological hammer, and all our sportsmen soon discovered how tenacious these birds were of life. When in the evening pluming themselves in a flock, they make the same odd mixture of sounds which bullfrogs do within the tropics.

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December 1832 - February 1833

February — March 1834-

Tierra del Fuego

Some of Darwin's best writing appears in his descriptions of the weather, the landscape, and the people of Tierra del Fuego, the "Land of Fires." His first experience with genuine savages impresses him deeply and unforgettably. He can scarcely believe that Jemmy Button and the other Fuegians on board have come only three years earlier from these same people, but that very fact confirms his conviction that the difference between civilized men and savages is the same as that between domesticated and wild animals. In fact, he seems to regard civilized men as simply domesticated savages. Fitzroy, however, has difficulty reconciling himself to the fact that "we" are "even remotely descended from human beings in such a state," even though he knows that Caesar found the Britons painted and clothed in skins like these Fuegians. Little could he have imagined as he watched Darwin's first meeting with savages, that his naturalist companion was to establish that civilized men and savages alike were descended from non-human species.

Darwin's account of Jemmy Button on shipboard, of his rejoining his own people, and of the final smoke signal of farewell is warm and tender. Darwin sees him as a fellow human being, different only because of the different conditions of his life. What, he asks, ever led these people to such miserable and inhospitable shores? they are certainly capable of becoming civilized—the experiment with Jemmy Button has proved that. Darwin's observations suggest that the en-

vironment, physical and social, determines the character of any human group. He stops with this generalization probably because other interests absorb his attention. He does not seem aware that before him lies material for a whole new science, that of cultural anthropology.

Darwin, like Fitzroy, accepted stories of "cannibalism" among the Fuegians on the flimsiest hearsay evidence. It has since been strongly denied. Also, his comment on their language as scarcely deserving to be called "articulate" was wide of the mark. An English missionary later compiled a dictionary of Jahgan, the language which the Fuegians on the Beagle spoke. It contained no less than 32,000 words and inflections, which included fifty different words for family relationships.

Captain Fitzroy was a strong believer in Christian missions and thought that the returned Fuegians, together with the missionary Matthews, would help bring Christianity to these Indian tribes. Darwin shared Fitzroy's belief in the value of the efforts of missionaries. In June 1836, while on the way to the Cape of Good Hope, they wrote a pamphlet together which was published, under their joint signatures, in the South African Christian Recorder. It advocated individual and state support for foreign missions. This seems to have been the one topic they could continue to agree upon, although probably for different reasons: Fitzroy to save souls and Darwin to extend European civilization. Both believed that shipwrecked sailors would suffer a different fate if they fell among people under the missionary's civilizing influence rather than among "savages."

As a result of the bad experiences of the returned Fuegians among their countrymen both Fitzroy and Darwin at this time gave up the idea of missionary work among the F uegians. Still Fitzroy thought that something had been gained, for he wrote:

"Perhaps a ship-wrecked seaman may hereafter receive help and kind treatment from Jemmy Button's children." the fact is that just twenty-five years after they left him at Woollya, Jemmy Button played a leading role in the massacre of a group of unarmed missionaries as they were beginning their first Sunday service in a simple building they had just put up at this same place. Thanks to other missionaries who continued the work, we know that Fuegia Basket visited a mission settlement on Beagle Channel in 1873 and still remembered London, Fitzroy, and the Beagle. Whether Darwin ever learned these things is not certain. We do know that from the late 1860's until his death he contributed regularly to the mission work there. The Fuegian tribes are now nearly extinct—a fate that, as Darwin records later in this journal, seems to befall many aboriginal peoples as a result of the white man's incursions among them.

the storm Darwin describes in the twenty-four-day effort to get westward on the outside coast (that is, by rounding or "doubling" the Horn) and in which they got only a few miles, nearly sank the Beagle. They learned later that three ships were totally wrecked off Tierra del Fuego in the same gales. In connection with the storm that nearly capsized them, Darwin related in a letter how at breakfast that very morning he remarked that a gale wasn't such a bad thing when you're in a good "sea-boat." Fitzroy told him to wait till they "shipped a sea." That noon they did, with water deep on the deck. Only later did Darwin mention that the Beagle was "a class of vessel which is generally thought unfit to double the Horn."

CHAPTER TEN

December 17, 1832. Having now finished with Patagonia and the Falkland Islands, I will describe our first arrival in Tierra del Fuego. A little after noon we doubled Cape San Diego and entered the famous Strait of Le Maire. We kept close to the Fuegian shore, but the outline of the rugged, inhospitable Staten-land was visible amidst the clouds. In the afternoon we anchored in the Bay of D ECEMBER 17, 1832. Having now finished with Pata-Good Success. While entering we were saluted in a manner becoming the inhabitants of this savage land. A group of F uegians, partly concealed by the entangled forest, were perched on a wild point overhanging the sea; and as we passed by, they sprang up and, waving their tattered cloaks, sent forth a loud and sonorous shout. The savages followed the ship, and just before dark we saw their fire and again heard their wild cry.

the harbor consists of a fine piece of water half surrounded by low rounded mountains of clay-slate, which are covered to the water's edge by one dense gloomy forest. A single glance at the landscape was sufficient to show me how widely different it was from anything I had ever beheld. At night it blew a gale of wind, and heavy squalls from the mountains swept past us. It would have been a bad time out at sea, and we, as well as others, may call this Good Success Bay.

MEETING THE FUEGIANS

In the morning the captain sent a party to communicate with the Fuegians. When we came within hail, one of the four natives who were present advanced to receive us and began to shout most vehemently, wishing to direct us where to land. When we were on shore the party looked rather alarmed, but continued talking and making gestures with great rapidity. It was without exception the most curious and interesting spectacle I ever beheld. I could not have believed how wide was the difference between savage and civilized man: it is greater than between a wild and domesticated animal, inasmuch as in man there is a greater power of improvement. The chief spokesman was old, and appeared to be the head of the family; the three others were powerful young men, about six feet high. the women and children had been sent away. These Fuegians are a very different race from the stunted, miserable wretches further westward, and they seem closely allied to the famous Patagonians of the Strait of Magellan. Their only garment consists of a mantle made of guanaco skin, with the wool outside; this they wear just thrown over their shoulders, leaving their persons as often exposed as covered. Their skin is of a dirty coppery red color.

The old man had a fillet of white feathers tied round his head which partly confined his black, coarse, and entangled hair. His face was crossed by two broad transverse bars; one, painted bright red, reached from ear to ear and included the upper lip; the other, white like chalk, extended above and parallel to the first, so that even his eyelids were thus colored. The other two men were ornamented by streaks of black powder, made of charcoal. The party altogether closely resembled the devils which come on the stage in plays like Der F reischiitz.

Their very attitudes were abject, and the expression of their countenances distrustful, surprised, and startled. After we had presented them with some scarlet cloth, which they immediately tied round their necks, they became good friends. This was shown by the old man patting our breasts and making a chuckling kind of noise, as people do when feeding chickens. I walked with the old man, and this demonstration of friendship was repeated several times; it was concluded by three hard slaps, which were given me on the breast and back at the same time. He then bared his bosom for me to return the compliment, which being done, he seemed highly pleased.

The language of these people, according to our notions, scarcely deserves to be called articulate. Captain Cook has compared it to a man clearing his throat, but certainly no European ever cleared his throat with so many hoarse, guttural, and clicking sounds.

They are excellent mimics: as often as we coughed or yawned or made any odd motion, they immediately imitated us. Some of our party began to squint and look awry; but one of the young Fuegians (whose whole face was painted black, excepting a white band across his eyes) succeeded in making

far more hideous grimaces. They could repeat with perfect correctness each word in any sentence we addressed them, and they remembered such words for some time. Yet we Europeans all know how difficult it is to distinguish apart the sounds in a foreign language. Which of us, for instance, could follow an American Indian through a sentence of more than three words? All savages appear to possess, to an uncommon degree, this power of mimicry. I was told, almost in the same words, of the same ludicrous habit among the Kafirs [a group of South African tribes] ; the Australians likewise have long been notorious for being able to imitate and describe the gait of any man, so that he may be recognized. How can this faculty be explained? Is it a consequence of the more practiced habits of perception and keener senses, common to all men in a savage state, as compared with those long civilized?
When a song was struck up by our party, I thought the Fuegians would have fallen down with astonishment. With equal surprise they viewed our dancing; but one of the young men, when asked, had no objection to a little waltzing. Little accustomed to Europeans as they appeared to be, yet they knew and dreaded our firearms; nothing would tempt them to take a gun in their hands. They begged for knives, calling them by the Spanish word “cuchilla.” they explained also what they wanted by acting as if they had a piece of blubber in their mouth and then pretending to cut instead of tear it.

THE FUEGIANS ON THE BEAGLE

I have not as yet noticed the Fuegians whom we had on board. During the formerThe Voyage of the Adventure and Beagle in 1826 to 1830, Captain Fitzroy seized on a party of natives as hostages for the loss of a boat, which had been stolen, to the

great jeopardy of a party employed on the survey; and some of these natives, as well as a child whom he bought for a pearl button, he took with him to England, determining to educate them and instruct them in religion at his own expense. To settle these natives in their own country was one chief inducement to Captain Fitzroy to undertake our presentThe Voyage; and before the Admiralty had resolved to send out this expedition, Captain Fitzroy had generously chartered a vessel and would himself have taken them back. The natives were accompanied by a missionary, R. Matthews, of whom and of the natives Captain Fitzroy has published a full and excellent account.
Two men, one of whom died in England of the smallpox, a boy, and a little girl were originally taken; and we had now on board York Minster, Jemmy Button (whose name expresses his purchase money), and Fuegia Basket. York Minster was a full-grown, short, thick, powerful man; his disposition was reserved, tacitum, morose, and, when excited, violently passionate; his affections were very strong towards a few friends on board; his intellect good. Jemmy Button was a universal favorite, but likewise passionate; the expression of his face at once showed his nice disposition. He was merry and often laughed, and was remarkably sympathetic with anyone in pain : when the water was rough, I was often a little seasick, and he used to come to me and say in a plaintive voice, “Poor, poor fellow!” but the notion, after his aquatic life, of a man being seasick, was too ludicrous, and he was generally obliged

to turn on one side to hide a smile or laugh, and then he would repeat his “Poor, poor fellow!” He was of a patriotic disposition, and he liked to praise his own tribe and country, in which he truly said there were “plenty of trees,” and he abused all the other tribes: he stoutly declared that there was no devil

in his land. Jemmy was short, thick, and fat, but vain of his personal appearance; he used always to wear gloves, his hair was neatly cut, and he was distressed if his well-polished shoes were dirtied. He was fond of admiring himself in a looking-glass; and a merry-faced little Indian boy from the Rio Negro, whom we had for some months on board, soon perceived this and used to mock him. Jemmy, who was always rather jealous of the attention paid to this little boy, did not at all like this, and used to say, with rather a contemptuous twist of his head, “Too much skylark.” It seems yet wonderful to me, when I think over all his many good qualities, that he should have been of the same race, and doubtless partaken of the same character, with the miserable, degraded savages whom we first met here.

Lastly, Fuegia Basket was a nice, modest, reserved young girl, with a rather pleasing but sometimes sullen expression, and very quick in learning anything, especially languages. This she showed in picking up some Portuguese and Spanish when left on shore for only a short time at Rio de Janeiro and Montevideo, and in her knowledge of English. York Minster was very jealous of any attention paid to her, for it was clear he determined to marry her as soon as they were settled on shore.

Although all three could both speak and understand a good deal of English, it was singularly difficult to obtain much information from them concerning the habits of their countrymen: this was partly owing to their apparent difficulty in understanding the simplest alternative. Everyone accustomed to very young children knows how seldom one can get an answer even to so simple a question as whether a thing is black or white; the idea of black or white seems alternately

to fill their minds. So it was with these Fuegians, and hence it was generally impossible to find out, by cross-questioning, whether one had rightly understood anything which they had asserted. Their sight was remarkably acute; it is well known that sailors, from long practice, can make out a distant object much better than a landsman; but both York and Jemmy were much superior to any sailor on board. Several times they have declared what some distant object has been, and, though doubted by everyone, they have proved right when it has been examined through a telescope. They were quite conscious of this power, and Jemmy, when he had any little quarrel with the officer on watch, would say, “Me see ship, me no tell.”

It was interesting to watch the conduct of the savages, when we landed, toward Jemmy Button; they immediately perceived the difference between him and ourselves, and held much conversation one with another on the subject. The old man addressed a long harangue to Jemmy, which it seems was to invite him to stay with them. But Jemmy understood very little of their language, and was, moreover, thoroughly ashamed of his countrymen. When York Minster afterwards came on shore, they noticed him in the same way and told him he ought to shave; yet he had not twenty dwarf hairs on his face, whilst we all wore our untrimmed beards. They examined the color of his skin and compared it with ours. One of our arms being bared, they expressed the liveliest surprise and admiration at its whiteness, just in the same way in which

I have seen the ourang-outang do at the Zoological Gardens. We thought that they mistook two or three of the officers, who were rather shorter and fairer, though adorned with large beards, for the ladies of our party. The tallest amongst the Fuegians was evidently much pleased at his height being

noticed. When placed back to back with the tallest of the boat's crew, he tried his best to edge on higher ground, and to stand on tiptoe. He opened his mouth to show his teeth, and turned his face for a side view; and all this was done with such alacrity that I dare say he thought himself the handsomest man in Tierra del Fuego. After our first feeling of grave astonishment was over, nothing could be more ludicrous than the odd mixture of surprise and imitation which these savages every moment exhibited.

GLOOMY FORESTS

The next day I attempted to penetrate some way into the country. Tierra del Fuego may be described as a mountainous land partly submerged in the sea, so that deep inlets and bays occupy the place where valleys should exist. The mountainsides, except on the exposed western coast, are covered from the water's edge upward by one great forest. The trees reach to an elevation of between 1,000 and 1,500 feet, and are succeeded by a band of peat, with minute alpine plants; and this again is succeeded by the line of perpetual snow, which, according to Captain King, in the Strait of Magellan descends to between 3,000 and 4,000 feet. . . .

There was a degree of mysterious grandeur in mountain behind mountain, with the deep intervening valleys, all covered by one thick, dusky mass of forest. The atmosphere likewise, in this climate where gale succeeds gale, with rain, hail, and sleet, seems blacker than anywhere else. In the Strait of Magellan, looking due southward from Port Famine, the distant channels between the mountains appeared from their gloominess to lead beyond the confines of this world.

CAPE HORN

December 21. The Beagle got under way, and on the succeeding day, favored to an uncommon degree by a fine easterly breeze, we closed in with the Barnevelts, and, running past Cape Deceit with its stony peaks, about three o'clock doubled the weather-beaten Cape Horn. The evening was calm and bright, and we enjoyed a fine view of the surrounding isles. Cape Horn, however, demanded his tribute, and before night sent us a gale of wind directly in our teeth. We stood out to sea, and on the second day again made the land, when we saw on our weather bow this notorious promontory in its proper form —veiled in a mist, and its dim outline surrounded by a storm of wind and water. Great black clouds were rolling across the heavens, and squalls of rain, with hail, swept by us with such extreme violence that the captain determined to run into Wigwam Cove. This is a snug little harbor not far from Cape Horn, and here, at Christmas Eve, we anchored in smooth water. The only thing which reminded us of the gale outside was every now and then a puff from the mountains, which made the ship surge at her anchors.

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While going one day on shore near Wollaston Island, we pulled alongside a canoe with six Fuegians. These were the most abject and miserable creatures I anywhere beheld. On the east coast the natives, as we have seen, have guanaco cloaks, and on the west they possess sealskins. Amongst these central tribes the men generally have an otterskin, or some small

scrap about as large as a pocket handkerchief, which is barely sufficient to cover their backs as low down as their loins. It is laced across the breast by strings, and according as the wind

blows it is shifted from side to side. But these Fuegians in the canoe were quite naked, and even one full-grown woman was absolutely so. It was raining heavily, and the fresh water, together with the spray, trickled down her body. In another harbor not far distant, a woman who was suckling a recently born child came one day alongside the vessel and remained there out of mere curiosity whilst the sleet fell and thawed on her naked bosom and on the skin of her naked baby! these poor wretches were stunted in their growth, their hideous faces bedaubed with white paint, their skins filthy and greasy, their hair entangled, their voices discordant, and their gestures violent. Viewing such men, one can hardly make oneself believe that they are fellow creatures and inhabitants of the same world. It is a common subject of conjecture what pleasure in life some of the lower animals can enjoy; how much more reasonably the same question may be asked with respect to these barbarians! At night, five or six human beings, naked and scarcely protected from the wind and rain of this tempestuous climate, sleep on the wet ground coiled up like animals. Whenever it is low water, winter or summer, night or day, they must rise to pick shellfish from the rocks; and the women either dive to collect sea eggs, or sit patiently in their canoes and with a baited hair-line, without any hook, jerk out little fish. If a seal is killed or the floating carcass of a putrid whale discovered, it is a feast; such miserable food is assisted by a few tasteless berries and fungi.

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Whilst beholding these savages, one asks: whence have they come? What could have tempted, or what change compelled a tribe of men to leave the fine regions of the north, to travel down the Cordillera or backbone of America, to invent and

build canoes, which are not used by the tribes of Chile, Peru, and Brazil, and then to enter on one of the most inhospitable countries within the limits of the globe? Although such reflections must at first seize on the mind, yet we may feel sure that they are partly erroneous. There is no reason to believe that the Fuegians decrease in number; therefore we must suppose that they enjoy a sufficient share of happiness, of whatever kind it may be, to render life worth having. Nature, by making habit omnipotent and its effects hereditary, has fitted the Fuegian to the climate and the productions of his miserable country.

TO PONSONBY SOUND

After having been detained six days in Wigwam Cove by very bad weather, we put to sea on the 30th day of December. Captain Fitzroy wished to get westward to land York and Fuegia in their own country. When at sea we had a constant succession of gales, and the current was against us: we drifted to 75° 23' south. On the 11th of January 1833, by carrying a press of sail, we fetched within a few miles of the great rugged mountain of York Minster (so called by Captain Cook, and the origin of the name of the elder Fuegian), when a violent squall compelled us to shorten sail and stand out to sea. The surf was breaking fearfully on the coast, and the spray was carried over a cliff estimated at two hundred feet in height. On the 12th the gale was very heavy, and we did not know exactly where we were: it was a most unpleasant sound to hear constantly repeated “Keep a good look-out to leeward.”

On the 13th the storm raged with its full fury; our horizon was narrowly limited by the sheets of spray borne by the wind. The sea looked ominous, like a dreary waving plain with patches of

drifted snow; whilst the ship labored heavily, the albatross glided with its expanded wings right up the wind. At noon a great sea broke over us and filled one of the whaleboats, which was obliged to be instantly cut away. The poor Beagle trembled at the shock, and for a few minutes would not obey her helm; but soon, like a good ship that she was, she righted and came up to the wind again. Had another sea followed the first, our fate would have been decided soon, and forever. We had now been twenty-four days trying in vain to get westward; the men were worn out with fatigue, and they had not had for many nights or days a dry thing to put on. Captain Fitzroy gave up the attempt to get westward by the outside coast.

In the evening we ran in behind False Cape Horn and dropped our anchor in forty-seven fathoms, fire flashing from the windlass as the chain rushed round it. How delightful was that still night after having been so long involved in the din of the warring elements!

January 15, 1833. The Beagle anchored in Goeree Roads. Captain Fitzroy having resolved to settle the Fuegians, according to their wishes, in Ponsonby Sound, four boats were equipped to carry them there through the Beagle Channel. This channel, which was discovered by Captain Fitzroy during the last voyage, is a most remarkable feature in the geography of this, or indeed of any other, country: it may be compared to the valley of Lochness in Scotland, with its chain of lakes and friths. It is about one hundred and twenty miles long, with an average breadth, not subject to any very great variation, of about two miles, and is throughout the greater part so perfectly straight that the view, bounded on each side by a line of mountains, gradually becomes indistinct in the long distance. It crosses the southern part of Tierra del Fuego in an east and west line, and

in the middle is joined at right angles on the south side by an irregular channel which has been called Ponsonby Sound. This is the residence of Jemmy Button's tribe and family.

January 19. Three whaleboats and the yawl, with a party of twenty-eight, started under the command of Captain Fitzroy. In the afternoon we entered the eastern mouth of the channel, and shortly afterwards found a snug little cove concealed by some surrounding islets. Here we pitched our tents and lighted our fires. Nothing could look more comfortable than this scene. The glassy water of the little harbor, with the branches of the trees hanging over the rocky beach, the boats at anchor, the tents supported by the crossed oars, and the smoke curling up the wooded valley, formed a picture of quiet retirement.

The next day (20th) we smoothly glided onwards in our little fleet and came to a more inhabited district. Few if any of these natives could ever have seen a white man; certainly nothing could exceed their astonishment at the apparition of the four boats. Fires were lighted on every point (hence the name of Tierra del Fuego, or the land of fire), both to attract our attention and to spread far and wide the news. Some of the men ran for miles along the shore. I shall never forget how wild and savage one group appeared: suddenly four or five men came to the edge of an overhanging cliff; they were absolutely naked, and their long hair streamed about their faces; they held rugged staffs in their hands, and, springing from the ground, they waved their arms round their heads and sent forth the most hideous yells.

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At night we endeavored in vain to find an uninhabited cove, and at last were obliged to bivouac not far from a party of natives. They were very inoffensive as long as they were

few in numbers, but in the morning (2lst), being joined by others, they showed symptoms of hostility, and we thought that we should have to come to a skirmish. . . .

January 22. After having passed an unmolested night in what would appear to be neutral territory between Jemmy's tribe and the people whom we saw yesterday, we sailed pleasantly along. . . .

At night we slept close to the junction of Ponsonby Sound with the Beagle Channel. A small family of Fuegians who were living in the cove were quiet and inoffensive, and soon joined our party round a blazing fire. We were well clothed and, though sitting close to the fire, were far from too warm; yet these naked savages, though farther off, were observed, to our great surprise, to be streaming with perspiration at undergoing such a roasting. They seemed, however, very well pleased, and all joined in the chorus of the seamen's songs; but the manner in which they were invariably a little behindhand was quite ludicrous.

JEMMY BUTTON'S TRIBE

During the night the news had spread, and early in the morning (23rd) a fresh party arrived, belonging to the Tekenika, or Jemmy's tribe. Several of them had run so fast that their noses were bleeding, and their mouths frothed from the rapidity with which they talked; and with their naked bodies all bedaubed with black, white, and red, they looked like so many demoniacs who had been fighting. We then proceeded (accompanied by twelve canoes, each holding four or five people) down Ponsonby Sound to the spot where poor Jemmy expected to find his mother and relatives. He had already heard that his father was dead, but as he had had a "dream in his head" to that effect, he did not seem to care much about

it, and repeatedly comforted himself with the very natural reflection "Me no help it." He was not able to learn any particulars regarding his father's death, as his relations would not speak about it.

Jemmy was now in a district well known to him, and guided the boats to a quiet pretty cove named Woollya, surrounded by islets, every one of which and every point had its proper native name. We found here a family of Jemmy's tribe; but not his relations: we made friends with them, and in the evening they sent a canoe to inform Jemmy's mother and brothers.

The cove was bordered by some acres of good sloping land, not covered (as elsewhere) either by peat or by forest trees. Captain Fitzroy originally intended, as before stated, to have taken York Minster and Fuegia to their own tribe on the west coast; but as they expressed a wish to remain here, and as the spot was singularly favorable, Captain Fitzroy determined to settle here the whole party, including Matthews, the missionary. Five days were spent in building for them three large wigwams, in landing their goods, in digging two gardens, and

sowing seeds.

The next morning after our arrival (the 24th) the Fuegians began to pour in, and Jemmy's mother and brothers arrived. Jemmy recognized the stentorian voice of one of his brothers at a prodigious distance. The meeting was less interesting than that between a horse turned out into a field when he joins an old companion. There was no demonstration of affection; they simply stared for a short time at each other; and the mother immediately went to look after her canoe. We heard, however, through York that the mother had been inconsolable for the loss of Jemmy, and had searched everywhere for him, thinking that he might have been left after having been taken in the boat. The women took much notice of and were very kind to

Fuegia. We had already perceived that Jemmy had almost forgotten his own language. I should think there was scarcely another human being with so small a stock of language, for his English was very imperfect. It was laughable, but almost pitiable, to hear him speak to his wild brother in English and then ask him in Spanish ("no sabe?") whether he did not understand him.

Everything went on peaceably during the three next days whilst the gardens were digging and wigwams building. We estimated the number of natives at about one hundred and twenty. The women worked hard, whilst the men lounged about all day long, watching us. They asked for everything they saw, and stole what they could. They were delighted at our dancing and singing, and were particularly interested at seeing us wash in a neighboring brook; they did not pay much attention to anything else, not even to our boats. . . .

SURVEYING THE BEAGLE CHANNEL

Captain Fitzroy determined to send the yawl and one whale-boat back to the ship, and to proceed with the two other boats, one under his own command (in which he most kindly allowed me to accompany him) and one under Mr. Hammond, to survey the western parts of the Beagle Channel, and afterwards to return and visit the settlement. The day, to our astonishment, was overpoweringly hot, so that our skins were scorched; with this beautiful weather, the view in the middle of the Beagle Channel was very remarkable. Looking towards either hand, no object intercepted the vanishing points of this long canal between the mountains. The circumstance of its being an arm of the sea was rendered very evident by several huge whales spouting in different directions. On one occasion

I saw two of these monsters, probably male and female, slowly swimming one after the other within less than a stone's throw of the shore, over which the beech tree extended its branches. We sailed on till it was dark and then pitched our tents in a quiet creek. The greatest luxury was to find for our beds a beach of pebbles, for they were dry and yielded to the body. Peaty soil is damp; rock is uneven and hard; sand gets into one's meat when cooked and eaten boat-fashion; but when lying in our blanket bags, on a good bed of smooth pebbles, we passed most comfortable nights.

It was my watch till one o'clock. There is something very solemn in these scenes. At no time does the consciousness in what a remote corner of the world you are then standing come so strongly before the mind. Everything tends to this effect; the stillness of the night is interrupted only by the heavy breathing of the seamen beneath the tents, and sometimes by the cry of a nightbird. The occasional barking of a dog, heard in the distance, reminds one that it is the land of the savage.

january 29. Early in the morning we arrived at the point where

the Beagle Channel divides into two arms, and we entered the northern one. The scenery here becomes even grander than before. . …
. . . The farthest point westward which we reached was Stewart Island, a distance of about one hundred and fifty miles from our ship. We returned into the Beagle Channel by the southern arm, and thence proceeded with no adventure back to Ponsonby Sound.

WOOLLYA

February 6. We arrived at Woollya. Matthews gave so bad an account of the conduct of the Fuegians that Captain Fitzroy

determined to take him back to the Beagle; and ultimately he was left at New Zealand, where his brother was a missionary. From the time of our leaving, a regular system of plunder commenced; fresh parties of the natives kept arriving; York and Jemmy lost many things, and Matthews almost everything which had not been concealed underground. Every article seemed to have been torn up and divided by the natives. Matthews described the watch he was obliged to keep as most harassing; night and day he was surrounded by the natives, who tried to tire him out by making incessant noise close to his head. One day an old man, whom Matthews asked to leave his wigwam, immediately returned with a large stone in his hand; another day a whole party came armed with stones and stakes, and some of the younger men and Jemmy's brother were crying: Matthews met them with presents. Another party showed by signs that they wished to strip him naked and pluck all the hairs out of his face and body. I think we arrived just in time to save his life. Jemmy's relatives had been so vain and foolish that they had showed to strangers their plunder and their manner of obtaining it. It was quite melancholy leaving the three Fuegians with their savage countrymen, but it was a great comfort that they had no personal fears. York, being a powerful resolute man, was pretty sure to get on well, together with his wife Fuegia. Poor Jemmy looked rather disconsolate, and would then, I have little doubt, have been glad to have returned with us. His own brother had stolen many things from him, and, as he remarked, "What fashion call that"; he abused his countrymen, "All bad men, no sabe [know] nothing," and, though I never heard him swear before, "damned fools." Our three Fuegians, though they had been only three years with civilized men, would, I am sure, have been glad to have re-

tained their new habits; but this was obviously impossible. I fear it is more than doubtful whether their visit will have been of any use to them.

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AGAIN AT WOOLLYA

On the last day of February in the succeeding year (1834) the Beagle anchored in a beautiful little cove at the eastern entrance of the Beagle Channel. Captain Fitzroy determined on the bold and, as it proved, successful attempt to beat against the westerly winds by the same route which we had followed in the boats to the settlement at Woollya.

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On the 5th of March we anchored in the cove at Woollya, but we saw not a soul there. We were alarmed at this, for the natives in Ponsonby Sound showed by gestures that there had been fighting, and we afterwards heard that the dreaded Oens men had made a descent. Soon a canoe, with a little flag flying, was seen approaching, with one of the men in it washing the paint off his face. This man was poor Jemmy,

now a thin haggard savage, with long disordered hair, and naked except a bit of a blanket round his waist. We did not recognize him till he was close to us, for he was ashamed of himself and turned his back to the ship. We had left him plump, fat, clean, and well dressed—I never saw so complete and grievous a change. As soon, however, as he was clothed and the first flurry was over, things wore a good appearance. He dined with Captain Fitzroy and ate his dinner as tidily as formerly. He told us he had "too much" (meaning enough) to eat, that he was not cold, that his relations were very good people, and that he did not wish to go back to England: in

the evening we found out the cause of this great change in Jemmy's feelings, in the arrival of his young and nice-looking wife. With his usual good feeling, he brought two beautiful otterskins for two of his best friends, and some spearheads and arrows made with his own hands for the Captain. He said he had built a canoe for himself, and he boasted that he could talk a little of his own language! But it is a most singular fact that he appears to have taught all his tribe some English: an old man spontaneously announced "jemmy Button's wife." Jemmy had lost all his property. He told us that York Minster had built a large canoe and, with his wife, Fuegia, had several months since gone to his own country, and had taken farewell by an act of consummate villainy; he persuaded jemmy and his mother to come with him, and then on the way deserted them by night, stealing every article of their property.

Jemmy went to sleep on shore, and in the morning returned and remained on board till the ship got under weigh, which frightened his wife, who continued crying violently till he got into his canoe. He returned loaded with valuable property. Every soul on board was heartily sorry to shake hands with him for the last time. I do not now doubt that he will be as happy as, perhaps happier than, if he had never left his own country. Everyone must sincerely hope that Captain Fitzroy's noble hope may be fulfilled, of being rewarded for the many generous sacrifices which he made for these Fuegians, by some shipwrecked sailor being protected by the descendants of Jemmy Button and his tribe! When jemmy reached the shore, he lighted a signal fire, and the smoke curled up, bidding us a last and long farewell as the ship stood on her course into the open sea.

May—June 1834
Strait of .Magellan to the Pacific

This is the middle chapter of Darwin's journal and it is also, in his mind, the turning point of the whole voyage. To him the passage through the Strait of Magellan marks both the beginning of the return home and the opening out of the new world of the Pacific. The idea of seeing the west coast of South America and of crossing the Pacific Ocean and visiting its faraway islands had been one of the inducements that made Darwin eager to go on the trip.

During his second trip to the Falkland Islands, Darwin was so sick and tired of this southern tip of the continent that he wrote home, "If anyone catches me there again, I will give him leave to hang me up as a scarecrow for all future naturalists." Even then he was dreaming of the Andes to explore and "geologize" in. "The future," he wrote home, "is indeed to me a brilliant prospect." His sister Caroline answered that its very brilliance frightened her. Darwin assured her that he was really very careful on his trips and added, "I may mention as a proof, in all my rambles, I have never had any one accident . or scrape." In spite of all his adventures, strenuous trips, and physical dangers, Darwin's serious conflicts and "scrapes" were to occur years later when he fought against the weight of intellectual conservatism and tradition rather than against heavy gales, jaguars, and tropical diseases.

In his entry of June 9 he speaks of the party's delight in seeing Mount Sarmiento, which he describes as one of the

highest mountains in Tierra del Fuego. Apparently it is out of modesty that he fails to mention that the only mountain there higher than Sarmiento was Mount Darwin, named for him by Captain Fitzroy the year before. In a letter to his sister, however, he speaks of "Mt.! ! Darwin!!" This peak and Darwin Sound, east of the Beagle Channel, were the first geographical entities to be given the young naturalist's name. Fitzroy recorded in his record of the voyage that on January 30, 1833, on the long trip in the whaleboats, he named Darwin Sound after his messmate "for so willingly encountering the discomfort and risk" of such a cruise in a small boat. Other places named after Darwin include a second Mount Darwin in the California Sierras; Darwin, the capital of North Territory in Australia; Darwin, Argentina, and Bahia Darwin (Darwin Bay) on the coast of South Chile.

Darwin's observations on the dependence of so many kinds of living creatures on the seaweed known as kelp again reveal his interest in the interrelationships of living things. He sees, indeed, the possibility of a great volume on the single subject of the inhabitants of a bed of kelp. Destroy the kelp, he says, and many species of fish, otters, seals, cormorants, and even the Fuegians themselves would probably become extinct. He has the imagination to call these kelp beds "under-water forests" and he compares them with the jungles of the tropics. Living things are linked together in a great chain, he is saying, and it is staggering to think of the far-reaching effects if one link in that chain were broken.

CHAPTER ELEVEN

(FIGURE)

In the end of May 1834 we entered for the second time the eastern mouth of the Strait of Magellan. The country on both sides of this part of the strait consists of nearly level plains, like those of Patagonia. Cape Negro, a little within the second narrows, may be considered as the point where the land begins to assume the marked features of Tierra del Fuego. On the east coast, south of the strait, broken park-like scenery in a like manner connects these two countries, which are opposed to each other in almost every feature. It is truly surprising to find in a space of twenty miles such a change in the landscape. If we take a rather greater distance, as between Fort Famine and Gregory Bay—that is, about sixty miles—the difference is still more wonderful. At the former place we have rounded mountains concealed by impervious forests,

which are drenched with the rain brought by an endless succession of gales; while at Cape Gregory there is a clear and bright blue sky over the dry and sterile plains. The atmospheric currents, although rapid, turbulent and unconfined by any apparent limits, yet seem to follow, like a river in its bed, a regular determined course.

“GIANT” PATAGONIANS

During our previous visit (in January) we had an interview at Cape Gregory with the famous so-called gigantic Patagonians, who gave us a cordial reception. Their height appears greater than it really is, from their large guanaco mantles, their long flowing hair, and general figure; on an average their height is about six feet, with some men taller and only a few shorter; and the women are also tall; altogether they are certainly the tallest race which we anywhere saw. In features they strikingly resemble the more northern Indians whom I saw with Rosas, but they have a wilder and more formidable appearance: their faces were much painted with red and black, and one man was ringed and dotted with white like a Fuegian. Captain Fitzroy offered to take any three of them on board, and all seemed determined to be of the three. It was long before we could clear the boat; at last we got on board with our three giants, who dined with the Captain and behaved quite like gentlemen, helping themselves with knives, forks, and spoons: nothing was so much relished as sugar. This tribe has had so much communication with sealers and whalers that most of the men can speak a little English and Spanish; and they are half civilized, and proportionally demoralized.
The next morning a large party went on shore to barter for

skins and ostrich feathers; firearms being refused, tobacco was in greatest request, far more so than axes and tools. The whole population of the toldos, men, women, and children, were arranged on a bank. It was an amusing scene, and it was impossible not to like the so-called giants, they were so thoroughly good-humored and unsuspecting; they asked us to come again. They seem to like to have Europeans to live with them, and old Maria, an important woman in the tribe, once begged Mr. Low to leave any one of his sailors with them. They spend the greater part of the year here, but in summer they hunt along the foot of the Cordillera; sometimes they travel as far as the Rio Negro, seven hundred and fifty miles to the north. They are well stocked with horses, each man having, according to Mr. Low, six or seven, and all the women, and even children, their one own horse. In the time of Sarmiento (1580), these Indians had bows and arrows, now long since disused; they then also possessed some horses. This is a very curious fact, showing the extraordinarily rapid multiplication of horses in " South America. The horse was first landed at Buenos Aires in 1537, and the colony being then for a time deserted, the horse ran wild; in 1580, only forty-three years afterwards, we hear of them at the Strait of Magellan! Mr. Low informs me that a neighboring tribe of foot Indians is now changing into horse Indians: the tribe at Gregory Bay giving them their wom- out horses, and sending in winter a few of their best skilled men to hunt for them.

June 1. We anchored in the fine bay of Port Famine. It was now the beginning of winter, and I never saw a more cheerless prospect; the dusky woods, piebald with snow, could be only seen indistinctly through a drizzling hazy atmosphere. We were,

however, lucky in getting two fine days. On one of these, Mount Sarmiento, a distant mountain 6,800 feet high, presented a very noble spectacle.

I have already mentioned the somber and dull character of the evergreen forests, in which two or three species of trees grow, to the exclusion of all others. Above the forest land there are many dwarf alpine plants, which all spring from the mass of peat and help to compose it: these plants are very remarkable from their close alliance with the species growing on the mountains of Europe, though so many thousand miles distant.

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ZOOLOGY OF TIERRA DEL FUEGO

The zoology of Tierra del Fuego, as might have been expected from the nature of its climate and vegetation, is very poor. Of mammalia, besides whales and seals, there is one bat, a kind of mouse (Reithrodon chinchilloides), two true mice, a ctenomys allied to or identical with the tucutuco, two foxes (Canis Magellanicus and C. Azarae) , a sea otter, the guanaco, and a deer. Most of these animals inhabit only the drier eastern parts of the country, and the deer has never been seen south of the Strait of Magellan. Observing the general correspondence of the cliffs of soft sandstone, mud, and shingle on the opposite sides of the strait and on some intervening islands, one is strongly tempted to believe that the land was once joined, and thus allowed animals so delicate and helpless as the tucutuco and Reithrodon to pass over. . . .

The gloomy woods are inhabited by few birds: occasionally the plaintive note of a white-tufted tyrant flycatcher (M yiobius albiceps) may be heard, concealed near the summit of the

. most lofty trees: and more rarely the loud strange cry of a black woodpecker with a fine scarlet crest on its head. A little dusky-colored wren (Scytalopus M agellanicus) hops in a skulking manner among the entangled mass of the fallen and decaying trunks. But the creeper (Oxyurus tupinieri) is the commonest bird in the country. Throughout the beech forests high up and low down, in the most gloomy, wet, and impenetrable ravines, it may be met with. . . . In the more open parts, three or four species of finches, a thrush, a starling (or Icterus), two Opetiorhynchi, and several hawks and owls occur.

The absence of any species whatever in the whole class of reptiles is a marked feature in the zoology of this country, as well as in that of the Falkland Islands. I do not ground this statement merely on my own observation, but I heard it from the Spanish inhabitants of the latter place, and from Jemmy Button with regard to Tierra del Fuego. . . .

Beetles occur in very small numbers: it was long before I could believe that a country as large as Scotland, covered with vegetable productions and with a variety of stations, could be so unproductive. . . .

GIANT SEAWEED

If we turn from the land to the sea, we shall find the latter as abundantly stocked with living creatures as the former is poorly so. In all parts of the world a rocky and partially protected shore perhaps supports, in a given space, a greater number of individual animals than any other station. There is one marine production which from its importance is worthy of particular history. It is the kelp [brown seaweed], or Macrocystis pyrifera. This plant grows on every rock from low-water mark to a great depth, both on the outer coast and within the

channels. I believe, during the voyages of the Adventure and Beagle, not one rock near the surface was discovered which was not buoyed by this floating weed. The good service it thus affords to vessels navigating near this stormy land is evident; and it certainly has saved many a one from being wrecked.

I know few things more surprising than to see this plant growing and flourishing amidst those great breakers of the western ocean, which no mass of rock, let it be ever so hard, can long resist. The stem is round, slimy, and smooth, and seldom has a diameter of so much as an inch. . . . The beds of this seaweed, even when of not great breadth, make excellent natural floating breakwaters. It is quite curious to see, in an exposed harbor, how soon the waves from the open sea, as they travel through the straggling stems, sink in height and pass into smooth water.

(FIGURE)

The number of living creatures of all orders, whose existence intimately depends on the kelp, is wonderful. A great volume might be written describing the inhabitants of one of these beds of seaweed. Almost all the leaves, excepting those that float on the surface, are so thickly encrusted with corallines . as to be of a white color. We find exquisitely delicate structures, some inhabited by simple hydra-like polypi, others by more organized kinds, and beautiful compound Ascidiae [sea squirts]. On the leaves, also, various patelliform [disk-shaped] shells, Trochi, uncovered molluscs [soft-bodied animals with external shells], and some bivalves [double-shelled molluscs] are attached. Innumerable crustacea frequent every part of the plant. On shaking the great entangled roots, a pile of small fish, shells, cuttlefish, crabs of all orders, sea eggs, starfish, beautiful Holuthuriae [sea cucumbers], Planariae, and crawling nereidous [sea worms] animals of a multitude of forms all fall out together. Often as I recurred to a branch of the kelp, I never failed to discover animals of new and curious structures. In Chiloe, where the kelp does not thrive very well, the numerous shells, corallines, and crustacea are absent; but there yet remain a few of the F lustraceae [moss-like sea animals], and some compound Ascidiae ; the latter, however, are of different species from those in Tierra del Fuego: we here see the fucus [kelp] possessing a wider range than the animals which use it as an abode. I can only compare these great aquatic forests of the southern hemisphere with the terrestrial ones in the intertropical regions. Yet if in any country a forest was destroyed, I do not believe nearly so many species of animals would perish as would here from the destruction of the kelp. Amidst the leaves of this plant numerous species of fish live which nowhere else could find food or shelter; with their destruction the many

cormorants and other fishing birds, the otters, seals, and porpoises would soon perish also; and, lastly, the Fuegian savage, the miserable lord of this miserable land, would redouble his cannibal feast, decrease in numbers and perhaps cease to exist.

TO THE PACIFIC

]une 8. We weighed anchor early in the morning and left Port Famine. Captain Fitzroy determined to leave the Strait of Magellan by the Magdalen Channel, which had not long been discovered. Our course lay due south, down that gloomy passage which I have before alluded to as appearing to lead to another and worse world. The wind was fair, but the atmosphere was very thick, so that we missed much curious scenery. The dark ragged clouds were rapidly driven over the mountains, from their summits nearly down to their bases. The glimpses which we caught through the dusky mass were highly interesting; jagged points, cones of snow, blue glaciers, strong outlines, marked on a lurid sky, were seen at different distances and heights. In the midst of such scenery we anchored at Cape Turn, close to Mount Sarmiento, which was then hidden in the clouds. At the base of the lofty and almost perpendicular sides of our little cove there was one deserted wigwam, and it alone reminded us that man sometimes wandered into these desolate regions. But it would be difficult to imagine a scene where he seemed to have fewer claims or less authority. The inanimate works of nature—rock, ice, snow, wind, and water—all warring with each other, yet combined against man—here reigned in absolute sovereignty.

]une 9—In the morning we were delighted by seeing the veil of mist gradually rise from Sarmiento and display it to our

view. This mountain, which is one of the highest in Tierra del Fuego, has an altitude of 6,800 feet. Its base, for about an eighth of its total height, is clothed by dusky woods, and above this a field of snow extends to the summit. These vast piles of snow, which never melt and seem destined to last as long as the world holds together, present a noble and even sublime spectacle. . . . Several glaciers descended in a winding course from the upper great expanse of snow to the seacoast: they may be likened to great frozen Niagaras, and perhaps these cataracts of blue ice are full as beautiful as the moving ones of water. By night we reached the western part of the channel, but the water was so deep that no anchorage could be found. We were in consequence obliged to stand off and on in this narrow arm of the sea during a pitch-dark night of fourteen hours long.

june 10. In the morning we made the best of our way into the open Pacific. The western coast generally consists of low, rounded, quite barren hills of granite and greenstone. Sir Narborough called one part South Desolation because it is "so desolate a land to behold," and well indeed might he say so. Outside the main islands, there are numberless scattered rocks on which the long swell of the open ocean incessantly rages. We passed out between the East and West Furies, and a little further northward there are so many breakers that the sea is called the Milky Way. One sight of such a coast is enough to make a landsman dream for a week about shipwrecks, peril, and death; and with this sight we bade farewell forever to Tierra del Fuego.

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July — September 1834
Central Chile

DARWIN FOUND VALPARAISO more like London or Paris than any other place they had visited, but complained that: "It is most disagreeable to be obliged to shave and dress decently." It was from here that Darwin, in a letter to his sister Caroline, sent his love to another sister, saying: "We do not write to each other for the same reason—we are too busy with our children. She with Master Robert and Henry, etc., and I with Master Megatherium and Mastodon." He again referred to sending home more of his diary, which he later used as the basis for this work. Each time he sent a portion of it home he worried about its safety. Once he said, "I would as soon lose a piece of my memory as it."

Darwin's description in this chapter, August 17, of the view from the summit of a mountain in the lesser range between the coast and the Andes is a beautiful example of the close relationship he always found between the aesthetic appreciation of natural beauty and scientific knowledge. His pleasure from the beautiful scenery, he says, "was heightened by the many reflections which arose" from it. "We cannot help wondering," he exclaims, "at the force which has upheaved these mountains, and even more so at the countless ages which it must have required to have broken through, removed and leveled whole masses of them." This same heightening of the enjoyment of the beauties of nature, whether of microscopic organisms, mountains, tropical jungles, or deserts, through a

scientific understanding of their natural origins and processes, remained a distinctive feature of all of Darwin's later life.

On the return trip to Valparaiso, Darwin became quite ill, probably of malaria, which with other diseases that produced high fever and chills went under the general name of ague. It is hard for the present-day reader to remember that when Darwin was on the Beagle there was no knowledge that mosquitoes carried malaria germs. He told in Chapter 7 of letting mosquitoes bite his hand in a malaria-infested area to see how many would do so. In five minutes he counted fifty bites. Darwin thought, like everybody else at the time, that ague arose from miasma or poisonous air given off by stagnant pools of water.

In spite of his sickness, he continued riding, collecting shells for eight days until he reached Valparaiso. For the next month he was confined to bed. Something of what he suffered during the days and nights while ill and forced to travel, he revealed in the entry in his Diary for September 19:

At night I was exceedingly exhausted; but had the uncommon luck of obtaining some clean straw for my bed. I was amused afterwards by reflecting how truly comparative all comfort is. If I had been in England and very unwell, clean straw and stinking horse cloths would have been thought a very miserable bed.

CHAPTER TWELVE

(FIGURE)

JULY, 23. The Beagle anchored late at night in the bay of Valparaiso, the chief seaport of Chile. When morning came everything appeared delightful. After Tierra del F uego, the climate felt quite delicious—the atmosphere so dry, and the heavens so clear and blue with the sun shining brightly, that all nature seemed sparkling with life. The view from the anchorage is very pretty. The town is built at the very foot of a range of hills, about 1,600 feet high, and rather steep. From its position, it consists of one long, straggling street, which runs parallel to the beach, and wherever a ravine comes down, the houses are piled up on each side of it. The rounded hills, being only partially protected by a very scanty vegetation, are worn into numberless little gullies, which expose a singularly bright red soil. . . .

I had the good fortune to find living here Mr. Richard Corfield, an old schoolfellow and friend, to whose hospitality and kindness I was greatly indebted, in having afforded me a most pleasant residence during the Beagle's stay in Chile. The immediate neighborhood of Valparaiso is not very productive to the naturalist. During the long summer the wind blows steadily from the southward, and a little off shore, so that rain never falls; during the three winter months, however, it is sufficiently abundant. The vegetation in consequence is very scanty; except in some deep valleys, there are no trees, and only a little grass and a few low bushes are scattered over the less steep parts of the hills. When we reflect that at the distance of 356 miles to the south, this side of the Andes is completely

hidden by one impenetrable forest, the contrast is very remarkable. I took several long walks while collecting objects of natural history. . . . . .

EXCURSION TO THE FOOT OF THE ANDES

August 14. I set out on a riding excursion for the purpose of geologizing the basal parts of the Andes, which alone at this time of the year are not shut up by the winter snow. Our first day's ride was northward along the seacoast. After dark we reached the hacienda of Quintero, the estate which formerly belonged to Lord Cochrane. My object in coming here was to see the great beds of shells, which stand some yards above the level of the sea and are burnt for lime. The proofs of the elevation of this whole line of coast are unequivocal: at the height of a few hundred feet old-looking shells are numerous, and I found some at 1,300 feet. These shells either lie loose on the surface, or are embedded in a reddish-black vegetable mold. I was much surprised to find under the microscope that this vegetable mold is really marine mud, full of minute particles of organic bodies.

August 15. We returned towards the valley of Quillota. The country was exceedingly pleasant, just such as poets would call pastoral: green open lawns, separated by small valleys with rivulets, and the cottages, we may suppose of the shepherds, scattered on the hillsides. We were obliged to cross the ridge of the Chilicauquen. At its base there were many fine evergreen forest trees, but these flourished only in the ravines,.where there was running water. Any person who had seen only the country near Valparaiso would never have imagined that there had been such picturesque spots in Chile. As soon as we reached the brow of the Sierra, the valley of Quillota was

immediately under our feet. The prospect was one of remarkable artificial luxuriance. The valley is very broad and quite flat, and is thus easily irrigated in all parts. The little square gardens are crowded with orange and olive trees and every sort of vegetable. On each side huge bare mountains rise, and this from the contrast renders the patchwork valley the more pleasing. Whoever called "Valparaiso" the "Valley of Paradise" must have been thinking of Quillota. We crossed over to the hacienda of San Isidro, situated at the very foot of the Bell Mountain.

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August 16. The major-domo of the hacienda was good enough to give me a guide and fresh horses, and in the morning we set out to ascend the Campana, or Bell Mountain, which is 6,400 feet high. The paths were very bad, but both the geology and scenery amply repaid the trouble. We reached, by the evening, a spring called the Agua del Guanaco, which is situated at a great height.

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The setting of the sun was glorious, the valleys being black whilst the snowy peaks of the Andes yet retained a ruby tint. When it was dark, we made a fire beneath a little arbor of bamboos, fried our charqui (or dried slips of beef), took our maté, and were quite comfortable. There is an inexpressible charm in thus living in the open air. The evening was calm and still; the shrill noise of the mountain vizcacha and the faint cry of a goatsucker were occasionally to be heard. Besides these, few birds or even insects frequent these dry, parched mountains.

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AT THE TOP OF BELL MOUNTAIN

August 17. We spent the day on summit, and I never enjoyed one more thoroughly. Chile, bounded by the Andes and the Pacific, was seen as in a map. The pleasure from the scenery, in itself beautiful, was heightened by the many reflections which arose from the mere view of the Campana range with its lesser parallel ones, and of the broad valley of Quillota directly intersecting them. Who can avoid wondering at the force which has upheaved these mountains, and even more so at the countless ages which it must have required to have broken through, removed, and leveled whole masses of them? It is well in this case to call to mind the vast shingle and sedimentary beds of Patagonia, which, if heaped on the Cordillera, would increase its height by so many thousand feet. When in that country I wondered how any mountain chain could have supplied such masses and not have been utterly obliterated. We must not now reverse the wonder and doubt whether all-powerful time can grind down mountains "even the gigantic Cordillera—into gravel and mud.

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Almost every part of the hill had been drilled by attempts to open gold mines: the rage for mining has left scarcely a spot in Chile unexamined. I spent the evening as before, talking round the fire with my two companions. The guasos of Chile, who correspond to the gauchos of the Pampas, are, however, a very different set of beings. Chile is the more civilized of the two countries, and the inhabitants, in consequence, have lost much individual character. Gradations in rank are much more strongly marked: the guaso does not by any means consider every man his equal, and I was quite

surprised to find that my companions did not like to eat at the same time with myself. The feeling of inequality is a necessary consequence of the existence of an aristocracy of wealth. It is said that some few of the greater landowners possess from five to ten thousand pounds sterling per annum, an inequality of riches which I believe is not met with in any of the cattle-breeding countries eastward of the Andes. A traveler does not here meet that unbounded hospitality which refuses all payment, but yet is so kindly offered that no scruples can be raised in accepting it. Almost every house in Chile will receive you for the night, but a trifle is expected to be given in the morning; even a rich man will accept two or three shillings. The gaucho, although he may be a cutthroat, is a gentleman; the guaso is in few respects better, but at the same time a vulgar, ordinary fellow. The two men, although employed much in the same manner, are different in their habits and attire, and the peculiarities of each are universal in their respective countries. The gaucho seems part of his horse, and scorns to exert himself excepting when on its back; the guaso may be hired to work as a laborer in the fields. The former lives entirely on animal food, the latter almost wholly on vegetable. We do not here see the white boots, the broad drawers, and scarlet chilipa, the picturesque costume of the Pampas. Here, common trousers are protected by black and green worsted leggings. The poncho, however, is common to both. The chief pride of the guaso lies in his spurs, which are absurdly large. I measured one which was six inches in the diameter of the rowel [spiked wheel of the spur], and the rowel itself contained upwards of thirty points. The stirrups are on the same scale, each consisting of a square, carved block of wood, hollowed out, yet weighing three or four pounds.

The guaso is perhaps more expert with the lazo than the gaucho, but, from the nature of the country, he does not know the use of the bolas.

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September 13. We slept at the gold mines of Yaquil, which are worked by Mr. Nixon, an American gentleman, to whose kindness I was much indebted during the four days I stayed at his house. The next morning we rode to the mines, which are situated at the distance of some leagues, near the summit of a lofty hill. On the way we had a glimpse of the lake Taguatagua, celebrated for its floating islands. . . . They are composed of the stalks of various dead plants intertwined together, and on the surface of which other living ones take root. Their form is generally circular, and their thickness from four to six feet, of which the greater part is immersed in the water. As the wind blows, they pass from one side of the lake to the other, and often carry cattle and horses as passengers. When we arrived at the mine, I was struck by the pale appearance of many of the men, and inquired from Mr. Nixon respecting their condition. The mine is 450 feet deep, and each man brings up about 200 pounds weight of stone. With this load they have to climb up the alternate notches cut in the trunks of trees, placed in a zigzag line up the shaft. Even beardless young men, eighteen and twenty years old, with little muscular development of their bodies (they are quite naked excepting drawers), ascend with this great load from nearly the same depth. A strong man who is not accustomed to this labor perspires most profusely with merely carrying up his own body. With this very severe labor, they live entirely on boiled beans and bread. They would prefer having bread alone, but their masters, finding that they cannot work so

hard upon this, treat them like horses and make them eat the beans. Their pay is here rather more than at the mines of Jajuel, being from 24 to 28 shillings per month. They leave the mine only once in three weeks, when they stay with their families for two days. One of the rules in this mine sounds very harsh, but answers pretty well for the master. The only method of stealing gold is to secrete pieces of the ore and take them out as occasion may offer. Whenever the major-domo finds a lump thus hidden, its full value is stopped out of the wages of all the men, who thus, without they all combine, are obliged to keep watch over each other.

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One day a German collector in natural history, of the name of Renous, called, and nearly at the same time an old Spanish lawyer. I was amused at being told the conversation which took place between them. Renous speaks Spanish so well that the old lawyer mistook him for a Chilean. Renous, alluding to me, asked him what he thought of the King of England sending out a collector to their country to pick up lizards and beetles and to break stones? The old gentleman thought seriously for some time, and then said, “It is not well—hay un gato encerrado aqui (there is a cat shut up here). No man is so rich as to send out people to pick up such rubbish. I do not like it: if one of us were to go and do such -things in England, do not you think the King of England would very soon send us out of his country?” And this old gentleman, from his profession, belongs to the better informed and more intelligent classes! Renous himself, two or three years before, left in a house at San Fernando some caterpillars, under charge of a girl to feed, that they might turn into butterflies. This was rumored through the town, and at last the padres and governor

consulted together and agreed it must be some heresy. Accordingly, when Renous returned, he was arrested.

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September 22. We continued to pass over green plains without a tree. The next day we arrived at a house near Navedad, on the seacoast, where a rich haciendero gave us lodgings. I stayed here the two ensuing days and, although very unwell, managed to collect from the tertiary formation some marine shells.

September 24. Our course was now directed towards Valparaiso, which with great difficulty I reached on the 27th, and was there confined to my bed till the end of October.

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November 1884-Ianuary 1835

Chiloe and the Chonos Islands

THIS CHAPTER COMBINES a miscellaneous collection of observations with some of Darwin's most delightful writing and with more reflections on species. As usual, nothing either human or natural is foreign to him. He observes the climate of these islands, their trees and plants, their birds and animals, their towns, the racial background of the people, their character, means of livelihood, clothing, arts, and their general economy. He philosophizes about granite and its place in the earth's crust. In connection with these speculations, he makes a very interesting comment on the relation between knowledge and imagination. Where our knowledge ends, he says, imagination begins. For Darwin, imagination was an important part of the creative process of science. It always led him on to new frontiers of knowledge, for he thought up new theories and hypotheses and these in tum led him to observe new and significant facts. Darwin's whole life work illustrated this method of scientific progress.

Darwin is again thinking about species in his discussion of the zoology of the Chonos Islands. He wonders what chance caused the spread of a strange little mouse to some of these islands and not to others. He wonders why two very odd birds—the cheucau and the guid-guid—are the commonest birds on this archipelago. They seem to be insignificant in the great scheme of nature. Why were they "created"? He answers his own question by pointing out that perhaps they were essential members of society (interrelated with other forms of life) at some previous time or in some other country.

CHAPTER THIRTEEN

(FIGURE)

NOVEM BER 10. The Beagle sailed from Valparaiso to the south, for the purpose of surveying the southern part of Chile, the island of Chiloe, and the broken land called the Chonos archipelago, as far south as the Peninsula of Tres Montes. On the 21st we anchored in the bay of San Carlos, the capital of Chiloe.

This island is about ninety miles long, with a breadth of rather less than thirty. The land is hilly, but not mountainous, and is covered by one great forest, except where a few green patches have been cleared round the thatched cottages. From a distance the view somewhat resembles that of Tierra del Fuego, but the woods, when seen nearer, are incomparably more beautiful. Many kinds of fine evergreen trees and plants with a tropical character here take the place of the gloomy

beech of the southern shores. In winter the climate is detestable, and in summer it is only a little better. I should think there are few parts of the world, within the temperate regions, where so much rain falls. The winds are very boisterous, and the sky almost always clouded: to have a week of fine weather is something wonderful. It is even difficult to get a single glimpse of the Cordillera: during our first visit, once only the volcano of Osorno stood out in bold relief, and that was before sunrise; it was curious to watch, as the sun rose, the outline gradually fading away in the glare of the eastern sky.

The inhabitants, from their complexion and low stature, appear to have three-fourths of Indian blood in their veins. They are a humble, quiet, industrious set of men. Although the fertile soil, resulting from the decomposition of the volcanic rocks, supports a rank vegetation, yet the climate is not favorable to any production which requires much sunshine to ripen it. There is very little pasture for the larger quadrupeds; and in consequence, the staple articles of food are pigs, potatoes, and fish. The people all dress in strong woolen garments, which each family makes for itself and dyes with indigo of a dark blue color. The arts, however, are in the rudest state—as may be seen in their strange fashion of plowing, their method of spinning, grinding corn, and in the construction of their boats. The forests are so impenetrable, that the land is nowhere cultivated except near the coast and on the adjoining islets. Even where paths exist, they are scarcely passable from the soft and swampy state of the soil. The inhabitants, like those of Tierra del Fuego, move about chiefly on the beach or in boats. Although with plenty to eat, the people are very poor; there is no demand for labor, and consequently the lower order cannot scrape together money sufficient to purchase even the smallest

luxuries. There is also a great deficiency of a circulating medium. I have seen a man bringing on his back a bag of charcoal with which to buy some trifle, and another carrying a plank to exchange for a bottle of wine. Hence every tradesman must also be a merchant, and again sell the goods which he takes in exchange.

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November 30. Early on Sunday morning we reached Castro, the ancient capital of Chiloe, but now a most forlorn and deserted place. The usual quadrangular arrangement of Spanish towns could be traced, but the streets and plaza were coated with fine green turf, on which sheep were browsing. The church, which stands in the middle, is entirely built of plank, and has a picturesque and venerable appearance. The poverty of the place may be conceived from the fact that, although containing some hundreds of inhabitants, one of our party was unable anywhere to purchase either a pound of sugar or an ordinary knife. No individual possessed either a watch or a clock; and an old man who was supposed to have a good idea of time was employed to strike the church bell by guess. The arrival of our boats was a rare event in this quiet retired corner of the world, and nearly all the inhabitants came down to the beach to see us pitch our tents. They were very civil, and offered us a house; and one man even sent us a cask of cider as a present. In the afternoon we paid our respects to the governor —a quiet old man who, in his appearance and manner of life, was scarcely superior to an English cottager. At night heavy rain set in, which was hardly sufficient to drive away from our tents the large circle of lookers-on. An Indian family, who had come to trade in a canoe from Caylen, bivouacked near us. They had no shelter during the rain. In the morning I asked

a young Indian, who was wet to the skin, how he had passed the night. He seemed perfectly content, and answered, “Muy bien, sefior.”

December 1 . We steered for the island of Lemuy. . . . When we reached Lemuy we had much difficulty in finding any place to pitch our tents, for it was spring tide, and the land was wooded down to the water’s edge. In a short time we were surrounded by a large group of the nearly pure Indian inhabitants. They were much surprised at our arrival, and said one to the other, “This is the reason we have seen so many parrots lately; the cheucau [an odd red-breasted little bird which inhabits the thick forest and utters very peculiar noises] has not cried ‘beware’ for nothing.” They were soon anxious for barter. Money was scarcely worth anything, but their eagerness for tobacco was something quite extraordinary. After tobacco, indigo came next in value; then capsicum [peppers], old clothes, and gunpowder. The latter article was required for a very innocent purpose: each parish has a public musket, and the gunpowder was wanted for making a noise on their saint or feast days.

POVERTY OF THE INDIANS

The people here live chiefly on shellfish and potatoes. At certain seasons they catch also, in “corrales,” or hedges under water, many fish which are left on the mud banks as the tide falls. They occasionally possess fowls, sheep, goats, pigs, horses, and cattle, the order in which they are here mentioned expressing their respective numbers. I never saw anything more obliging and humble than the manners of these people. They generally began with stating that they were poor natives of the place, and not Spaniards, and that they were in sad want of

tobacco and other comforts. At Caylen, the most southern island, the sailors bought with a stick of tobacco, of the value of three half-pence, two fowls, one of which, the Indian stated, had skin between its toes, and turned out to be a fine duck; and with some cotton handkerchiefs, worth three shillings, three sheep and a large bunch of onions were procured. . .

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December 6. In the evening we reached the island of San Pedro, where we found the Beagle at anchor. In doubling the point, two of the officers landed to take a round of angles with the theodolite [a surveying instrument]. A fox (Canis fulvipes) of a kind said to be peculiar to the island and very rare in it, and which is a new species, was sitting on the rocks. He was so intently absorbed in watching the work of the oflicers that I was able, by quietly walking up behind, to knock him on the head with my geological hammer. This fox, more curious or more scientific, but less wise, than the generality of his brethren, is now mounted in the museum of the Zoological Society.

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December 18. We stood out to sea. On the 20th we bade farewell to the south, and with a fair wind turned the ship's head northward. From Cape Tres Montes we sailed pleasantly along the lofty weather-beaten coast, which is remarkable for the bold outline of its hills and the thick covering of forest even on the almost precipitous flanks. The next day a harbor was discovered, which on this dangerous coast might be of great service to a distressed vessel. It can easily be recognized by a hill 1,600 feet high, which is even more perfectly conical than the famous sugar loaf at Rio de Janeiro. The next day, after anchoring, I succeeded in reaching the summit of this hill. It

was a laborious undertaking, for the sides were so steep that in some parts it was necessary to use the trees as ladders. There were also several extensive brakes of the fuchsia, covered with its beautiful drooping flowers, but very difficult to crawl through. In these wild countries it gives much delight to gain the summit of any mountain. There is an indefinite expectation of seeing something very strange, which, however often it may be balked, never failed with me to recur on each successive attempt. Everyone must know the feeling of triumph and pride which a grand view from a height communicates to the mind. In these little-frequented countries there is also

(FIGURE)

joined to it some vanity that you perhaps are the first man who ever stood on this pinnacle or admired this view.

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December 30. We anchored in a snug little cove at the foot of some high hills, near the northern extremity of Tres Montes. After breakfast the next morning, a party ascended one of these mountains, which was 2,400 feet high. The scenery was remarkable. The chief part of the range was composed of grand, solid, abrupt masses of granite which appeared as if they had been coeval with the beginning of the world. The granite was capped with mica-slate, and this in the lapse of ages had been worn into strange finger-shaped points. These two formations, thus differing in their outlines, agree in being almost destitute of vegetation. This barrenness had to our eyes a strange appearance, from having been so long accustomed to the sight of an almost universal forest of dark green trees. I took much delight in examining the structure of these mountains. The complicated and lofty ranges bore a noble aspect of durability—equally profitless, however, to man and to all other animals. Granite to the geologist is classic ground: from its widespread limits, and its beautiful and compact texture, few rocks have been more anciently recognized. Granite has given rise, perhaps, to more discussion concerning its origin than any other formation. We generally see it constituting the fundamental rock, and, however formed, we know it is the deepest layer in the crust of this globe to which man has penetrated. The limit of man's knowledge in any subject possesses a high interest, which is perhaps increased by its close neighborhood to the realms of imagination.

january 1, 1835. The new year is ushered in with the ceremonies proper to it in these regions. She lays out no false hopes;

a heavy northwestern gale, with steady rain, bespeaks the rising year. Thank God, we are not destined here to see the end of it, but hope then to be in the Pacific Ocean, where a blue sky tells one there is a heaven—a something beyond the clouds above our heads.

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ZOOLOGY OF THE CHONOS ISLANDS

The zoology of these broken islets of the Chonos archipelago is, as might have been expected, very poor. Of quadrupeds two aquatic kinds are comfnon. The Myopotamus Coypus (like a beaver, but with a round tail) is well known from its fine fur, which is an object of trade throughout the tributaries of La Plata. It here, however, exclusively frequents salt water, which same circumstance has been mentioned as sometimes occurring with the great rodent, the capybara. A small sea otter is very numerous; this animal does not feed exclusively on fish, but, like the seals, draws a large supply from a small red crab which swims in shoals near the surface. . . . At one place I caught in a trap a singular little mouse (M. brachiotis) ; it appeared common on several of the islets, but the Chilotans at Low's Harbor said that it was not found in all. What a succession of chances, or what changes of level, must have been brought into play, thus to spread these small animals throughout this broken archipelago!

In all parts of Chiloe and Chonos, two very strange birds occur. One is called by the inhabitants "cheucau" (Pteroptochos rubecula) : it frequents the most gloomy and retired spots within the damp forests. Sometimes, although its cry may be heard close at hand, let a person watch ever so attentively he will not see the cheucau; at other times, let him

stand motionless and the red-breasted little bird will approach within a few feet in the most familiar manner. It then busily hops about the entangled mass of rotting canes and branches, with its little tail cocked upward. The cheucau is held in superstitious fear by the Chilotans, on account of its strange and varied cries. There are three very distinct cries: one is called "chiduco," and is an omen of good; another, "huitreu," which is extremely unfavorable; and a third, which I have forgotten. These words are given in imitation of the noises; and the natives are in some things absolutely governed by them. The Chilotans assuredly have chosen a most comical little creature for their prophet. An allied species, but rather larger, is called by the natives "guid-guid" (Pteroptochos Tarnii), and by the English the barking bird. This latter name is well given, for I defy anyone at first to feel certain that a small dog is not yelping somewhere in the forest. Just as, with the cheucau, a person will sometimes hear the bark close by, but in vain may endeavor by watching, and with still less chance by beating the bushes, to see the bird; yet at other times the guid-guid fearlessly comes near. Its manner of feeding and its general habits are very similar to those of the cheucau.

. . . In my rough notes I describe the strange noises which, although frequently heard within these gloomy forests, yet scarcely disturb the general silence. The yelping of the guid-guid and the sudden whew-whew of the cheucau sometimes come from afar off, and sometimes from close at hand; the little black wren of Tierra del Fuego occasionally adds its cry; the creeper (Oxyurus) follows the intruder screaming and twittering; the hummingbird may be seen every now and then darting from side to side and emitting, like an insect, its shrill chirp; lastly, from the top of some lofty tree the indistinct but

plaintive note of the white-tufted tyrant flycatcher (M yiobius) may be noticed. From the great preponderance in most countries of certain common genera of birds, such as the finches, one feels at first surprised at meeting with the peculiar forms above enumerated, as the commonest birds in any district. .

When finding, as in this case, animals which seem to play so insignificant a part in the great scheme of nature, one is apt to wonder why they were created. But it should always be recollected that in some other country perhaps they are essential members of society, or at some former period may have been so. If America south of 37° were sunk beneath the waters of the ocean, these two birds might continue to exist in Central Chile for a long period, but it is very improbable that their numbers would increase. We should then see a case which must inevitably have happened with very many animals.

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January — March 1835
Chiloe and Concepcio'n: Great Earthquake

AFTER TWO DREARY months in and around Chiloe and the Chonos Islands Darwin is rewarded with the firsthand experience of a huge volcanic eruption and a great earthquake. He couldn't have ordered it better, much as he is distressed at the destruction and devastation that result. For here he actually sees and feels one of those convulsions of the earth's crust, the results of which he has been studiously observing for several years. Darwin is deeply moved by this experience of the "perfect horror" of earthquakes. This earth, our home, "the very emblem of solidity, has moved beneath our feet like a thin crust over a fluid." It creates in a second "a strange idea of insecurity which hours of reflection would not have produced." This is not only a vivid description of the sensation of an earthquake. It is also a clue to the significance of Darwin's voyage on the Beagle.

It has been said that all the material required for the theory of evolution could have been found in the libraries of England when Darwin set sail. But someone had to experience the volcanoes and earthquakes, see the fossil seashells high in the mountains, the giant animals buried under the ground, in order to develop the theory. It was Darwin's opportunity to combine extensive book learning with such experiences as these that enabled him to achieve such a revolution in human thought. The "great earthquake" makes him vividly aware that he is not only reflecting upon but experiencing things which

provide clues to the past history of the earth and its inhabitants. On March 10 he wrote home to tell how glad he was to have seen the ruins of Concepcion. "It is one of the three most interesting spectacles I have beheld since leaving England,—a Fuegian Savage;—Tropical Vegetation;—and the ruins of Concepcion. It is indeed most wonderful to witness such desolation produced in minutes of time." Curiously, none of these three things plays a significant part in the conclusions he is eventually to reach as a result of his five-year voyage. They do illustrate, however, different levels of his interests and observations even though he is not primarily an anthropologist, a botanist, or a geologist.

For months he can do little else than study and speculate on the coincidence of volcanic eruptions and earthquakes. And from what he can now observe he seeks to reconstruct the history of mountain-making in the Andes. No European geologist had ever studied this region, much less experienced a tremendous earthquake in it. Darwin sent reports of his studies to his old teacher, Professor Henslow. Lyell read them and recognized at once how shrewd and dependable this amateur observer was.

CHAPTER FOURTEEN

(FIGURE)

ON January the 15th we sailed from Low's Harbor, and three days afterward anchored a second time in the bay of San Carlos in Chiloe. On the night of the 19th the volcano of Osomo was in action. At midnight the sentry observed something like a large star, which gradually increased in size till about three o'clock, when it presented a very magnificent spectacle. By the aid of a glass, dark objects, in constant succession, were seen, in the midst of a great glare of red light, to be thrown up and to fall down. The light was sufficient to cast on the water a long bright reflection. Large masses of molten matter seem very commonly to be cast out of the craters in this part of the Cordillera. I was assured that when the Corcovado is in eruption, great masses are projected upward and are seen to burst in the air, assuming

many fantastical forms, such as trees; their size must be immense, for they can be distinguished from the high land behind San Carlos, which is no less than ninety-three miles from the Corcovado. In the morning the volcano became tranquil.

I was surprised at hearing afterwards that Aconcagua in Chile, 480 miles northward, was in action on this same night; and still more surprised to hear that the great eruption of Coseguina (2,700 miles north of Aconcagua), accompanied by an earthquake felt over 1,000 miles, also occurred within six hours of this same time. This coincidence is the more remarkable as Coseguina had been dormant for twenty-six years, and Aconcagua most rarely shows any signs of action. It is difficult even to conjecture whether this coincidence was accidental or shows some subterranean connection. If Vesuvius, Etna, and Hecla in Iceland (all three relatively nearer each other than the corresponding points in South America) suddenly burst forth in eruption on the same night, the coincidence would be thought remarkable; but it is far more remarkable in this case, where the three vents fall on the same great mountain chain, and where the vast plains along the entire eastern coast, and the upraised recent shells along more than 2,000 miles on the western coast, show in how equable and connected a manner the elevatory forces have acted.

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February 4. Sailed from Chiloe. . . . We steered northward along shore, but, owing to thick weather, did not reach Valdivia till the night of the 8th. The next morning the boat proceeded to the town, which is distant about ten miles. We followed the course of the river, occasionally passing a few hovels and patches of ground cleared out of the otherwise

unbroken forest, and sometimes meeting a canoe with an Indian family. The town is situated on the low banks of the stream, and is so completely buried in a wood of apple trees that the streets are merely paths in an orchard.

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GREAT EARTHQUAKE

February 20. This day has been memorable, in the annals of Valdivia, for the most severe earthquake experienced by the oldest inhabitant. I happened to be on shore, and was lying down in the wood to rest myself. It came on suddenly, and lasted two minutes, but the time appeared much longer. The rocking of the ground was very sensible. The undulations appeared to my companion and myself to come from due east, while others thought they proceeded from southwest: this shows how difficult it sometimes is to perceive the direction of the vibrations. There was no difficulty in standing upright, but the motion made me almost giddy: it was something like the movement of a vessel in a little cross-ripple, or still more like that felt by a person skating over thin ice which bends under the weight of his body.

A bad earthquake at once destroys our oldest associations: the earth, the very emblem of solidity, has moved beneath our feet like a thin crust over a fluid; one second of time has created in the mind a strange idea of insecurity which hours of reflection would not have produced. In the forest, as a breeze moved the trees, I felt only the earth tremble, but saw no other effect. Captain Fitzroy and some officers were at the town during the shock, and there the scene was more striking; for although the houses, from being built of wood, did not fall, they were violently shaken, and the boards creaked and rattled together. The people rushed Out of doors in the greatest alarm. It is these accompaniments that create that perfect horror of earthquakes experienced by all who have thus seen, as well as felt, their effects. Within the forest it was a deeply interesting, but by no means an awe-exciting, phenomenon. The tides were very curiously affected. The great shock took place at the time of low water; and an old woman who was on the beach told me that the water flowed very quickly, but not in great waves, to high-water mark, and then as quickly returned to its proper level; this was also evident by the line of wet sand. This same kind of quick but quiet movement in the tide happened a few years since at Chiloe, during a slight earthquake, and created much causeless alarm. In the course of the evening there were many weaker shocks, which seemed to produce in the harbor the most complicated currents, and some of great strength.

RUINS OF CONCEPCION

March 4. We entered the harbor of Concepcion. While the ship was beating up to the anchorage, I landed on the island of Quiriquina. The major-domo of the estate quickly rode down to tell me the terrible news of the great earthquake of the 20th: “That not a house in Concepcion or Talcahuano [the port] was standing; that seventy villages were destroyed; and that a great wave had almost washed away the ruins of Talcahuano.” Of this latter statement I soon saw abundant proofs—the whole coast being strewed over with timber and furniture as if a thousand ships had been wrecked. Besides chairs, tables, bookshelves, etc., in great numbers, there were several roofs of cottages which had been transported almost whole. The storehouses at Tulcahuano had been burst open,

and great bags of cotton, yerba, and other valuable merchandise were scattered on the shore. During my walk round the island, I observed that numerous fragments of rock, which, from the marine productions adhering to them, must recently have been lying in deep water, had been cast up high on the beach; one of these was six feet long, three broad, and two thick.

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The next day I landed at Talcahuano, and afterwards rode to Concepcion. Both towns presented the most awful yet interesting spectacle I ever beheld. To a person who had formerly known them, it possibly might have been still more impressive, for the ruins were so mingled together, and the whole scene possessed so little the air of a habitable place, that it was scarcely possible to imagine its former condition. The earthquake commenced at half past eleven o'clock in the forenoon. If it had happened in the middle of the night, the greater number of the inhabitants (which in this one province amount to many thousands) must have perished, instead of less than a hundred: as it was, the invariable practice of running out of doors at the first trembling of the ground alone saved them. In Concepcion each house, or row of houses, stood by itself, a heap or line of ruins; but in Talcahuano, owing to the great wave, little more than one layer of bricks, tiles, and timber, with here and there part of a wall left standing, could be distinguished. From this circumstance Concepcion, although not so completely desolated, was a more terrible and, if I may so call it, picturesque sight. The first shock was very sudden. The major-domo at Quiriquina told me that the first notice he received of it was finding both the horse he rode and himself rolling together on the ground. Rising up, he was again

thrown down. He also told me that some cows which were standing on the steep side of the island were rolled into the sea. The great wave caused the destruction of many cattle; on one low island, near the head of the bay, seventy animals were washed off and drowned. It is generally thought that this has been the worst earthquake ever recorded in Chile; but as the very severe ones occur only after long intervals, this cannot easily be known; nor indeed would a much worse shock have made any great difference, for the ruin was now complete. Innumerable small tremblings followed the great earthquake, and within the first twelve days no less than three hundred were counted.

(FIGURE)

After viewing Concepcion, I cannot understand how the greater number of inhabitants escaped unhurt. The houses in

many parts fell outwards, thus forming in the middle of the streets little hillocks of brickwork and rubbish. Mr. Rouse, the English consul, told us that he was at breakfast when the first movement warned him to run out. He had scarcely reached the middle of the courtyard when one side of his house came thundering down. He retained presence of mind to remember that if he once got on the top of that part which had already fallen, he would be safe. Not being able from the motion of the ground to stand, he crawled up on his hands and knees; and no sooner had he ascended this little eminence than the other side of the house fell in, the great beams sweeping close in front of his head. With his eyes blinded and his mouth choked with the cloud of dust which darkened the sky, at last he gained the street. As shock succeeded shock at the interval of a few minutes, no one dared approach the shattered ruins; and no one knew whether his dearest friends and relations were not perishing from the want of help. Those who had saved any property were obliged to keep a constant watch, for thieves prowled about and, at each little trembling of the ground, with one hand they beat their breasts and cried “misericordia!” and then with the other filched what they could from the ruins. The thatched roofs fell over the fires, and flames burst forth in all parts. Hundreds knew themselves ruined, and few had the means of providing food for the day.

Earthquakes alone are suflicient to destroy the prosperity of any country. If beneath England the now inert subterranean forces should exert those powers which most assuredly in former geological ages they have exerted, how completely would the entire condition of the country be changed! What would become of the lofty houses, thickly packed cities, great manufactories, the beautiful public and private edifices? If the

new period of disturbance were first to commence by some great earthquake in the dead of night, how terrific would be the carnage! England would at once be bankrupt; all papers, records, and accounts would from that moment be lost. Government being unable to collect the taxes and failing to maintain its authority, the hand of violence and rapine would remain uncontrolled. In every large town famine would go forth, pestilence and death following in its train.

TIDAL WAVES

Shortly after the shock, a great wave was seen, from the distance of three or four miles, approaching in the middle of the bay with a smooth outline; but along the shore it tore up cottages and trees as it swept onward with irresistible force. At the head of the bay it broke in a fearful line of white breakers which rushed up to a height of 23 vertical feet above the highest spring tides. Their force must have been prodigious, for at the fort a cannon with its carriage, estimated at four tons in weight, was moved 15 feet inward. A schooner was left in the midst of the ruins, 200 yards from the beach. The first wave was followed by two others, which in their retreat carried away a vast wreck of floating objects.

In one part of the bay a ship was pitched high and dry on shore, was carried off, again driven on shore, and again carried off. In another part, two large vessels anchored near together were whirled about, and their cables were thrice wound round each other: though anchored at a depth of 36 feet, they were for some minutes aground. The great wave must have traveled slowly, for the inhabitants of Talcahuano had time to run up the hills behind the town; and some sailors pulled out seaward, trusting successfully to their boat riding

securely over the swell if they could reach it before it broke. One old woman with a little boy four or five years old ran into a boat, but there was nobody to row it out: the boat was consequently dashed against an anchor and cut in twain; the old woman was drowned, but the child was picked up some hours afterward clinging to the wreck. Pools of salt water were still standing amid the ruins of the houses, and children, making boats with old tables and chairs, appeared as happy as their parents were miserable. It was, however, exceedingly interesting to observe how much more active and cheerful all appeared than could have been expected. It was remarked with much truth that, from the destruction being universal, no one individual was humbled more than another, or could suspect his friends of coldness—that most grievous result of the loss of wealth. Mr. Rouse and a large party whom he kindly took under his protection lived for the first week in a garden beneath some apple trees. At first they were as merry as if it had been a picnic, but soon afterward heavy rain caused much discomfort, for they were absolutely without shelter.

In Captain Fitzroy's excellent account of the earthquake it is said that two explosions, one like a column of smoke and another like the blowing of a great whale, were seen in the bay. The water also appeared everywhere to be boiling, and it "became black, and exhaled a most disagreeable sulphureous smell." These latter circumstances were observed in the Bay of Valparaiso during the earthquake of 1822; they may, I think, be accounted for by the disturbance of the mud at the bottom of the sea containing organic matter in decay. In the Bay of Callao, during a calm day, I noticed that as the ship dragged her cable over the bottom, its course was marked by a line of bubbles. The lower orders in Talcahuano thought that the

earthquake was caused by some old Indian women who two years ago, being offended, stopped the volcano of Antuco. This silly belief is curious because it shows that experience has taught them to observe that there exists a relation between the suppressed action of the volcanoes and the trembling of the ground. It was necessary to apply the witchcraft to the point where their perception of cause and effect failed; and this was the closing of the volcanic vent. This belief is the more singular in this particular instance because, according to Captain Fitzroy, there is reason to believe that Antuco was noways affected.

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I have not attempted to give any detailed description of the appearance of Concepcion, for I feel that it is quite impossible to convey the mingled feelings which I experienced. Several of the officers visited it before me, but their strongest language failed to give a just idea of the scene of desolation. It is a bitter and humiliating thing to see works which have cost man so much time and labor overthrown in one minute; yet compassion for the inhabitants was almost instantly banished by the surprise in seeing a state of things produced in a moment of time which one was accustomed to attribute to a succession of ages. In my opinion, we have scarcely beheld, since leaving England, any sight so deeply interesting.

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ELEVATION OF THE LAND

The most remarkable effect of this earthquake was the permanent elevation of the land; it would probably be far more correct to speak of it as the cause. There can be no doubt that the land round the Bay of Concepcion was upraised two

or three feet; but it deserves notice that, owing to the wave having obliterated the old lines of tidal action on the sloping sandy shores, I could discover no evidence of this fact, except in the united testimony of the inhabitants that one little rocky shoal, now exposed, was formerly covered with water. At the island of Santa Maria (about thirty miles distant) the elevation was greater; on one part Captain Fitzroy found beds of putrid mussel shells still adhering to the rocks ten feet above high-water mark: the inhabitants had formerly dived at low-water spring tides for these shells. The elevation of this province is particularly interesting from its having been the theater of several other violent earthquakes, and from the vast numbers of seashells scattered over the land, up to a height of certainly 600, and I believe of 1,000, feet. At Valparaiso, as I have remarked, similar shells are found at the height of 1,300 feet: it is hardly possible to doubt that this great elevation has been effected by successive small uprisings, such as that which accompanied or caused the earthquake of this year, and likewise by an insensibly slow rise, which is certainly in progress on some parts of this coast.

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March—April 1835

Valparaiso and Across the Andes

DARWIN HAD BEEN eagerly awaiting the opportunity to cross the snow-covered Andes ever since he first glimpsed this great mountain range on the trip up the Rio Negro. On March 10 he wrote home of his planned trip and confessed it would cost a lot of money. He was sure his father wouldn't begrudge it to him, for this was the last journey he could take on shore before they got to Australia. (It was scarcely over before he was off on a 420-mile horseback trip up the Chilean coast.) "Oh the precious money wasted in Cambridge," he wrote. "I am ashamed to think of it."

He sees the valleys of the Andes bordered by beds of shingle and sand thousands of feet thick. He finds it hard to convince himself that natural forces, such as the work of rivers, can have ground down the rocks of the Andes into such masses. But, on the other hand, when he listens to the stones rattling over one another in the mountain torrents, he grasps the sense of time stretching back and back—long ages during which, day and night, the stones have rattled down slowly and inexorably, thus building up these very beds he sees before him.

Other observations convince him that these shingle terraces have been deposited by the mountain rivers as the land slowly rose to form the great mountain chain of the Andes. At 14,000 feet above sea level he finds fossil seashells of animals that once crawled on the bottom of the sea. At 7,000 feet he finds petrified trees which were being turned to stone when they were

submerged in the depths of the ocean. Here is proof that the Andes have risen from the sea. From other evidence be concludes that this must have been a slow rise, and not a sudden one, as most of the geologists of his day thought.

As he descends the eastern slopes of the Andes he notices the change in the species of plants and animals. Again he is noting an important fact he can use later to support his theories. A great mountain chain like the Andes constitutes a natural barrier that animals cannot cross; and the animals on one side of the barrier are very different from those on the other side. They have changed for reasons Darwin does not understand yet, but they have changed nevertheless.

After he returned from his trip across the Andes, Darwin wrote of his delight at such a climax to his geologizing in South America. “I literally could hardly sleep at night for thinking over my day’s work.” In this letter, too, he told that the trip had added half a mule’s load to the cargo of specimens he was preparing to send to England. He must send so much because without “plenty of proof” he could not expect a word of what he had written on this to be believed. This was perhaps Darwin’s first reference to what was to become one of his most noted characteristics. He would never advance a theory about anything unless he was convinced he had sufficiently tested it and had all the evidence necessary to prove it.

CHAPTER FIFTEEN

(FIGURE)

MARCH 7, 1835. We stayed three days at Concepcion,
M and then sailed for Valparaiso. The wind being northerly, we only reached the mouth of the harbor of Concepcion before it was dark. Being very near the land, and a fog coming on, the anchor was dropped. Presently a large American whaler appeared close alongside of us, and we heard the Yankee swearing at his men to keep quiet whilst he listened for the breakers. Captain Fitzroy hailed him, in a loud, clear voice, to anchor where he then was. The poor man must have thought the voice came from the shore: such a Babel of cries issued at once from the ship—everyone hallooing out, “Let go the anchor! Veer cable! Shorten sail!” It was the most laughable thing I ever heard. If the ship’s crew had been all captains and no men, there could not have been a greater uproar of

orders. We afterwards found that the mate stuttered: I suppose all hands were assisting him in giving his orders.

On the 11th we anchored at Valparaiso, and two days afterwards I set out to cross the Cordillera. I proceeded to Santiago, where Mr. Caldcleugh most kindly assisted me in every possible way in making the little preparations which were necessary.

In this part of Chile there are two passes across the Andes to Mendoza: the one most commonly used—namely, that of Aconcagua or Uspallata—is situated some way to the north; the other, called the Portillo, is to the south, and nearer, but . more lofty and dangerous.

TO THE PORTILLO PASS AND ARGENTINA

March 18. We set out for the Portillo pass. Leaving Santiago, we crossed the wide bumed-up plain on which that city stands, and in the afternoon arrived at the Maypu, one of the principal rivers in Chile. The valley, at the point where it enters the first Cordillera, is bounded on each side by lofty barren mountains; and although not broad, it is very fertile. Numerous cottages were surrounded by vines, and by orchards of apple, nectarine, and peach trees—their boughs breaking with the weight of the beautiful ripe fruit. In the evening we passed the custom house, where our luggage was examined. . . .

At night we slept at a cottage. Our manner of traveling was delightfully independent. In the inhabited parts we bought a little firewood, hired pasture for the animals, and bivouacked in the corner of the same field with them. Carrying an iron pot, we cooked and ate our supper under a cloudless sky, and knew no trouble. My companions were Mariano Gonzales, who had formerly accompanied me in Chile, and an “arriero,” with his ten mules and a “madrina.” The madrina (or godmother) is a most important personage: she is an old steady mare with

a little bell round her neck; and wherever she goes, the mules, like good children, follow her. The affection of these animals for their madrinas saves infinite trouble. If several large troops are turned into one field to graze, in the morning the muleteers have only to lead the madrinas a little apart and tinkle their bells; and although there may be two or three hundred together, each mule immediately knows the bell of its own madrina and comes to her. It is nearly impossible to lose an old mule, for if detained for several hours by force, she will, by the power of smell, like a dog track out her companions, or rather the madrina, for, according to the muleteer, she is the chief object of affection. The feeling, however, is not of an individual nature ; for I believe I am right in saying that any animal with a bell will serve as a madrina. In a troop each animal carries on a level road a cargo weighing 416 pounds, but in a mountainous country 100 pounds less; yet with what delicate slim limbs, without any proportional bulk of muscle, these animals support so great a burden! The mule always appears to me a most surprising animal. That a hybrid should possess more reason, memory, obstinacy, social affection, powers of muscular endurance, and length of life than either of its parents, seems to indicate that art has here outdone nature. Of our ten animals, six were intended for riding and four for carrying cargoes, each taking turn about. We carried a good deal of food in case we should be snowed up, as the season was rather late for passing the Portillo.

RISE OF THE ANDES

March 19. We rode during this day to the last and therefore most elevated house in the valley. The number of inhabitants became scanty; but wherever water could be brought on the land, it was very fertile. All the main valleys in the Cordillera

are characterized by having, on both sides, a fringe or terrace of shingle and sand, rudely stratified and generally of considerable thickness. No one fact in the geology of South America interested me more than these terraces of rudely stratified shingle. They precisely resemble in composition the matter which the torrents in each valley would deposit if they were checked in their course by any cause, such as entering a lake or arm of the sea; but the torrents, instead of depositing matter, are now steadily at work wearing away both the solid rock and these alluvial deposits, along the whole line of every main valley and side valley. It is impossible here to give the reasons, but I am convinced that the shingle terraces were accumulated during the gradual elevation of the Cordillera by the torrents delivering, at successive levels, their detritus on the beachheads of long narrow arms of the sea, first high up the valleys, then lower and lower down as the land slowly rose. If this be so, and I cannot doubt it, the grand and broken chain of the Cordillera, instead of having been suddenly thrown up, as was till lately the universal and still is the common opinion of geologists, has been slowly upheaved in mass, in the same gradual manner as the coasts of the Atlantic and Pacific have risen within the recent period. A multitude of facts in the structure of the Cordillera, on this view, receive a simple explanation.

AN ETERNITY

The rivers which flow in these valleys ought rather to be called mountain torrents. Their inclination is very great, and their water the color of mud. The roar which the Maypu made, as it rushed over the great rounded fragments, was like that of the sea. Amidst the din of rushing waters, the noise from the stones, as they rattled one over another, was most distinctly

audible even from a distance. This rattling noise, night and day, may be heard along the whole course of the torrent. The sound spoke eloquently to the geologist; the thousands and thousands of stones, which, striking against each other, made the one dull uniform sound, were all hurrying in one direction. It was like thinking on time, where the minute that now glides past is irrecoverable. So was it with these stones; the ocean is their eternity, and each note of that wild music told of one more step towards their destiny.

It is not possible for the mind to comprehend, except by a slow process, any effect which is produced by a cause repeated so often that the multiplier itself conveys an idea not more definite than the savage implies when he points to the hairs of his head. As often as I have seen beds of mud, sand, and shingle accumulated to the thickness of many thousand feet, I have felt inclined to exclaim that causes such as the present rivers and the present beaches could never have ground down and produced such masses. But, on the other hand, when listening to the rattling noise of these torrents, and calling to mind that whole races of animals have passed away from the face of the earth, and that during this whole period, night and day, these stones have gone rattling onwards in their course, I have thought to myself, can any mountains, any continent, withstand such waste?

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GEOLOGY OF THE ANDES

March 20. As we ascended the valley, the vegetation, with the exception of a few pretty alpine flowers, became exceedingly scanty; and of quadrupeds, birds, or insects, scarcely one could be seen. The lofty mountains, their summits marked with a few patches of snow, stood well separated from each other,

the valleys being filled up with an immense thickness of stratified alluvium. The features in the scenery of the Andes which struck me most, as contrasted with the other mountain chains with which I am acquainted, were the flat fringes sometimes expanding into narrow plains on each side of the valleys—the bright colors, chiefly red and purple, of the utterly bare and precipitous hills of porphyry—the grand and continuous wall-like dikes—the plainly divided strata which, where nearly vertical, formed the picturesque and wild central pinnacles, but, where less inclined, composed the great massive mountains on the outskirts of the range—and, lastly, the smooth conical piles of fine and brightly colored detritus which sloped up at a high angle from the base of the mountains, sometimes to a height of more than 2,000 feet.

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I will here give a very brief sketch of the geology of the several parallel lines forming the Cordillera. Of these lines, there are two considerably higher than the others; namely, on the Chilean side, the Peuquenes ridge, which, where the road crosses it, is 13,210 feet above the sea; and the Portillo ridge, on the Mendoza side, which is 14,305 feet. . . . In these upper beds shells are tolerably frequent, and they belong to about the period of the lower chalk of Europe. It is an old story, but not the less wonderful, to hear of shells which were once crawling on the bottom of the sea now standing nearly 14,000 feet above its level. The lower beds in this great pile of strata have been dislocated, baked, crystallized, and almost blended together, through the agency of mountain masses of a peculiar white soda-granitic rock.

CROSSING THE RIDGE

About noon we began the tedious ascent of the Peuquenes ridge, and then for the first time experienced some little difficulty in our respiration. The mules would halt every fifty yards, and after resting for a few seconds the poor willing animals started of their own accord again. The short breathing from the rarefied atmosphere is called by the Chilenos “puna,” and they have most ridiculous notions concerning its origin. Some say “all the waters here have puna”; others that “where there is snow there is puna”—and this no doubt is true. The only sensation I experienced was a slight tightness across the head and chest, like that felt on leaving a warm room and running quickly in frosty weather. There was some imagination even in this; for upon finding fossil shells on the highest ridge, I entirely forgot the puna in my delight. Certainly the exertion of walking was extremely great, and the respiration became deep and laborious. I am told that in Potosi (about 13,000 feet above the sea) strangers do not become thoroughly accustomed to the atmosphere for an entire year. The inhabitants all recommend onions for the puna; as this vegetable has sometimes been given in Europe for pectoral complaints, it may possibly be of real service: for my part, I found nothing so good as the fossil shells!

When about halfway up we met a large party with seventy loaded mules. It was interesting to hear the wild cries of the muleteers, and to watch the long descending string of the animals; they appeared so diminutive, there being nothing but the bleak mountains with which they could be compared. When near the summit, the wind, as generally happens, was impetuous and extremely cold. On each side of the ridge we

had to pass over broad bands of perpetual snow, which were now soon to be covered by a fresh layer. When we reached the crest and looked backwards, a glorious view was presented. The atmosphere resplendently clear; the sky an intense blue; the profound valleys; the wild broken forms; the heaps of ruins, piled up during the lapse of ages; the bright-colored rocks, contrasted with the quiet mountains of snow; all these together produced a scene no one could have imagined. Neither plant nor bird, excepting a few condors wheeling around the higher pinnacles, distracted my attention from the inanimate mass. I felt glad that I was alone: it was like watching a thunderstorm, or hearing in full orchestra a chorus of the Messiah.

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At the place where we slept, water necessarily boiled, from the diminished pressure of the atmosphere, at a lower temperature than it does in a less lofty country; the case being the converse of that of a Papin's digester [a kind of pressure cooker]. Hence the potatoes, after remaining for some hours in the boiling water, were nearly as hard as ever. The pot was left on the fire all night, and next morning it was boiled again, but yet the potatoes were not cooked. I found out this by overhearing my two companions discussing the cause; they had come to the simple conclusion "that the cursed pot [which was a new one] did not choose to boil potatoes."

March 22. After eating our potato-less breakfast, we traveled across the intermediate tract to the foot of the Portillo range. In the middle of summer, cattle are brought up here to graze; but they had now all been removed: even the greater number of the guanacos had decamped, knowing well that if overtaken here by a snowstorm they would be caught in a trap. We had a fine view of a mass of mountains called Tupungato, the whole

clothed with unbroken snow, in the midst of which there was a blue patch, no doubt a glacier—a circumstance of rare occurrence in these mountains. Now commenced a heavy and long climb, similar to that up the Peuquenes. Bold conical hills of red granite rose on each hand; in the valleys there were several broad fields of perpetual snow. These frozen masses, during the process of thawing, had in some parts been converted into pinnacles or columns, which, as they were high and close together, made it difficult for the cargo mules to pass. On one of these columns of ice a frozen horse was sticking as on a pedestal, but with its hind legs straight up in the air. The animal, I suppose, must have fallen with its head downward into a hole when the snow was continuous, and afterward the surrounding parts must have been removed by the thaw.

When nearly on the crest of the Portillo, we were enveloped in a falling cloud of minute frozen spicula [tiny needle-like particles]. This was very unfortunate, as it continued the whole day and quite intercepted our view. The pass takes its name of Portillo from a narrow cleft or doorway on the highest ridge, through which the road passes. From this point, on a clear day, those vast plains which uninterruptedly extend to the Atlantic Ocean can be seen. We descended to the upper limit of vegetation, and found good quarters for the night under the shelter of some large fragments of rock. We met here some passengers who made anxious inquiries about the state of the road. Shortly after it was dark the clouds suddenly cleared away, and the effect was quite magical. The great mountains, bright with the full moon, seemed impending over us on all sides, as over a deep crevice: one morning very early I witnessed the same striking effect. As soon as the clouds were dispersed, it froze severely; but as there was no wind, we slept very comfortably. The increased brilliancy of the moon and stars at this eleva-

tion, owing to the perfect transparency of the atmosphere, was very remarkable. Travelers, having observed the difficulty of judging heights and distances amidst lofty mountains, have generally attributed it to the absence of objects of comparison. It appears to me that it is fully as much owing to the transparency of the air confounding objects at different distances, and likewise partly to the novelty of an unusual degree of fatigue arising from a little exertion—habit being thus opposed to the evidence of the senses. I am sure that this extreme clearness of the air gives a peculiar character to the landscape, all objects appearing to be brought nearly into one plane, as in a drawing or panorama. The transparency is, I presume, owing to the equable and high state of atmospheric dryness. This dryness was shown by the manner in which woodwork shrank (as I soon found by the trouble my geological hammer gave me) ; by articles of food, such as bread and sugar, becoming extremely hard; and by the preservation of the skin and parts of the flesh of the beasts which had perished on the road. To the same cause we must attribute the singular facility with which electricity is excited. My flannel waistcoat, when rubbed in the dark, appeared as if it had been washed with phosphorus; every hair on a dog's back cracked; even the linen sheets and leathem straps of the saddle, when handled, emitted sparks.

DESCENT TO THE EAST

March 23. The descent on the eastern side of the Cordillera is much shorter or steeper than on the Pacific side; in other words, the mountains rise more abruptly from the plains than from the alpine country of Chile. A level and brilliantly white sea of clouds was stretched out beneath our feet, shutting out the view of the equally level Pampas. We soon entered the

band of clouds, and did not again emerge from it that day. About noon, finding pasture for the animals and bushes for firewood at Los Arenales, we stopped for the night. This was near the uppermost limit of bushes, and the elevation, I suppose, was between seven and eight thousand feet.

I was much struck with the marked difference between the vegetation of these eastern valleys and those on the Chilean side; yet the climate, as well as the kind of soil, is nearly the same, and the difference of longitude very trifling. The same remark holds good with the quadrupeds, and in a lesser degree with the birds and insects. I may instance the mice, of which I obtained thirteen species on the shores of the Atlantic and five on the Pacific, and not one of them is identical. We must expect all those species which habitually or occasionally frequent elevated mountains, and certain birds which range as far south as the Strait of Magellan. This fact is in perfect accordance with the geological history of the Andes; for these mountains have existed as a great barrier since the present races of animals have appeared; and therefore, unless we suppose the same species to have been created in two different places, we ought not to expect any closer similarity between the organic beings on the opposite sides of the Andes than on the opposite shores of the ocean. In both cases we must leave out of the question those kinds which have been able to cross the barrier, whether of solid rock or salt water.

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March 25. I was reminded of the Pampas of Buenos Aires by seeing the disk of the rising sun intersected by a horizon level as that of the ocean. During the night a heavy dew fell, a circumstance which we did not experience within the Cordillera. The road proceeded for some distance due east across a low swamp;

then meeting the dry plain, it turned to the north towards Mendoza. The distance is two very long days' journey. Our first day's journey was called fourteen leagues to Estacado, and the second seventeen to Luxan, near Mendoza. The whole distance is over a level desert plain with not more than two or three houses. . . .

LOCUSTS AND BUGS

After our two days' tedious journey, it was refreshing to see in the distance the rows of poplars and willows growing round the village and river of Luxan. Shortly before we arrived at this place, we observed to the south a ragged cloud of a dark reddish-brown color. At first we thought it was smoke from some great fire on the plains, but we soon found that it was a swarm of locusts. They were flying northward; and with the aid of a light breeze, they overtook us at a rate of ten or fifteen miles an hour. The main body filled the air from a height of twenty feet to that, as it appeared, of two or three thousand above the ground; "and the sound of their wings was as the sound of chariots of many horses running to battle," or rather, I should say, like a strong breeze passing through the rigging of a ship. The sky, seen through the advanced guard, appeared like a mezzo-tinto engraving, but the main body was impervious to sight; they were not, however, so thick together but that they could escape a stick waved backwards and forwards. When they alighted, they were more numerous than the leaves in the field, and the surface became reddish instead of being green: the swarm having once alighted, the individuals flew from side to side in all directions. Locusts are not an uncommon pest in this country: already during this season, several smaller swarms had come up from the south, where, as apparently in all other

parts of the world, they are bred in the deserts. The poor cottagers in vain attempted by lighting fires, by shouts, and by waving branches, to avert the attack. This species of locust closely resembles, and perhaps is identical with, the famous Gryllus migratorius of the East.

We crossed the Luxan, which is a river of considerable size, though its course towards the seacoast is very imperfectly known: it is even doubtful whether, in passing over the plains, it is not evaporated and lost. We slept in the village of Luxan, which is a small place surrounded by gardens and forms the most southern cultivated district in the province of Mendoza; it is five leagues south of the capital. At night I experienced an attack (for it deserves no less a name) of the benchuca, a species of Reduvius, the great black bug of the Pampas. It is most disgusting to feel soft wingless insects, about an inch long, crawling over one's body. Before sucking they are quite thin, but afterwards they become round and bloated with blood, and in this state are easily crushed. One which I caught at Iquique (for they are found in Chile and Peru) was very empty. When placed on a table, and though surrounded by people, if a finger was presented, the bold insect would immediately protrude its sucker, make a charge, and, if allowed, draw blood. No pain was caused by the wound. It was curious to watch its body during the act of sucking, as in less than ten minutes it changed from being as flat as a wafer to a globular form. This one feast, for which the benchuca was indebted to one of the officers, kept it fat during four whole months; but after the first fortnight, it was quite ready to have another suck.

March 27. We rode on to Mendoza. The country was beautifully cultivated, and resembled Chile. This neighborhood is celebrated for its fruit, and certainly nothing could appear more

flourishing than the vineyards and the orchards of figs, peaches, and olives. We bought watermelons nearly twice as large as a man's head, most deliciously cool and well-flavored, for a half-penny apiece; and for the value of threepence, half a wheel-barrowful of peaches. The cultivated and enclosed part of this province is very small; there is little more than that which we passed through between Luxan and the capital. The land, as in Chile, owes its fertility entirely to artificial irrigation, and it is really wonderful to observe how extraordinarily productive a barren traversia [plains of sandy mineral soil] is thus rendered.

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March 29. We set out on our return to Chile by the Uspallata pass situated north of Mendoza. We had to cross a long and most sterile traversia of fifteen leagues. The soil in parts was absolutely bare, in others covered by numberless dwarf cacti armed with formidable spines and called by the inhabitants "little lions." There were also a few low bushes. Although the plain is nearly three thousand feet above the sea, the sun was very powerful; and the heat, as well as the clouds of impalpable dust, rendered the traveling extremely irksome. Our course during the day lay nearly parallel to the Cordillera, but gradually approaching them. Before sunset we entered one of the wide valleys, or rather bays, which open on the plain : this soon narrowed into a ravine, where a little higher up the house of Villa Vicencio is situated. As we had ridden all day without a drop of water, both our mules and selves were very thirsty, and we looked out anxiously for the stream which flows down this valley. It was curious to observe how gradually the water made its appearance: on the plain the course was quite dry; by degrees it became a little damper; then puddles of water appeared ; these soon became connected; and at Villa Vicencio there was a nice little rivulet.

TREES OF STONE

March 30. The solitary hovel which bears the imposing name of Villa Vicencio has been mentioned by every traveler who has crossed the Andes. I stayed here and at some neighboring mines during the two succeeding days. . . . In the central part of the range, at an elevation of about seven thousand feet, I observed on a bare slope some snow-white projecting columns. These were petrified trees, eleven being silicified [petrified with silica], and from thirty to forty converted into coarsely crystallized white calcareous spar [chalkstone]. They were abruptly broken off, the upright stumps projecting a few feet above the ground. The trunks measured from three to five feet in circumference. They stood a little way apart from each other, but the whole formed one group. Mr. Robert Brown has been kind enough to examine the wood: he says it belongs to the fir tribe, partaking of the character of the Araucarian family, but with some curious points of aflinity with the yew. The volcanic sandstone in which the trees were embedded, and from the lower part of which they must have sprung, had accumulated in successive thin layers around their trunks; and the stone yet retained the impression of the bark.

It required little geological practice to interpret the marvelous story which this scene at once unfolded, though I confess I was at first so much astonished that I could scarcely believe the plainest evidence. I saw the spot where a cluster of fine trees once waved their branches on the shores of the Atlantic when that ocean (now driven back 700 miles) came to the foot of the Andes. I saw that they had sprung from a volcanic soil which had been raised above the level of the sea, and that subsequently this dry land, with its upright trees, had been let down into the

depths of the ocean. In these depths, the formerly dry land was covered by sedimentary beds, and these again by enormous streams of submarine lava—one such mass attaining the thickness of a thousand feet; and these deluges of molten stone and aqueous deposits five times alternately had been spread out. The ocean which received such thick masses must have been profoundly deep; but again the subterranean forces exerted themselves, and I now beheld the bed of that ocean forming a chain of mountains more than seven thousand feet in height.

Nor had those antagonist forces been dormant which are always at work wearing down the surface of the land: the great piles of strata had been intersected by many wide valleys, and the trees, now changed into silex [quartz], were exposed projecting from the volcanic soil, now changed into rock, whence formerly, in a green and budding state, they had raised their lofty heads. Now all is utterly irreclaimable and desert; even the lichen cannot adhere to the stony casts of former trees.

Vast and scarcely comprehensible as such changes must ever appear, yet they have all occurred within a period recent when compared with the history of the Cordillera; and the Cordillera itself is absolutely modern as compared with many of the fossiliferous strata of Europe and America.

RETURN TO VALPARAISO

April 1 . We crossed the Uspallata range, and at night slept at the custom house—the only inhabited spot on the plain. Shortly before leaving the mountains there was a very extraordinary view; red, purple, green, and quite white sedimentary rocks, alternating with black lavas, were broken up and thrown into all kinds of disorder by masses of porphyry of every shade of color, from dark brown to the brightest lilac. It was the first

view I ever saw which really resembled those pretty sections which geologists make of the inside of the earth.

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April 6. In the morning we found some thief had stolen one of our mules and the bell of the madrina. We therefore rode only two or three miles down the valley and stayed there the ensuing day in hopes of recovering the mule, which the arriero thought had been hidden in some ravine. The scenery in this part had assumed a Chilean character: the lower sides of the mountains, dotted over with the pale evergreen Quillay tree, and with the great chandelier-like cactus, are certainly more to be admired than the bare eastern valleys, but I cannot quite agree with the admiration expressed by some travelers. The extreme pleasure, I suspect, is chiefly owing to the prospect of a good fire and of a good supper, after escaping from the cold regions above: and I am sure I most heartily participated in these feelings.

April 8. We left the valley of the Aconcagua, by which we had descended, and reached in the evening a cottage near the Villa de Santa Rosa. The fertility of the plain was delightful: the autumn being advanced, the leaves of many of the fruit trees were falling; and of the laborers, some were busy in drying figs and peaches on the roofs of their cottages, while others were gathering the grapes from the vineyards. It was a pretty scene; but I missed that pensive stillness which makes the autumn in England indeed the evening of the year. On the 10th we reached Santiago, where I received a very kind and hospitable reception from Mr. Caldcleugh. My excursion cost me twenty-four days, and never did I more deeply enjoy an equal space of time. A few days afterwards I returned to Mr. Corfield’s house at Valparaiso.

April -June 1835

From Valparaiso to Lima, Peru

ON APRIL 23 Darwin wrote to his sister Susan about the long horseback trip he would start in two days, going north from Valparaiso. “Everything,” he says, “which can interest a geologist is found in those districts.” There are mines of rock salt, gypsum, saltpeter, and sulphur, curiously formed valleys, volcanoes, fossil shells, and strange scenery. It is a brilliant prospect but has its dismal side: “that horrid phantom Money.” He had just spent sixty pounds in crossing the Andes and now must draw a hundred pounds more. But his father can be assured that after September, when he leaves the coast of South America to cross the Pacific, he won’t spend any money because he won’t be able to. Then he adds: “I verily believe I could spend money in the very moon.” The trouble is, he explains, that when he gets to some interesting place, while the horses are resting, he hears of something wonderful a hundred miles off and a muleteer offers to take him there for so many dollars. What can he do? This, he says, is a temptation he has never resisted. He was quite glad when this trip was over. From Lima he wrote home: “Excluding the interest arising from Geology such travelling would be downright Martyrdom. But with this subject in your mind there is food in the great surrounding scenes for constant meditation.”

While Darwin was riding up the coast he heard stories about the Beagle that greatly amused him. As she went in and out of all the ports on her surveying mission, Darwin learned, all the

people were convinced she was a smuggler. Each person thought his neighbor was in on the secret and complained of the Captain’s want of confidence in them in not coming to terms. Darwin had difficulty trying to convince them otherwise, and noted in his Diary: “A person who could possibly mistake Captain Fitzroy for a smuggler, would never perceive any difference between a Lord Chesterfield and his valet.”

But not only was Fitzroy suspected of being a smuggler. Darwin reveals, in the entry of June 11, how he himself was suspected of being a mining prospector. For what other reason could he possibly be so occupied in examining rock strata and the like? His way of answering these troublesome questions was as ingenious as it was charming: weren’t they themselves curious about earthquakes, volcanoes, and hot springs? He notes that this method worked on all but a few—those who, like some in England, “are a century behindhand” and think that it is wrong to question why things are as they are.

Throughout this whole trip Darwin is so deeply preoccupied with geology that little else engages his attention. Once in Lima, however, he was relaxed enough to be struck by the beauty of the Spanish women. He noted in his Diary that “they are better worth looking at than all the churches and buildings in Lima.”

CHAPTER SIXTEEN

(FIGURE)

APRIL 27 . I set out on a journey to Coquimbo, and thence through Guasco to Copiapo, where Captain Fitzroy kindly offered to pick me up in the Beagle. The distance in a straight line along the shore northward is only 420 miles, but my mode of traveling made it a very long journey. I bought four horses and two mules, the latter carrying the luggage on alternate days. The six animals together only cost the value of twenty-five pounds sterling, and at Copiapo I sold them again for twenty-three. We traveled in the same independent manner as before, cooking our own meals, and sleeping in the open air. As we rode toward the Vifio del Mar, I took a farewell view of Valparaiso, and admired its picturesque appearance. …

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May 2. The road continued to follow the coast, at no great distance from the sea. The few trees and bushes which are common in Central Chile decreased rapidly in numbers, and were replaced by a tall plant something like a yucca in appearance. The surface of the country, on a small scale, was singularly broken and irregular: abrupt little peaks of rock rising out of small plains or basins. The indented coast and the bottom of the neighboring sea, studded with breakers, would, if converted into dry land, present similar forms; and such a conversion without doubt has taken place in the part over which we rode.

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(FIGURE)

CHILEAN MINERS

May 4. Finding the coast road devoid of interest of any kind, we turned inward towards the mining district and valley of Illapel. This valley, like every other in Chile, is level, broad, and very fertile: it is bordered on each side either by cliffs of stratified shingle or by bare rocky mountains. Above the straight line of the uppermost irrigating ditch, all is brown as on a high road; while all below is of as bright a green as verdigris [copper pigment], from the beds of alfalfa, a kind of clover. We proceeded to Los Hornos, another mining district, where the principal hill was drilled with holes, like a great ants' nest. The Chilean miners are a peculiar race of men in their habits. Living for weeks together in the most desolate spots, when they descend to the villages on feast days there is no excess or extravagance into which they do not run. They sometimes gain a considerable sum, and then, likesailors with prize money, they try how soon they can contrive to squander it. They drink excessively, buy quantities of clothes, and in a few days return

penniless to their miserable abodes, there to work harder than beasts of burden. . . .

(FIGURE)

The dress of the Chilean miner is peculiar and rather picturesque. He wears a very long shirt of some dark-colored baize, with a leathern apron, the whole being fastened round his waist by a, bright-colored sash. His trousers are very broad, and his small cap of scarlet cloth is made to fit the head closely. We met a party of these miners in full costume, carrying the body of one of their companions to be buried. They marched at a very quick trot, four men supporting the corpse. One set, having run as hard as they could for about two hundred yards, were re-

lieved by four others who had previously dashed on ahead on horseback. Thus they proceeded, encouraging each other by wild cries: altogether the scene formed a most strange funeral. We continued traveling northward in a zigzag line, sometimes stopping a clay to geologize. The country was so thinly inhabited, and the track so obscure, that we often had difficulty in finding our way.

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May 23. We descended into the fertile valley of Coquimbo, and followed it till we reached a hacienda belonging to a relation of Don José, where we stayed the next day. I then rode one day's journey further, to see what were declared to be some petrified shells and beans, which latter turned out to be small quartz pebbles. We passed through several small villages, and the valley was beautifully cultivated, and the whole scenery very grand. We were here near the main Cordillera, and the surrounding hills were lofty. In all parts of Northern Chile, fruit trees produced much more abundantly at a considerable height near the Andes than in the lower country. The figs and grapes of this district are famous for their excellence, and are cultivated to a great extent. This valley is perhaps the most productive one north of Quillota; I believe it contains, including Coquimbo, 25,000 inhabitants. The next day I returned to the hacienda, and thence, together with Don José, to Coquimbo.

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BARREN COUNTRY

lune 8. . . . After spending one day at Ballenar, I set out, on the 10th, for the upper part of the valley of Copiap6. We rode all day over an uninteresting country. I am tired of repeating

the epithets barren and sterile. These words, however, as commonly used, are comparative; I have always applied them to the plains of Patagonia, which can boast of spiny bushes and some tufts of grass; and this is absolute fertility, as compared with Northern Chile. Here again, there are not many spaces of two hundred yards square where some little bush, cactus, or lichen may not be discovered by careful examination, and in the soil seeds lie dormant ready to spring up during the first rainy winter. In Peru real deserts occur over wide tracts of country. In the evening we arrived at a valley in which the bed of the streamlet was damp: following it up, we came to tolerably good water. During the night, the stream, from not being evaporated and absorbed so quickly, flows a league lower down than during the day. Sticks were plentiful for firewood, so that it was a good place of bivouac for us; but for the poor animals there was not a mouthful to eat.

June 11. We rode without stopping for twelve hours, till we reached an old smelting furnace, where there was water and firewood; but our horses again had nothing to eat, being shut up in an old courtyard. The line of road was hilly, and the distant views interesting from the varied colors of the bare mountains. It was almost a pity to see the sun shining constantly over so useless a country; such splendid weather ought to have brightened fields and pretty gardens. The next day we reached the valley of Copiapo. I was heartily glad of it, for the whole journey was a continued source of anxiety; it was most disagreeable to hear, whilst eating our own suppers, our horses gnawing the posts to which they were tied, and to have no means of relieving their hunger. To all appearance, however, the animals were quite fresh, and no one could have told that they had eaten nothing for the last fifty-five hours. I had a letter of intro-

duction to Mr. Bingley, who received me very kindly at the hacienda of Potrero Seco. .

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. . . After staying a few days at Potrero Seco, I proceeded up the valley to the house of Don Benito Cruz, to whom I had a letter of introduction. I found him most hospitable; indeed, it is impossible to bear too strong testimony to the kindness with which travelers are received in almost every part of South America. The next day I hired some mules to take me by the ravine of Jolquera into the central Cordillera. On the second night the weather seemed to foretell a storm of snow or rain, and whilst lying in our beds we felt a trifling shock of an earthquake.

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Finding little of interest in this part of the ravine, we retraced our steps to the house of Don Benito, where I stayed two days collecting fossil shells and wood. Great prostrate silicified trunks of trees, imbedded in a conglomerate, were extraordinarily numerous. I measured one, which was fifteen feet in circumference: how surprising it is that every atom of the woody matter in this great cylinder should have been removed and replaced by silex so perfectly that each vessel and pore is preserved! These trees flourished at about the period of our lower chalk; they all belonged to the fir tribe.
It was amusing to hear the inhabitants discussing the nature of the fossil shells which I collected, almost in the same terms as were used a century ago in Europe—namely, whether or not they had been thus “born by nature.” My geological examination of the country generally created a good deal of surprise amongst the Chilenos: it was long before they could be convinced that I was not hunting for mines. This was sometimes troublesome. I found the most ready way of explaining my

employment was to ask them how it was that they themselves were not curious concerning earthquakes and volcanoes—why some springs were hot and others cold—why there were mountains in Chile, and not a hill in La Plata. These bare questions at once satisfied and silenced the greater number; some, however (like a few in England who are a century behindhand), thought that all such inquiries were useless and impious, and that it was sufficient that God had thus made the mountains.

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]uly 1 9. We anchored in the Bay of Callao, the seaport of Lima, the capital of Peru. We stayed here six weeks, but from the troubled state of public affairs I saw very little of the country

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September—October 1835
The Galapagos Islands

DARWIN's LAST LETTERS home from South America before he sailed for the Galapagos Islands reveal two things. One is that he was homesick after nearly four years away from England. He wrote that he longed for family, friends, and familiar places and thought how strange it would be to get back and find all his friends married men with families. The other thing that is clear from his letters is that his appetite for geologizing and collecting specimens was as strong as ever. He wrote that he looked "forward to the Galapagos with more interest than any other part of the voyage."

The Galapagos archipelago—a group of volcanic islands situated on the Equator six hundred miles off the coast of South America—struck him with wonder. The fields of black lava swarmed with strange reptiles: dragon-like lizards and giant tortoises. No wonder these were called the "Galapagos Islands" for "galapagos" is the Spanish word for tortoise. In his Diary he wrote that these tortoises appeared to him like creatures "of some other planet."

The other animals and plants of these islands were equally curious. Darwin collected all the specimens he could find and noted that the life there was different from anything he had seen before and was found nowhere else on earth. Towards the end of his visit he came to realize that the inhabitants of the different islands of the archipelago were different from each other in small ways. He was struck with the strange fact that although every one of the islands had pretty much the same environment, they had different species of reptiles, birds, and plants.

Darwin puzzled for twenty years about what he saw on these] islands. How did animals and plants get to these isolated pieces of land in the sea? Why were they peculiar to these islands alone? Why did they differ from island to island? Why did most of them resemble species of the American continent? He realized that he was here brought face to face with the question of how this variation took place. In answering it he came to the great question of how new beings first appeared on the earth.

His observations in South America had deeply impressed him. The fossils he had found convinced him that huge creatures similar to certain living relatives once lived there. He had begun to realize what vast stretches of time it must have taken to wear down mountains, make deep gorges and river valleys. He had noted the difference between the species that inhabited the two sides of the great Andes mountain chain. But on the Galapagos Islands he found new clues to the origin of species. If species are all separately and independently created, he asked years later in his Origin of Species, why are so many of the plants and animals of the Galapagos closely related to those of the American continent? The conditions of life in the Galapagos are quite unlike those in America. In fact, they are more like those of the Cape Verde Islands with respect to size, climate, soil, and so on. Yet the Cape Verde plants and animals are entirely different, being related to those of Africa. If different" species, he asked, are supposed to be separately and independently created, why should those "created" in the Galapagos differ from island to island and yet "bear so plainly the stamp of affinity to those created in America"?

As much as one marvels, even today, at the amazing species of the Galapagos Islands, one marvels even more at the extraordinary ability Darwin brought to the examination of them. They challenged him as had the inhabitants of no other

place. And he brought to them a patience of observation and a bold imagination that were unique. It was doubtless well that this visit came after nearly four years of training in observation and speculation. Otherwise, its lessons might have been lost. Captain Fitzroy, apparently, did not notice the variations in the difference of the finches' beaks that so attracted Darwin's attention. He reported that all the small birds there had short beaks thick at the base. This fact appeared to him as "one of] those admirable provisions of Infinite Wisdom by which each created thing is adapted to the place for which it is intended. . . ." Darwin was looking for another kind of explantation altogether.

The scientists referred to in this chapter are the experts who studied the specimens Darwin sent back to England.

CHAPTER SEVENTEEN

(FIGURE)

SEPTEMBER 15. This archipelago consists of ten principal islands, of which five exceed the others in size. They are situated under the Equator, and between five and six hundred miles westward of the coast of America. They are all formed of volcanic rocks; a few fragments of granite curiously glazed and altered by the heat can hardly be considered as an exception. Some of the craters surmounting the larger islands are of immense size, and they rise to a height of between three and four thousand feet. Their flanks are studded by innumerable smaller orifices. I scarcely hesitate to affirm that there must be in the whole archipelago at least two thousand craters. These consist either of lava and scoriae [slag], or of finely stratified, sandstone-like tuff [hardened volcanic ash or dust]. Most of the latter are beautifully symmetrical; they owe

their origin to eruptions of volcanic mud without any lava: it is a remarkable circumstance that every one of the twenty-eight tuff craters which were examined had their southern sides either much lower than the other sides, or quite broken down and removed. As all these craters apparently have been formed when standing in the sea, and as the waves from the trade wind and the swell from the open Pacific here unite their forces on the southern coasts of all the islands, this singular uniformity in the broken state of the craters, composed of the soft and yielding tuff, is easily explained.

Considering that these islands are placed directly under the Equator, the climate is far from being excessively hot; this seems chiefly caused by the singularly low temperature of the surrounding water, brought here by the great southern Polar current. Excepting during one short season, very little rain falls, and even then it is irregular; but the clouds generally hang low. Hence, whilst the lower parts of the islands are very sterile, the upper parts, at a height of a thousand feet and upwards, possess a damp climate and a tolerably luxuriant vegetation. This is especially the case on the windward sides of the islands, which first receive and condense the moisture from the atmosphere.

BLACK LAVA

In the morning (17th) we landed on Chatham Island, which, like the others, rises with a tame and rounded outline broken here and there by scattered hillocks, the remains of former craters. Nothing could be less inviting than the first appearance. A broken field of black basaltic lava, thrown into the most rugged waves and crossed by great fissures, is everywhere covered by stunted, sun-burned brushwood, which shows little

signs of life. The dry and parched surface, being heated by the noonday sun, gave to the air a close and sultry feeling, like that from a stove: we fancied even that the bushes smelled unpleasantly. Although I diligently tried to collect as many plants as possible, I succeeded in getting very few; and such wretched-looking little weeds would have better become an arctic than an equatorial flora. The brushwood appears, from a short distance, as leafless as our trees during winter; and it was some time before I discovered that not only almost every plant was now in full leaf, but that the greatest number were in flower. . . .

The Beagle sailed round Chatham Island, and anchored in several bays. One night I slept on shore on a part of the island where black truncated cones were extraordinarily numerous: from one small eminence I counted sixty of them, all surmounted by craters more or less perfect. The greater number consisted merely of a ring of red scoriae or slags, cemented together; and their height above the plain of lava was not more

than from fifty to a hundred feet: none had been very lately active. The entire surface of this part of the island seems to have been permeated, like a sieve, by the subterranean vapors: here and there the lava, whilst soft, has been blown into great bubbles; and in other parts, the tops of caverns similarly formed have fallen in, leaving circular pits with steep sides. From the regular form of the many craters, they gave to the country an artificial appearance which vividly reminded me of those parts of Staffordshire where the great iron foundries are most numerous. The day was glowing hot, and the scrambling over the rough surface and through the intricate thickets was very fatiguing; but I was well repaid by the strange Cyclopean [from Greek legends of a race of one-eyed giants] scene. As I was

walking along I met two large tortoises, each of which must have weighed at least two hundred pounds. One was eating a piece of cactus, and as I approached, it stared at me and slowly stalked away; the other gave a deep hiss, and drew in its head. These huge reptiles, surrounded by the black lava, the leafless shrubs, and large cacti, seemed to my fancy like some antediluvian animals. The few dull-colored birds cared no more for me than they did for the great tortoises.

SETTLEMENT OF EXILES

September 23. The Beagle proceeded to Charles Island. This archipelago has long been frequented, first by the buccaneers, and latterly by whalers, but it is only within the last six years that a small colony has been established here. The inhabitants are between two and three hundred in number: they are nearly all people of color who have been banished for political crimes from the Republic of the Equator [Ecuador], of which Quito is the capital. The settlement is placed about four and a half miles inland, and at a height probably of a thousand feet. In the first part of the road we passed through leafless thickets, as in Chatham Island. Higher up, the woods gradually became greener; and as soon as we crossed the ridge of the island we were cooled by a fine southerly breeze, and our sight refreshed by a green and thriving vegetation. In this upper region coarse grasses and ferns abound, but there are no tree ferns: I saw nowhere any member of the palm family, which is the more singular as, 360 miles northward, Cocos Island takes its name from the number of coconuts. The houses are irregularly scattered over a flat space of ground, which is cultivated with sweet potatoes and bananas. It will not easily be imagined how pleasant the sight of black mud was to us after having been so

long accustomed to the parched soil of Peru and northern Chile. The inhabitants, although complaining of poverty, obtain, without much trouble, the means of subsistence. In the woods there are many wild pigs and goats, but the staple article of animal food is supplied by the tortoises. Their numbers have of course been greatly reduced in this island, but the people yet count on two days' hunting giving them food for the rest of the week. It is said that formerly single vessels have taken away as many as seven hundred, and that the ship's company of a frigate some years since brought down in one day two hundred tortoises to the beach.

September 29. We doubled the southwest extremity of Albemarle Island, and the next day were nearly becalmed between it and Narborough Island. Both are covered with immense deluges of black naked lava, which have flowed either over the rims of the great cauldrons, like pitch over the rim of a pot in which it has been boiled, or have burst forth from smaller orifices on the flanks; in their descent they have spread over miles

of the seacoast. On both of these islands eruptions are known to have taken place; and in Albemarle we saw a small jet of smoke curling from the summit of one of the great craters. In the evening we anchored at Banks' Cove, in Albemarle Island. . . .

The rocks on the coast abounded with great black lizards, between three and four feet long; and on the hills an ugly yellowish-brown species was equally common. We saw many of this latter kind, some clumsily running out of our way, and others shuffiing into their burrows. I shall presently describe in more detail the habits of both these reptiles. The whole of this northern part of Albemarle Island is miserably sterile.

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A WORLD WITHIN ITSELF

October 8. The natural history of these islands is eminently curious, and well deserves attention. Most of the organic productions are aboriginal creations, found nowhere else; there is even a difference between the inhabitants of the different islands; yet all show a marked relationship with those of America, though separated from that continent by an open space of ocean, between five and six hundred miles in width. The archipelago is a little world within itself, or rather a satellite attached to America, whence it has derived a few stray colonists, and has received the general character of its indigenous productions. Considering the small size of these islands, we feel the more astonished at the number of their aboriginal beings, and at their confined range. Seeing every height crowned with its crater, and the boundaries of most of the lava streams still distinct, we are led to believe that within a period geologically recent, the unbroken ocean was here spread out. Hence, both in space and time, we seem to be brought somewhat near to that great fact, that mystery of mysteries—the first appearance of new beings on this earth.

Of terrestrial mammals, there is only one which must be considered as indigenous, namely, a mouse (Mus Galapagoensis) , and this is confined, as far as I could ascertain, to Chatham Island, the most easterly island of the group. It belongs, as I am informed by Mr. Waterhouse, to a division of the family of mice characteristic of America. . .

Of land birds I obtained twenty-six kinds, all peculiar to the group and found nowhere else, with the exception of one lark-like finch from North America. . . . The other twenty-five birds consist, first, of a hawk, curiously intermediate in structure

between a buzzard and the American group of carrion-feeding Polybori [hawks]; and with these latter birds it agrees most closely in every habit and even tone of voice. Secondly, there are two owls, representing the short-cared and white barn owls of Europe. Thirdly, a wren, three tyrant flycatchers . and a dove—all analogous to, but distinct from, American species. Fourthly, a swallow. . . . Fifthly, there are three species of mocking-thrush—a form highly characteristic of America. The remaining land birds form a most singular group of finches, related to each other in the structure of their beaks, short tails, form of body, and plumage: there are thirteen species, which Mr. Gould has divided into four sub-groups. All these species are peculiar to this archipelago. . .

PECULIAR FINCHES

The most curious fact is the perfect gradation in the size of the beaks in the different species of Geospiza [finches], from one as large as that of a hawfinch to that of a chaffinch, and (if Mr. Gould is right in including his sub-group Certhidea in the main group) even to that of a warbler. The largest beak in the genus Geospiza is shown in F ig. 1, and the smallest in Fig.

3; but instead of there being only one intermediate species, with a beak of the size shown in Fig. 2, there are no less than six species with insensibly graduated beaks. The beak of the sub-group Certhidea is shown in Fig. 4. The beak of Cactomis is somewhat like that of a starling; and that of the fourth sub-group, Camarhynchus, is slightly parrot-shaped. Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago one species had been taken and modified for different ends. In a like manner it

(FIGURE)

might be fancied that a bird originally a buzzard had been induced here to undertake the office of the carrion-feeding Polybori of the American continent.

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We will now turn to the order of reptiles, which gives the most striking character to the zoology of these islands. The species are not numerous, but the numbers of individuals of each species are extraordinarily great. There is one small lizard belonging to a South American genus, and two species (and probably more) of the Amblyrhynchus—a genus confined to the Galapagos Islands. There is one snake which is numerous;

it is identical . . . with the Psarnmophis Temminckii from Chile. Of sea turtle I believe there is more than one species; and of tortoises there are, as we shall presently show, two or three species or races. Of toads and frogs there are none: I was surprised at this, considering how well suited for them the temperate and damp upper woods appeared to be. . . . The absence of the frog family in the oceanic islands is the more remarkable when contrasted with the case of lizards, which swarm on most of the smallest islands. May this difference not be caused by the greater facility with which the eggs of lizards, protected by calcareous shells, might be transported through salt water than could the slimy spawn of frogs?

GIANT TORTOISES

I will first describe the habits of the tortoise (Testudo nigra, formerly called Indica), which has been so frequently alluded to. These animals are found, I believe, on all the islands of the archipelago; certainly on the greater number. They frequent in preference the high damp parts, but they likewise live in the lower and arid districts. I have already shown from the numbers which have been caught in a single day how very numerous they must be. Some grow to an immense size: Mr. Lawson, an Englishman and vice-governor of the colony, told us that he had seen several so large that it required six or eight men to lift them from the ground ; and that some had afforded as much as two hundred pounds of meat. The old males are the largest, the females rarely growing to so great a size: the male can readily be distinguished from the female by the greater length of its tail. The tortoises which live on those islands where there is no water, or in the lower and arid parts of the others, feed chiefly on the succulent cactus. Those which frequent the higher and

damp regions eat the leaves of various trees, a kind of berry (called guayavita) which is acid and austere, and likewise a pale green filamentous lichen (Usnera plicata) that hangs in tresses from the boughs of the trees.

The tortoise is very fond of water, drinking large quantities, and wallowing in the mud. The larger islands alone possess springs, and these are always situated towards the central parts and at a considerable height. The tortoises, therefore, which frequent the lower districts, when thirsty, are obliged to travel from a long distance. Hence broad and well-beaten paths branch off in every direction from the wells down to the sea-coast; and the Spaniards, by following them up, first discovered the watering places. When I landed at Chatham Island, I could not imagine what animal traveled so methodically along well-chosen tracks. Near the springs it was a curious spectacle to behold many of these huge creatures, one set eagerly traveling onwards with outstretched necks, and another set returning after having drunk their fill. When the tortoise arrives at the spring, quite regardless of any spectator, he buries his head in the water above his eyes and greedily swallows great mouthfuls at the rate of about ten in a minute. The inhabitants say each animal stays three or four days in the neighborhood of the water and then returns to the lower country; but they differed respecting the frequency of these visits. The animal probably regulates them according to the nature of the food on which it has lived. It is, however, certain that tortoises can subsist even on those islands where there is no other water than what falls during a few rainy days in the year.

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The tortoises, when purposely moving towards any point, travel by night and day, and arrive at their journey's end much

sooner than would be expected. The inhabitants, from observing marked individuals, consider that they travel a distance of about eight miles in two or three days. One large tortoise, which I watched, walked at the rate of sixty yards in ten minutes, that is, three hundred and sixty yards in the hour, or four miles a day—allowing a little time for it to eat on the road. During the breeding season, when the male and female are together, the male utters a hoarse roar or bellowing which, it is said, can be heard at the distance of more than a hundred yards. The female never uses her voice, and the male only at these times, so that when the people hear this noise they know that the two are together. They were at this time (October) laying their eggs. The female, where the soil is sandy, deposits them together and covers them up with sand; but where the ground is rocky she drops them indiscriminately in any hole: Mr. Bynoe [the Beagle's surgeon] found seven placed in a fissure. The egg is white and spherical; one which I measured was seven inches and three-eighths in circumference, and therefore larger than a hen's egg. The young tortoises, as soon as they are hatched, fall a prey in great numbers to the carrion-feeding buzzards. The old ones seem generally to die from accidents, as from falling down precipices: at least, several of the inhabitants told me that they had never found one dead without some evident cause. The inhabitants believe that these animals are absolutely deaf; certainly they do not overhear a person walking close behind them. I was always amused when overtaking one of these great monsters, as it was quietly pacing along, to see how suddenly, the instant I passed, it would draw in its head and legs and, uttering a deep his, fall to the ground with a heavy sound, as if struck dead. I frequently got on their backs and then, giving a few raps on the hinder part of their shells, they

would rise up and walk away—but I found it very difficult to keep my balance. The flesh of this animal is largely employed, both fresh and salted; and a beautiful clear oil is prepared from the fat. When a tortoise is caught, the man makes a slit in the skin near its tail, so as to see inside its body, whether the fat under the dorsal plate is thick. If it is not, the animal is liberated ; and it is said to recover soon from this strange operation. In order to secure the tortoises, it is not sufficient to turn them like turtle, for they are often able to get on their legs again. There can be little doubt that this tortoise is an aboriginal inhabitant of the Galapagos, for it is found on all, or nearly all, the islands, even on some of the smaller ones where there is no water; had it been an imported species, this would hardly have been the case in a group which has been so little frequented. . . .

LIZARDS OF THE SEA

The Amblyrhynchus, a remarkable genus of lizards, is confined to this archipelago: there are two species resembling each other in general form, one being terrestrial and the other aquatic. This latter species (A. cristatus) was first characterized by Mr. Bell, who well foresaw, from its short, broad head and strong claws of equal length, that its habits of life would turn out very peculiar and different from those of its nearest ally, the iguana. It is extremely common on all the islands throughout the group, and lives exclusively on the rocky sea beaches, being never found, at least I never saw one, even ten yards inshore. It is a hideous-looking creature, of a dirty black color, stupid, and sluggish in its movements. The usual length of a full-grown one is about a yard, but there are some even four feet long; a large one weighed twenty pounds. On the island of Albemarle they seem to grow to a larger size than elsewhere. Their tails

are flattened sideways, and all four feet partially webbed. They are occasionally seen some hundred yards from the shore, swimming about; and Captain Collnett, in his Voyage, says, “They go to sea in herds a-fishing, and sun themselves on the rocks; and may be called alligators in miniature.” It must not, however, be supposed that they live on fish. When in the water this lizard swims with perfect ease and quickness, by a serpentine movement of its body and flattened tail—the legs being motionless and closely collapsed on its sides. A seaman on board sank one with a heavy weight attached to it, thinking thus to kill it directly; but when, an hour afterwards, he drew up the line it was quite active. Their limbs and strong claws are admirably adapted for crawling over the rugged and fissured masses of lava which everywhere form the coast. In such situations, a group of six or seven of these hideous reptiles may oftentimes be seen on the black rocks a few feet above the surf, basking in the sun with outstretched legs.

I opened the stomachs of several, and found them largely distended with minced seaweed (U lvoe), which grows in thin foliaceous expansions of a bright green or a dull red color. I do not recollect having observed this seaweed in any quantity on the tidal rocks, and I have reason to believe it grows at the bottom of the sea, at some little distance from the coast. If such be the case, the object of these animals occasionally going out to sea is explained. The stomach contained nothing but the seaweed. Mr. Bynoe, however, found a piece of a crab in one; but this might have got in accidentally, in the same manner as I have seen a caterpillar in the midst of some lichen in the paunch of a tortoise. The intestines were large, as in other herbivorous animals. The nature of this lizard’s food, as well as the structure of its tail and feet, and the fact of its having been seen volun-

tarily swimming out at sea, absolutely prove its aquatic habits; yet there is in this respect one strange anomaly—namely, that when frightened it will not enter the water. Hence it is easy to drive these lizards down to any little point overhanging the sea, where they will sooner allow a person to catch hold of their tails than jump into the water. They do not seem to have any notion of biting; but when much frightened they squirt a drop of fluid from each nostril. I threw one several times as far as I could into a deep pool left by the retiring tide, but it invariably returned in a direct line to the spot where I stood. It swam near the bottom, with a very graceful and rapid movement, and occasionally aided itself over the uneven ground with its feet. As soon as it arrived near the edge, but still being under water, it tried to conceal itself in the tufts of seaweed, or it entered some crevice. As soon as it thought the danger was past, it crawled out on the dry rocks and shufffed away as quickly as it could. I several times caught this same lizard by driving it down to a point, and though possessed of such perfect powers of diving and swimming, nothing would induce it to enter the water; and as often as I threw it in, it returned in the manner above described. Perhaps this singular piece of apparent stupidity may be accounted for by the circumstance that this reptile has no enemy whatever on shore, whereas at sea it must often fall a prey to the numerous sharks. Hence, probably, urged by a fixed and hereditary instinct that the shore is its place of safety, whatever the emergency may be, it there takes refuge.

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BURROWING LAND LIZARDS

We will now turn to the terrestrial species (A. Demarlii), with a round tail, and toes without webs. This lizard, instead of

being found like the other on all the islands, is confined to the central part of the archipelago; namely, to Albemarle, James, Barrington, and Indefatigable islands. To the southward, in Charles, Hood, and Chatham islands, and to the northward, in Towers, Bindloes, and Abingdon, I neither saw nor heard of any. It would appear as if it had been created in the center of the archipelago, and thence had been dispersed only to a certain distance. Some of these lizards inhabit the high and damp parts of the islands, but they are much more numerous in the lower and sterile districts near the coast. I cannot give a more forcible proof of their numbers than by stating that when we were left at James Island we could not for some time find a spot free from their burrows on which to pitch our single tent. Like their brothers, the sea kind, they are ugly animals, of a yellowish orange beneath, and of a brownish red color above: from their low facial angle they have a singularly stupid appearance. They are, perhaps, of a rather less size than the marine species, but several of them weighed between ten and fifteen pounds. In their movements they are lazy and half torpid. When not frightened, they slowly crawl along with their tails and bellies dragging on the ground. They often stop and doze for a minute or two, with hind legs spread out on the parched soil.

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It is very interesting thus to find a well-characterized genus, having its marine and terrestrial species, belonging to so confined a portion of the world. The aquatic species is by far the most remarkable, because it is the only existing lizard which lives on marine vegetable productions. As I at first observed, these islands are not so remarkable for the number of the species of reptiles as for that of the individuals; when we re-

member the well-beaten paths made by the thousands of huge tortoises—the many turtles—the great warrens of the terrestrial Amblyhrynchus—and the groups of the marine species basking on the coast rocks of every island—we must admit that there is no other quarter of the world where this order replaces the herbivorous mammalia in so extraordinary a manner. The geologist on hearing this will probably refer back in his mind to the Secondary epochs, when lizards, some herbivorous, some carnivorous, and of dimensions comparable only with our existing whales, swarmed on the land and in the sea. It is, therefore, worthy of his observation that this archipelago, instead of possessing a humid climate and rank vegetation, cannot be considered otherwise than extremely arid and, for an Equatorial region, remarkably temperate.

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The botany of this group is fully as interesting as the zoology. . . . Dr. Hooker informs me that the flora has an undoubted Western American character; nor can he detect in it any affinity with that of the Pacific. If, therefore, we except the eighteenth marine, the one fresh-water, and one land-shell, which have apparently come here as colonists from the central islands of the Pacific, and likewise the one distinct Pacific species of the Galaipageian groups of finches, we see that this archipelago, though standing in the Pacific Ocean, is zoologically part of America.

NEW PLANTS, NEW BIRDS, NEW REPTILES

If this character were owing merely to immigrants from America, there would be little remarkable in it; but we see that a vast majority of all the land animals and that more than half of the flowering plants are aboriginal productions. It was most

striking to be surrounded by new birds, new reptiles, new shells, new insects, new plants, and yet by innumerable trifling details of structure, and even by the tones of voice and plumage of the birds, to have the temperate plains of Patagonia, or the hot dry deserts of Northern Chile, vividly brought before my eyes. Why, on these small points of land, which within a late geological period must have been covered by the ocean, which are formed of basaltic lava and therefore differ in geological character from the American continent, and which are placed under a peculiar climate—why were their aboriginal inhabitants, associated, I may add, in different proportions both in kind and number from those on the continent, and therefore acting on each other in a different manner—why were they created on American types of organization? It is probable that the islands of the Cape Verde group resemble, in all their physical conditions, far more closely the Galapagos Islands than these latter physically resemble the coast of America ; yet the aboriginal inhabitants of the two groups are totally unlike, those of the Cape Verde Islands bearing the impress of Africa, as the inhabitants of the Galapagos archipelago are stamped with that of America.

DIFFERENT ISLANDS—DIFFERENT ANIMALS

I have not as yet noticed by far the most remarkable feature in the natural history of this archipelago ; it is that the different islands to a considerable extent are inhabited by a different set of beings. My attention was first called to this fact by the vice-governor, Mr. Lawson, declaring that the tortoises differed from the different islands, and that he could with certainty tell from which island any one was brought. I did not for some time pay sufficient attention to this statement, and I had already partially mingled together the collections from two of the

islands. I never dreamed that islands about fifty or sixty miles apart, and most of them in sight of each other, formed of precisely the same rocks, placed under a quite similar climate, rising to a nearly equal height, would have been differently tenanted; but we shall soon see that this is the case. It is the fate of most voyagers no sooner to discover what is most interesting in any locality than they are hurried from it; but I ought, perhaps, to be thankful that I obtained sufficient materials to establish this most remarkable fact in the distribution of organic beings.

The inhabitants, as I have said, state that they can distinguish the tortoises from the different islands; and that they differ not only in size, but in other characters. Captain Porter has described those from Charles and from the nearest island to it, namely Hood Island, as having their shells in front thick and turned up like a Spanish saddle, whilst the tortoises from James Island are rounder, blacker, and have a better taste when cooked. . . . My attention was first thoroughly aroused by comparing together the numerous specimens, shot by myself and several other parties on board, of the mocking-thrushes, when, to my astonishment, I discovered that all those from Charles Island belonged to one species (Mimus trifasciatus) ; all from Albemarle Island to M. parvulus ; and all from James and Chatham islands (between which two other islands are situated as connecting links) belonged to M. melanotis. These two latter species are closely allied and would by some omithologists be considered as only well-marked races or varieties; but the M imus trifasciatus is very distinct. Unfortunately, most of the specimens of the finch tribe were mingled together; but I have strong reasons to suspect that some of the species of the sub-group Geospiza are confined to separate islands. If the

different islands have their representatives of Geospiza, it may help to explain the singularly large number of the species of this sub-group in this one small archipelago, and as a probable consequence of their numbers, the perfectly graduated series in the size of their beaks. . . . In my very small collection of insects, Mr. Waterhouse remarks that, of those which were ticketed with their locality, not one was common to any two of the islands.

DIFFERENT ISLANDS—DIFFERENT PLANTS

If we now return to the flora, we shall find the aboriginal plants of the different islands wonderfully different. I give all the following results on the high authority of my friend Dr. J. Hooker. I may premise that I indiscriminately collected everything in flower on the different islands, and fortunately kept my collections separate. Too much confidence, however, must not be placed in the proportional results, as the small collections brought home by some other naturalists, though in some respects confirming the results, plainly show that much remains to be done in the botany of this group: the Leguminosae [pea family], moreover, have as yet been only approximately worked out.

Name of island	total no. of species	No. of species found in other parts of the world	No. of species confined to the Galapagpos archipelago	No. confined to one island	No. of species confined to the Galapagpos archipelago but found on more than one island
James	71	33	38	30	8
Albemarle	46	18	26	22	4
Chatham	32	16	16	12	4
Charles	68	39	29	21	8

Hence we have the truly wonderful fact that in James Island, of the thirty-eight Galeipageian plants, or those found in no other part of the world, thirty are exclusively confined to this one island; and in Albemarle Island, of the twenty-six aboriginal Galitpageian plants, twenty-two are confined to this one island—that is, only four are at present known to grow in the other islands of the archipelago; and so on, as shown in the above table, with the plants from Chatham and Charles islands. . . .

The distribution of the tenants of this archipelago would not be nearly so wonderful if, for instance, one island had a mocking-thrush, and a second island some other quite distinct genus; if one island had its genus of lizard, and a second island another distinct genus, or none whatever; or if the different islands were inhabited, not by representative species of the same genera of plants, but by totally different genera—as does to a certain extent hold good, for, to give one instance, a large berry-bearing tree at James Island had no representative species in Charles Island. But it is the circumstance that several of the islands possess their own species of the tortoise, mocking-thrush, finches, and numerous plants, these species having the same general habits, occupying analogous situations, and obviously filling the same place in the natural economy of this archipelago, that strikes me with wonder. It may be suspected that some of these representative species, at least in the case of the tortoise and of some of the birds, may hereafter prove to be only well-marked races; but this would be of equally great interest to the philosophical naturalist. . . . I must repeat that neither the nature of the soil, nor height of the land, nor the climate, nor the general character of the associated beings, and therefore their action one on another, can differ much in the different islands.

If there be any sensible difference in their climates, it must be between the windward group (namely Charles and Chatham islands) and that to leeward; but there seems to be no corresponding difference in the productions of these two halves of the archipelago.

The only light which I can throw on this remarkable difference in the inhabitants of the different islands is that very strong currents of the sea, running in a westerly and W.N.W. direction, must separate, as far as transportal by the sea is concerned, the southern islands from the northern ones; and between these northern islands a strong N.W. current was observed, which must effectually separate James and Albemarle islands. As the archipelago is free to a most remarkable degree from gales of wind, neither the birds, insects, nor lighter seeds would be blown from island to island. And, lastly, the profound depth of the ocean between the islands, and their apparently recent (in a geological sense) volcanic origin, render it highly unlikely that they were ever united; and this, probably, is a far more important consideration than any other, with respect to the geographical distribution of their inhabitants. Reviewing the facts here given, one is astonished at the amount of creative force, if such an expression may be used, displayed on these small, barren, and rocky islands; and still more so at its diverse yet analogous action on points so near each other. I have said that the Galapagos archipelago might be called a satellite attached to America, but it should rather be called a group of satellites, physically similar, organically distinct, yet intimately related to each other, and all related in a marked, though much lesser degree, to the great American continent.

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October—December 1835
Tahiti and New Zealand

As BEAUTIFUL As he found Tahiti, Darwin found little there to challenge his scientific interests. But one day, while canoeing among the island's coral reefs, he began to question seriously how they were formed. "It is my opinion," he wrote in his Diary, "that besides the avowed ignorance concerning the tiny architects of each individual species, little is yet known, in spite of the much that has been written, of the structure and origin of the Coral Islands and reefs." He appears to have grave doubts about existing ideas on their origin, and to be speculating on a new theory.

Darwin is here revealing his ever-growing scientific abilities by (1) recognizing an unsolved problem as a result of study and observation, (2) exploring the inadequacies of existing theories, and (3) preparing himself with possible new theories that will guide him in his observations.

The only significant biological comment concerning New Zealand is one that Darwin records rather casually near the end of this chapter. As reptiles dominated the Galapagos, a genus of birds replaced four-footed mammals here. New Zealand's only native mammal was a small rat, and even this one species was being destroyed by an imported one—the Norway rat. Native plants were being crowded out by weeds introduced from abroad. What accounted for all this? Observations which for others would constitute merely "interesting facts" were for Darwin puzzling questions. An essential feature of Darwin's greatness was that he found problems where so many others found only facts.

CHAPTER EIGHTEEN

OCTOBER 20. The survey of the Galapagos Archipelago being concluded, we steered towards Tahiti and commenced our long passage of 3,200 miles. In the course of a few days we sailed out of the gloomy and clouded ocean district which extends during the winter far from the coast of South America. We then enjoyed bright and clear weather, while running pleasantly along at the rate of 150 or 160 miles a day before the steady trade wind. The temperature in this more central part of the Pacific is higher than near the American shore. The thermometer in the poop cabin, by night and day, ranged between 80° and 83°, which feels very pleasant; but with one degree or two higher, the heat becomes oppressive. We passed through the Low or Dangerous archipelago and saw several of those most curious rings of coral land, just rising

OCTOBER 20. The survey of the Galapagos archipelago

(FIGURE)

above the water's edge, which have been called lagoon islands. A long and brilliantly white beach is capped by a margin of green vegetation; and the strip, looking either way, rapidly narrows away in the distance, and sinks beneath the horizon. From the masthead a wide expanse of smooth water can be seen within the ring. These low hollow coral islands bear no proportion to the vast ocean out of which they abruptly rise; and it seems wonderful that such weak invaders are not overwhelmed by the all-powerful and never-tiring waves of that great sea miscalled the Pacific.

TAHITI

November 15. At daylight, Tahiti, an island which must forever remain classical to the voyager in the South Sea, was in view. At a distance the appearance was not attractive. The luxuriant vegetation of the lower part could not yet be seen, and as the clouds rolled past, the wildest and most precipitous peaks showed themselves towards the center of the island. As soon as we anchored in Matavai Bay, we were surrounded by canoes. This was our Sunday, but the Monday of Tahiti; if the case had been reversed, we should not have received a single visit, for the injunction not to launch a canoe on the Sabbath is rigidly obeyed. After dinner we landed to enjoy all the delights produced by the first impressions of a new country, and that country the charming Tahiti. A crowd of men, women, and children was collected on the memorable Point Venus, ready to receive us with laughing, merry faces. They marshaled us towards the house of Mr. Wilson, the missionary of the district, who met us on the road and gave us a very friendly reception. After sitting a short time in his house, we separated to walk about, but returned there in the evening.

The land capable of cultivation is scarcely in any part more than a fringe of low alluvial soil, accumulated round the base of the mountains, and protected from the waves of the sea by a coral reef which encircles the entire line of coast. Within the reef there is an expanse of smooth water, like that of a lake, where the canoes of the natives can ply with safety and where ships anchor. The low land which comes down to the beach of coral sand is covered by the most beautiful productions of the intertropical regions. In the midst of bananas, orange, cocoanut, and breadfruit trees, spots are cleared where yams, sweet potatoes, the sugar cane, and pineapples are cultivated. Even the brushwood is an imported fruit tree, namely, the guava, which from its abundance has become as noxious as a weed. In Brazil I have often admired the varied beauties of the bananas, palms, and orange trees contrasted together; and here we also have the breadfruit, conspicuous from its large, glossy, and deeply digitated leaf. It is admirable to behold groves of a tree, sending forth its branches with the vigor of an English oak, loaded with large and most nutritious fruit. However seldom the usefulness of an object can account for the pleasure of beholding it, in the case of these beautiful woods the knowledge of their high productiveness no doubt enters largely into the feeling of admiration. The little winding paths, cool from the surrounding shade, led to the scattered houses, the owners of which everywhere gave us a cheerful and most hospitable reception.

I was pleased with nothing so much as with the inhabitants. There is a mildness in the expression of their countenances which at once banishes the idea of a savage, and an intelligence which shows that they are advancing in civilization. The

common people, when working, keep the upper part of their bodies quite naked, and it is then that the Tahitians are seen to advantage. They are very tall, broad-shouldered, athletic, and well-proportioned. It has been remarked that it requires little habit to make a dark skin more pleasing and natural to the eye of a European than his own color. A white man bathing by the side of a Tahitian was like a plant bleached by the gardener's art compared with a fine dark green one growing vigorously in the open fields. Most of the men are tattooed, and the ornaments follow the curvature of the body so gracefully that they have a very elegant effect. One common pattern, varying in its details, is somewhat like the crown of a palm tree. It springs from the central line of the back and gracefully curls round both sides. The simile may be a fanciful one, but I thought the body of a man thus ornamented was like the trunk of a noble tree embraced by a delicate creeper.

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November 1 7. This day is reckoned in .the logbook as Tuesday the 17th, instead of Monday the 16th, owing to our, so far, successful chase of the sun. Before breakfast the ship was hemmed in by a flotilla of canoes, and when the natives were allowed to come on board, I suppose there could not have been less than two hundred. It was the opinion of everyone that it would have been difficult to have picked out an equal number from any other nation who would have given so little trouble. Everybody brought something for sale: shells were the main article of trade. The Tahitians now fully understand the value of money, and prefer it to old clothes or other articles. . . .

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EXCURSION TO THE MOUNTAINS

November 18. In the morning I came on shore early, bringing with me some provisions in a bag, and two blankets for myself and servant. These were lashed to each end of a long pole which was alternately carried by my Tahitian companions on their shoulders. These men are accustomed thus to carry for a whole day as much as fifty pounds at each end of their poles. I told my guides to provide themselves with food and clothing, but they said that there was plenty of food in the mountains, and for clothing, that their skins were sufficient. Our line of march was the valley of Tia-auru, down which a river flows into the sea by Point Venus. This is one of the principal streams in the island, and its source lies at the base of the loftiest central pinnacles, which rise to a height of about 7,000 feet. The whole island is so mountainous that the only way to penetrate into the interior is to follow up the valleys. Our road at first lay through woods which bordered each side of the river, and the glimpses of the lofty central peaks, seen as through an avenue, with here and there a waving coconut tree on one side, were extremely picturesque.

The valley soon began to narrow, and the sides to grow lofty and more precipitous. After having walked between three and four hours, we found the width of the ravine scarcely exceeded that of the bed of the stream. On each hand the walls were nearly vertical; yet, from the soft nature of the volcanic strata, trees and a rank vegetation sprung from every projecting ledge. These precipices must have been some thousand feet high, and the whole formed a mountain gorge far more magnificent than anything which I had ever before beheld. Until the midday sun stood vertically over the ravine,

the air felt cool and damp, but now it became very sultry. Shaded by a ledge of rock, beneath a fagade of columnar lava, we ate our dinner. My guides had already procured a dish of small fish and fresh-water prawns. They carried with them a small net stretched on a hoop; and where the water was deep and in eddies, they dived, and, like otters, with their eyes open, followed the fish into holes and corners, and thus caught them.

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A little higher up, the river divided itself into three little streams. The two northern ones were impracticable, owing to a succession of waterfalls which descended from the jagged summit of the highest mountain; the other to all appearance was equally inaccessible, but we managed to ascend it by a most extraordinary road. The sides of the valley were here nearly precipitous; but, as frequently happens with stratified rocks, small ledges projected, which were thickly covered by wild bananas, liliaceous plants, and other luxuriant productions of the tropics. The Tahitians, by climbing among these ledges, searching for fruit, had discovered a track by which the whole precipice could be scaled. The first ascent from the valley was very dangerous, for it was necessary to pass a steeply inclined face of naked rock by the aid of ropes which we brought with us. . . . We continued to ascend, sometimes along ledges and sometimes along knife-edged ridges, having on each hand profound ravines. In the Cordillera I have seen mountains on a far grander scale, but for abruptness nothing at all comparable with this. In the evening we reached a flat little spot on the banks of the same stream, which we had continued to follow, and which descends in a chain of waterfalls: here we bivouacked for the night. On each side of the ravine there were great beds of the mountain banana,

covered with ripe fruit. Many of these plants were from twenty to twenty-five feet high, and from three to four in circumference. By the aid of strips of bark for rope, and the stems of bamboos for rafters, and the large leaf of the banana for a thatch, the Tahitians in a few minutes built us an excellent house, and with withered leaves made a soft bed.

They then proceeded to make a fire and cook our evening meal. A light was procured by rubbing a blunt-pointed stick in a groove made in another, as if with the intention of deepening it, until by the friction the dust became ignited. A peculiarly white and very light wood (the Hibiscus tiliaceus) is alone used for this purpose: it is the same which serves for poles to carry any burden, and for the floating outriggers to their canoes. The fire was produced in a few seconds, but to a person who does not understand the art, it requires, as I found, the greatest exertion; but at last, to my great pride, I succeeded in igniting the dust. The gaucho in the Pampas uses a different method: taking an elastic stick about eighteen inches long, he presses one end on his breast and the other pointed end into a hole in a piece of wood, and then rapidly turns the curved part, like a carpenter's center-bit. The Tahitians, having made a small fire of sticks, placed a score of stones, of about the size of cricket balls, on the burning wood. In about ten minutes the sticks were consumed, and the stones hot. They had previously folded up in small parcels of leaves pieces of beef, fish, ripe and unripe bananas, and the tops of the wild arum. These green parcels were laid in a layer between two layers of the hot stones, and the whole then covered up with earth, so that no smoke or steam could escape. In about a quarter of an hour the whole was most deliciously cooked. The choice green parcels were now laid on a cloth of banana leaves, and with a coconut shell we drank the cool

water of the running stream; and thus we enjoyed our rustic meal.

WILD EDIBLE PLANTS

I could not look on the surrounding plants without admiration. On every side were forests of banana, the fruit of which, though serving for food in various ways, lay in heaps decaying on the ground. In front of us there was an extensive brake of wild sugar cane, and the stream was shaded by the dark green knotted stem of the ava—so famous in former days for its powerful intoxicating effects. I chewed a piece and found that it had an acrid and unpleasant taste which would have induced anyone at once to have pronounced it poisonous. Thanks to the missionaries, this plant now thrives only in these deep ravines, innocuous to everyone. Close by I saw the wild arum, the roots of which, when well baked, are good to eat, and the young leaves better than spinach. There was the wild yam, and a liliaceous plant called ti, which grows in abundance and has a soft brown root, in shape and size like a huge log of wood: this served us for dessert, for it is as sweet as treacle, and with a pleasant taste. There were, moreover, several other wild fruits and useful vegetables. The little stream, besides its cool water, produced eels and crayfish. I did indeed admire this scene when I compared it with an uncultivated one in the temperate zones. I felt the force of the remark that man, at least savage man, with his reasoning powers only partly developed, is the child of the tropics.

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After breakfast we proceeded on our journey. As my object was merely to see a little of the interior scenery, we returned by another track, which descended into the main valley lower

down. For some distance we wound, by a most intricate path, along the side of the mountain which formed the valley. In the less precipitous parts we passed through extensive groves of the wild banana. The Tahitians, with their naked, tattooed bodies, their heads ornamented with flowers, and seen in the dark shade of these groves, would have formed a fine picture of man inhabiting some primeval land. In our descent we followed the line of ridges; these were exceedingly narrow, and for considerable lengths steep as a ladder, but all clothed with vegetation. The extreme care necessary in poising each step rendered the walk fatiguing. I did not cease to wonder at these ravines and precipices: when viewing the country from one of the knife-edged ridges, the point of support was so small that the effect was nearly the same as it must be from a balloon. In this descent we had occasion to use the ropes only once, at the point where we entered the main valley. We slept under the same ledge of rock where we had dined the day before: the night was fine, but, from the depth and narrowness of the gorge, profoundly dark.

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November 26. In the evening, with a gentle land breeze, a course was steered for New Zealand; and as the sun set, we had a farewell view of the mountains of Tahiti—the island to which every voyager has offered up his tribute of admiration.

NEW ZEALAND

December 19. In the evening we saw in the distance New Zealand. We may now consider that we have nearly crossed the Pacific. It is necessary to sail over this great ocean to comprehend its immensity. Moving quickly onwards for weeks together, we meet with nothing but the same blue, profoundly

deep ocean. Even within the archipelagoes the islands are mere specks and far distant one from the other. Accustomed to look at maps drawn on a small scale, where dots, shading, and names are crowded together, we do not rightly judge how infinitely small the proportion of dry land is to the water of this vast expanse. The meridian of the Antipodes has likewise been passed; and now every league, it made us happy to think, was one league nearer to England. These Antipodes call to one's mind old recollections of childish doubt and wonder. Only the other day I looked forward to this airy barrier as a definite point in our voyage homewards; but now I find it and all such resting places for the imagination are like shadows, which a man moving onwards cannot catch. A gale of wind lasting for some days has lately given us full leisure to measure the future stages in our long homeward voyage, and to wish most earnestly for its termination.

December 21. Early in the morning we entered the Bay of Islands, and, being becalmed for some hours near the mouth, we did not reach the anchorage till the middle of the day. The country is hilly, with a smooth outline, and is deeply intersected by numerous arms of the sea extending from the bay. The surface appears from a distance as if clothed with coarse pasture, but this in truth is nothing but fern. On the more distant hills, as well as in parts of the valleys, there is a good deal of woodland. The general tint of the landscape is not a bright green, and it resembles the country a short distance to the south of Concepcion in Chile. In several parts of the bay, little villages of square tidy-looking houses are scattered close down to the water's edge. Three whaling ships were lying at anchor, and a canoe every now and then crossed from shore to shore; with these exceptions, an air of extreme quietness reigned over the

whole district. Only a single canoe came alongside. This, and the aspect of the whole scene, afforded a remarkable and not very pleasing contrast with our joyful and boisterous welcome at Tahiti.

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In the evening I went with Captain Fitzroy and Mr. Baker, one of the missionaries, to pay a visit to Kororadika: we wandered about the village, and saw and conversed with many of the people, both men, women, and children. Looking at the New Zealander, one naturally compares him with the Tahitian, both belonging to the same family of mankind. The comparison, however, tells heavily against the New Zealander. He may, perhaps, be superior in energy, but in every other respect his character is of a much lower order. One glance at their respective expressions brings conviction to the mind that one is a savage, the other a civilized man. It would be vain to seek in the whole of New Zealand a person with the face and mien of the old Tahitian chief Utamma. No doubt the extraordinary manner in which tattooing is here practiced gives a disagreeable expression to their countenances. The complicated but symmetrical figures covering the whole face puzzle and mislead an unaccustomed eye: it is moreover probable that the deep incisions, by destroying the play of the superficial muscles, give an air of rigid inflexibility. But, besides this, there is a twinkling in the eye which cannot indicate anything but cunning and ferocity. Their figures are tall and bulky, but not comparable in elegance with those of the working classes in Tahiti.

Both their persons and houses are filthily dirty and offensive: the idea of washing either their bodies or their clothes never seems to enter their heads. I saw a chief who was wear-

ing a shirt black and matted with filth, and when asked how it came to be so dirty, he replied, with surprise, “Do not you see it is an old one?” Some of the men have shirts, but the common dress is one or two large blankets, generally black with dirt, which are thrown over their shoulders in a very inconvenient and awkward fashion. A few of the principal chiefs have decent suits of English clothes, but these are only worn on great occasions.

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FEW ANIMALS—WEEDS RUN WILD

With regard to animals, it is a most remarkable fact that so large an island, extending over more than 700 miles in latitude and in many parts ninety broad, with varied stations, a fine climate, and land of all heights from 14,000 feet downwards, with the exception of a small rat, did not possess one indigenous animal. The several species of that gigantic genus of birds, the Deinornis, seem to have replaced mammiferous quadrupeds, in the same manner as the reptiles still do at the Galapagos archipelago. It is said that the common Norway rat, in the short space of two years, annihilated in this northern end of the island the New Zealand species. In many places I noticed several sorts of weeds which, like the rats, I was forced to own as countrymen. A leek has overrun whole districts, and will prove very troublesome, but it was imported as a favor by a French vessel. The common dock is also widely disseminated, and will, I fear, forever remain a proof of the rascality of an Englishman who sold the seeds for those of the tobacco plant.

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Christmas Day. In a few more days the fourth year of our absence from England will be completed. Our first Christmas

Day was spent at Plymouth; the second at St. Martin’s Cove, near Cape Horn; the third at Port Desire, in Patagonia; the fourth at anchor in a wild harbor in the peninsula of Tres Montes; this fifth here; and the next, I trust in Providence, will be in England. . . .

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December 30. In the afternoon we stood out of the Bay of Islands on our course to Sydney. I believe we were all glad to leave New Zealand. It is not a pleasant place. Among the natives there is absent that charming simplicity which is found at Tahiti, and the greater part of the English are the very refuse of society. Neither is the country itself attractive. .

January — March 1836
Australia and Tasmania

FROM THE TIME he left the Galapagos Islands until he reached the coral Cocos Islands, Darwin recorded more concerning social, economic, and cultural developments than he did on geology and zoology. The work of missionaries, relations of the original peoples of these lands to the new colonists, prospects for economic and social development occupy the center of his attention. He shows no special understanding of social movements. In contrast with his continual questioning of everything known or thought in the fields of geology and zoology, here he is simply a rather typical young Englishman of the second quarter of the nineteenth century.

Darwin is concerned, however, with the fact that "wherever the European has trod, death seems to pursue the aboriginal." The stronger brings about the extinction of the weaker, either through distilled liquors, warfare of extermination, disease, destruction of the animals on which the original peoples live, or by "some other mysterious agency." All this brings him to the biological reflection that "varieties of man seem to act on each other in the same way as different species of animals."

In Australia he grew more homesick than ever. His one consolation, he wrote a sister, was that the Captain was as homesick as himself. He trusted that Fitzroy would grow worse rather than better. They were all in such a bad way that he said: "There never was a ship so full of homesick heroes as the Beagle. We ought all to be ashamed of ourselves."

On the question of species, Darwin made an entry in his Diary which does not appear in the later Journal. He related how he was lying in the sun and thinking about the strange differences between the animals of Australia and those of the rest of the world. How did they come to be so different? "Surely," he reflected, "two distinct Creators must have been at work!" He was commenting on the fact that most of the mammals of Australia were marsupials, such as kangaroos, whose young were born in an immature condition and were carried in the mother's marsupium or pouch. Another peculiar feature of Australia was the egg-laying mammals, such as the duck-bill, or platypus, and spiny anteater—peculiar because they alone of all mammals laid eggs instead of bearing their young alive.

No wonder Darwin reflected about these strange animals! Later on, biologists explained this phenomenon on the basis of the theories Darwin himself worked out. At some early age the marsupials and egg-laying mammals which then lived on the continents of the world entered Australia. Higher mammals developed later on the continents and these wiped out the less perfect marsupials. But on the island of Australia, cut off from the continents of the world, the marsupials remained free from the competition of the higher forms and developed into the modern opossums, koalas, wombats, and kangaroos.

CHAPTER NINETEEN

(FIGURE)

JANUAR1’ 12, 1836. Early in the morning a light air carried us toward the entrance of Port Jackson. Instead of beholding a verdant country interspersed with fine houses, a straight line of yellowish cliff brought to our minds the coast of Patagonia. A solitary lighthouse, built of white stone, alone told us that we were near a great and populous city. Having entered the harbor, it appears fine and spacious, with cliff-formed shores of horizontally stratified sandstone. The nearly level country is covered with thin scrubby trees, bespeaking the curse of sterility. Proceeding further inland, the country improves: beautiful villas and nice cottages are here and there scattered along the beach. In the distance stone houses, two and three stories high, and windmills standing on the edge of a bank pointed out to us the neighborhood of the capital of Australia.

SYDNEY, AUSTRALIA

At last we anchored within Sydney Cove. We found the little basin occupied by many large ships and surrounded by warehouses. In the evening I walked through the town, and returned full of admiration at the whole scene. It is a most magnificent testimony to the power of the British nation. Here, in a less promising country, scores of years have done many times more than an equal number of centuries have effected in South America. My first feeling was to congratulate myself that I was born an Englishman. Upon seeing more of the town afterward, perhaps my admiration fell a little; but yet it is a fine town. The streets are regular, broad, clean, and kept in excellent order; the houses are of a good size, and the shops well furnished. It may be faithfully compared to the large suburbs which stretch out from London and a few other great towns in England; but not even near London or Birmingham is there an appearance of such rapid growth. The number of large houses and other buildings just finished was truly surprising; nevertheless, everyone complained of the high rents and difficulty in procuring a house. Coming from South America, where in the towns every man of property is known, no one thing surprised me more than not being able to ascertain at once to whom this or that carriage belonged.

EXCURSION

I hired a man and two horses to take me to Bathurst, a village about one hundred and twenty miles in the interior, and the center of a great pastoral district. By this means I hoped to gain a general idea of the appearance of the country. On the morning of the 1 6th (January) I set out on my excursion. . . . The extreme uniformity of the vegetation is the most remark-

able feature in the landscape of the greater part of New South Wales. Everywhere we have an open woodland, the ground being partially covered with a very thin pasture with little appearance of verdure. The trees nearly all belong to one family, and mostly have their leaves placed in a vertical, instead of, as in Europe, in a nearly horizontal position: the foliage is scanty, and of a peculiar pale green tint, without any gloss. Hence the woods appear light and shadowless: this, although a loss of comfort to the traveler under the scorching rays of summer, is of importance to the farmer, as it allows grass to grow where it otherwise would not. The leaves are not shed periodically: this character appears common to the entire southern hemisphere, namely, South America, Australia, and the Cape of Good Hope. The inhabitants of this hemisphere, and of the intertropical regions, thus lose perhaps one of the most glorious, though to our eyes common, spectacles in the world—the first bursting into full foliage of the leafless tree. They may, however, say that we pay dearly for this by having the land covered with mere naked skeletons for so many months. This is too true; but our senses thus acquire a keen relish for the exquisite green of the spring, which the eyes of those living within the tropics, sated during the long year with the gorgeous productions of those glowing climates, can never experience. The greater number of the trees, with the exception of some of the blue-gums, do not attain a large size; but they grow tall and tolerably straight, and stand well apart. The bark of some of the eucalypti falls annually, or hangs dead in long shreds which swing about with the wind, and give to the woods a desolate and untidy appearance. I cannot imagine a more complete contrast, in every respect, than between the forests of Valdivia or Chiloe and the woods of Australia.

EXTINCTION OF THE NATIVES

At sunset a party of a score of the black aborigines passed by, each carrying, in their accustomed manner, a bundle of spears and other weapons. By giving a leading young man a shilling, they were easily detained, and threw their spears for my amusement. They were all partly clothed, and several could speak a little English: their countenances were good-humored and pleasant, and they appeared far from being such utterly degraded beings as they have usually been represented. In their own arts they are admirable. A cap being fixed at thirty yards' distance, they transfixed it with a spear, delivered by the throwing-stick with the rapidity of an arrow from the bow of a practiced archer. In tracking animals or men they show most wonderful sagacity, and I heard of several of their remarks which manifested considerable acuteness. They will not, however, cultivate the ground, or build houses and remain stationary, or even take the trouble of tending a flock of sheep when given to them. On the whole, they appear to me to stand some few degrees higher in the scale of civilization than the Fuegians.

It is very curious thus to see in the midst of a civilized people a set of harmless savages wandering about without knowing where they shall sleep at night, and gaining their livelihood by hunting in the woods. As the white man has traveled onward, he has spread over the country, belonging to several tribes. These, although thus inclosed by one common people, keep up their ancient distinctions and sometimes go to war with each other. In an engagement which took place lately, the two parties most singularly chose the center of the village of Bathurst for the field of battle. This was of service to the de-

feated side, for the runaway warriors took refuge in the bar racks . The number of aborigines is rapidly decreasing. In my whole ride, with the exception of some boys brought up by Englishmen, I saw only one other party. This decrease, no doubt, must be partly owing to the introduction of spirits, to European diseases (even the milder ones of which, such as measles, prove very destructive), and to the gradual extinction of the wild animals. It is said that numbers of their children invariably perish in very early infancy from the effects of their wandering life ; and as the difficulty of procuring food increases, so must their wandering habits increase; and hence the population, without any apparent deaths from famine, is repressed in a manner extremely sudden compared to what happens in civilized countries, where the father, though in adding to his labor he may injure himself, does not destroy his offspring.

Besides these several evident causes of destruction, there appears to be some more mysterious agency generally at work. Wherever the European has trod, death seems to pursue the aboriginal. We may look to the wide extent of the Americas, Polynesia, the Cape of Good Hope, and Australia, and we find the same result. Nor is it the white man alone that thus acts the destroyer; the Polynesian of Malay extraction has in parts of the East Indian archipelago thus driven before him the dark-colored native. The varieties of man seem to act on each other in the same way as different species of animals—the stronger always extirpating the weaker. It was melancholy at New Zealand to hear the fine energetic natives saying that they knew the land was doomed to pass from their children. Everyone has heard of the inexplicable reduction of the population in the beautiful and healthy island of Tahiti since the date

of Captain Cook's voyages: although in that case we might have expected that it would have been increased, for infanticide, which formerly prevailed to so extraordinary a degree, has ceased, profligacy has greatly diminished, and the murderous wars become less frequent.

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(FIGURE)

KANGAROO HUNTING

Early on the next morning [the 19th], Mr. Archer, the joint superintendent, had the kindness to take me out kangaroo-hunting. We had continued riding the greater part of the day, but had very bad sport, not seeing a kangaroo or even a wild dog. The greyhounds pursued a kangaroo rat into a hollow tree, out of which we dragged it; it is an animal as large as a

rabbit, but with the figure of a kangaroo. A few years since, this country abounded with wild animals; but now the emu is banished to a long distance, and the kangaroo is become scarce; to both the English greyhound has been highly destructive. It may be long before these animals are altogether exterminated, but their doom is fixed. The aborigines are always anxious to borrow the dogs from the farmhouses; the use of them, the offal when an animal is killed, and some milk from the cows are the peace offerings of the settlers, who push farther and farther towards the interior. The thoughtless aboriginal, blinded by these trifling advantages, is delighted at the approach of the white man, who seems predestined to inherit the country of his children.

THE PLATYPUS

. . . In the dusk of the evening I took a stroll along a chain of ponds, which in this dry country represented the course of a river, and had the good fortune to see several of the famous Ornithorhynchus paradoxus [platypus]. They were diving and playing about the surface of the water, but showed so little of their bodies that they might easily have been mistaken for water rats. Mr. Browne shot one. Certainly it is a most extaordinary animal; a stuffed specimen does not at all give a good idea of the appearance of the head and beak when fresh, the latter becoming hard and contracted.

TASMANIA

january 30. The Beagle sailed for Hobart Town in Van Diemen's Land [Tasmania]. On the 5th of February, after a six days' passage, of which the first part was fine and the latter very cold and squally, we entered the mouth of Storm Bay; the

weather justified this awful name. The bay should rather be called an estuary, for it receives at its head the waters of the Derwent. Near the mouth there are some extensive basaltic platforms, but higher up the land becomes mountainous, and is covered by a light wood. The lower parts of the hills which skirt the bay are cleared, and the bright yellow fields of corn and dark green ones of potatoes appear very luxuriant. Late in the evening we anchored in the snug cove on the shores of which stands the capital of Tasmania. The first aspect of the place was very inferior to that of Sydney; the latter might be called a city, this only a town. . . .

EXILE OF THE NATIVES

All the aborigines have been removed to an island in Bass's Straits, so that Van Diemen's Land enjoys the great advantage of being free from a native population. This most cruel step seems to have been quite unavoidable, as the only means of stopping a fearful succession of robberies, burnings, and murders committed by the blacks and which sooner or later would have ended in their utter destruction. I fear there is no doubt that this train of evil and its consequences originated in the infamous conduct of some of our countrymen. Thirty years is a short period in which to have banished the last aboriginal from his native island—and that island nearly as large as Ireland. The correspondence on this subject, which took place between the government at home and that of Van Diemen's

Land, is very interesting. Although numbers of natives were shot and taken prisoners in the skirmishing which was going on at intervals for several years, nothing seems fully to have impressed them with the idea of our overwhelming power until the whole island, in 1830, was put under martial law, and by

proclamation the whole population commanded to assist in one great attempt to secure the entire race. The plan adopted was nearly similar to that of the great hunting matches in India: a line was formed reaching across the island, with the intention of driving the natives into a cul-de-sac on Tasman's peninsula. The attempt failed; the natives, having tied up their dogs, stole during one night through the lines. This is far from surprising, when their practiced senses and usual manner of crawling after wild animals is considered. I have been assured that they can conceal themselves on almost bare ground in a manner which until witnessed is scarcely credible, their dusky bodies being easily mistaken for the blackened stumps which are scattered all over the country. I was told of a trial between a party of Englishmen and a native, who was to stand in full view on the side of a bare hill; if the Englishmen closed their eyes for less than a minute, he would squat down, and then they were never able to distinguish him from the surrounding stumps. But to return to the hunting match: the natives, understanding this kind of warfare, were terribly alarmed, for they at once perceived the power and numbers of the whites. Shortly afterwards a party of thirteen belonging to two tribes came in and, conscious of their unprotected condition, delivered themselves up in despair. Subsequently, by the intrepid exertions of Mr. Robinson, an active and benevolent man who fearlessly visited by himself the most hostile of the natives, the whole were induced to act in a similar manner. They were then removed to an island, where food and clothes were provided them. Count Strzelecki states that "at the epoch of their deportation in 1835, the number of natives amounted to 210. In 1842, that is after the interval of seven years, they mustered only fifty-four individuals; and, while each family of the interior

of New South Wales, uncontaminated by contact with the whites, swarms with children, those of Flinders' Island had during eight years an accession of only fourteen in number !"

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UNINVITING COUNTRY

February 7. The Beagle sailed from Tasmania and, on the 6th of the ensuing month, reached King George's Sound, situated close to the southwestern comer of Australia. We stayed there eight days, and we did not during our voyage pass a more dull and uninteresting time. The country, viewed from an eminence, appears a woody plain, with here and there rounded and partly bare hills of granite protruding. One day I went out with a party in hopes of seeing a kangaroo hunt, and walked over a good many miles of country. Everywhere we found the soil sandy and very poor; it supported either a coarse vegetation of thin, low brushwood and wiry grass, or a forest of stunted trees. . . . The general bright green color of the brushwood and other plants, viewed from a distance, seemed to promise fertility. A single walk, however, was enough to dispel such an illusion; and he who thinks with me will never wish to walk again in so uninviting a country.

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THE WHITE COCKATOO MEN

A large tribe of natives called the White Cockatoo men happened to pay the settlement a visit while we were there. These men, as well as those of the tribe belonging to King George's

Sound, being tempted by the offer of some tubs of rice and sugar, were persuaded to hold a “corrobery,” or great dancing party. As soon as it grew dark, small fires were lighted, and

the men commenced their toilet, which consisted in painting themselves white in spots and lines. As soon as all was ready, large fires were kept blazing, round which the women and children were collected as spectators; the Cockatoo and King George’s men formed two distinct parties, and generally danced in answer to each other. The dancing consisted in their running either sideways or in Indian file into an open space and stamping the ground with great force as they marched together. Their heavy footsteps were accompanied by a kind of grunt, by beating their clubs and spears together, and by various other gesticulations, such as extending their arms and wriggling their bodies. It was a most rude, barbarous scene and, to our ideas, without any sort of meaning; but we observed that the black women and children watched it with the greatest pleasure. Perhaps these dances originally represented actions, such as wars and victories. There was one called the emu dance, in which each man extended his arm in a bent manner, like the neck of that bird. In another dance, one man imitated the movements of a kangaroo grazing in the woods, whilst a second crawled up and pretended to spear him. When both tribes mingled in the dance, the ground trembled with the heaviness of their steps, and the air resounded with their wild cries. Everyone appeared in high spirits, and the group of nearly naked figures, viewed by the light of the blazing fires, all moving in hideous harmony, formed a perfect display of a festival amongst the lowest barbarians. In Tierra del Fuego we have beheld many curious scenes in savage life, but never, I think, one where the natives were in such high spirits and so perfectly at their ease. After the dancing was over, the whole party formed a great circle on the ground, and the boiled rice and sugar was distributed, to the delight of all.

After several tedious delays from clouded weather, on the 14th of March we gladly stood out of King George's Sound on our course to Keeling Island. Farewell, Australia! You are a rising child, and doubtless someday will reign a great princess in the South; but you are too great and ambitious for affection, yet not great enough for respect. I leave your shores without sorrow or regret.

April 1836
Cocos Islands

THE Cocos or Keeling Islands are a group of twenty-seven little coral islets in the Indian Ocean, first settled in 1817 by the Captain Ross of whom Darwin speaks here.

Darwin's chief interest was the origin of such coral islands and reefs. To understand this chapter, one must know that corals are animals related to jellyfish and sea anemones, but are anchored like plants in one place. Each coral animal has a delicate, hollow sac-like body which extracts lime from the sea water and builds up a hard stone-like skeleton around it. Millions of individual corals live joined together in vast colonies which form reefs and islands. When the living corals die, their skeletons remain and new coral animals grow on the stony mass.

We have already seen that Darwin had been questioning the prevailing theories of the formation of coral islands before seeing them. He cited three main theories and rejects them all. Two of the theories had one fatal defect: they did not take into account a fact discovered on the Beagle. Innumerable soundings made by Captain Fitzroy revealed that the reef-building coral polyps did not live at a depth greater than 120 to 180 feet. (We know now that they live as deep as light penetrates.) If that was so, then how was it that the coral reefs went down to much greater depths? Having established that reef corals could live only in relatively shallow water, Darwin concluded that the ocean floor had been sinking gradually

while the corals kept growing on the skeletons of ones that sank. He published these findings in full in 1842 in a separate volume on Coral Reefs.

Drillings in the Bikini atoll in 1947 remarkably confirmed Darwin's observations. One drilling reached a depth of 2,556 feet and brought up samples of coral skeletons laid down twenty to twenty-five million years ago. Since we know that reef coral can live and grow only in shallow water, these coral skeletons, now submerged in the depths of the sea, must once have lived close to the top of the water. Thus, the drillings at Bikini support the conclusion that the ocean floor sank or the sea rose. Other recent findings have confirmed Darwin's theory of the subsiding of the ocean floor, so that it is now generally accepted as an explanation of the origin of coral reefs.

CHAPTER TWENTY

APRIL 1. We arrived in view of the Keeling or Cocos Islands, situated in the Indian Ocean and about six hundred miles distant from the coast of Sumatra. This is one of the lagoon islands (or atolls) of coral formation, similar to those in the Low archipelago, which we passed near. When the ship was in the channel at the entrance, Mr. Liesk, an English resident, came off in his boat. The history of the

1 PRIL 1. We arrived in view of the Keeling or Cocos

inhabitants of this place, in as few words as possible, is as follows. About nine years ago Mr. Hare, a worthless character, brought from the East Indian archipelago a number of Malay slaves, which now, including children, amount to more than a hundred. Shortly afterward Captain Ross, who had before visited these islands in his merchant ship, arrived from England, bringing with him his family and goods for settlement:

along with him came Mr. Liesk, who had been a mate in his vessel. The Malay slaves soon ran away from the islet on which Mr. Hare was settled, and joined Captain Ross's party. Mr. Hare upon this was ultimately obliged to leave the place.

The Malays are now nominally in a state of freedom, and certainly are so, as far as regards their personal treatment; but in most other points they are considered as slaves. From their discontented state, from the repeated removals from islet to islet, and perhaps also from a little mismanagement, things are not very prosperous. The island has no domestic quadruped excepting the pig, and the main vegetable production is the coconut. The whole prosperity of the place depends on this tree: the only exports being oil from the nut, and the nuts themselves, which are taken to Singapore and Mauritius, where they are chiefly used, when grated, in making curries. On the coconut, also, the pigs, which are loaded with fat, almost entirely subsist, as do the ducks and poultry. Even a huge land crab is furnished by nature with the means to open and feed on this most useful production.

The ring-formed reef of the lagoon island is surmounted in the greater part of its length by linear islets. On the northern or leeward side there is an opening through which vessels can pass to the anchorage within. On entering, the scene was very curious and rather pretty; its beauty, however, entirely depended on the brilliancy of the surrounding colors. The shallow, clear, and still water of the lagoon, resting in its greater part on white sand, is, when illumined by a vertical sun, of the most vivid green. This brilliant expanse, several miles in width, is on all sides divided, either by a line of snow-white breakers from the dark heaving waters of the ocean, or from the blue vault of heaven by the strips of land crowned

by the level tops of the coconut trees. As a white cloud here and there affords a pleasing contrast with the azure sky, so in the lagoon bands of living coral darken the emerald-green WQICI..

ON THE SHORE OF DIRECTION ISLAND

The next morning after anchoring I went on shore on Direction Island. The strip of dry land is only a few hundred yards in width; on the lagoon side there is a white calcareous beach, the radiation from which under this sultry climate was very oppressive; and on the outer coast a solid broad flat of coral rock served to break the violence of the open sea. Excepting near the lagoon, where there is some sand, the land is entirely composed of rounded fragments of coral. In such a loose, dry, stony soil, the climate of the intertropical regions alone could produce a vigorous vegetation. On some of the smaller islets, nothing could be more elegant than the manner in which the young and full-grown coconut trees, without destroying each other's symmetry, were mingled into one wood. A beach of glittering white sand formed a border to these fairy spots.

I will now give a sketch of the natural history of these islands, which, from its very paucity, possesses a peculiar interest. The coconut tree, at the first glance, seems to compose the whole wood; there are, however, five or six other trees. One of these grows to a very large size, but, from the extreme softness of its wood, is useless; another sort affords excellent timber for shipbuilding. Besides the trees, the number of plants is exceedingly limited, and consists of insignificant weeds. In my collection, which includes, I believe, nearly the perfect flora, there are twenty species, without reckoning a moss, lichen,

and fungus. . . . As the islands consist entirely of coral and at one time must have existed as mere water-washed reefs, all their terrestrial productions must have been transported here by the waves of the sea. In accordance with this, the Florula [flora] has quite the character of a refuge for the destitute: Professor Henslow informs me that of the twenty species nineteen belong to different genera, and these again to no less than sixteen families!

DRIFTING SEEDS

In Holman's Travels an account is given, on the authority of Mr. A. S. Keating, who resided twelve months on these islands, of the various seeds and other bodies which have been known to have been washed on shore. "Seeds and plants from Sumatra and Java have been driven up by the surf on the windward side of the islands. . . . Large masses of Java teak and yellow wood have also been found, besides immense trees of red and white cedar, and the blue gumwood of New Holland, in a perfectly sound condition. All the hardy seeds, such as creepers, retain their germinating power, but the softer kinds, among which is the mangostin, are destroyed in the passage. Fishing canoes, apparently from Java, have at times been washed on shore." It is interesting thus to discover how numerous the seeds are, which, coming from several countries, are drifted over the wide oceans. Professor Henslow tells me he believes that nearly all the plants which I brought from these islands are common littoral species in the East Indian archipelago. From the direction, however, of the winds and currents, it seems scarcely possible that they could have come here in a direct line. If, as suggested with much probability by Mr. Keating, they were first carried towards the coast of

New Holland and thence drifted back together with the productions of that country, the seeds, before germinating. must have traveled between 1,800 and 2,400 miles.

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FEW LAND ANIMALS

The list of land animals is even poorer than that of the plants. Some of the islets are inhabited by rats, which were brought in a ship from the Mauritius, wrecked here. These rats are considered by Mr. Waterhouse as identical with the English kind, but they are smaller and more brightly colored. There are no true land birds; for a snipe and a rail (Rallus Phillippensis), though living entirely in the dry herbage, belong to the order of waders. Birds of this order are said to occur on several of the small low islands in the Pacific. . . . From these facts I believe that the waders, after the innumerable web-footed species, are generally the first colonists of small isolated islands. I may add that whenever I noticed birds, not of oceanic species, very far out at sea, they always belonged to this order; and hence they would naturally become the earliest colonists on any remote point of land.

Of reptiles I saw only one small lizard. Of insects I took pains to collect every kind. Exclusive of spiders, which were numerous, there were thirteen species. Of these, one only was a beetle. A small ant swarmed by thousands under the loose dry blocks of coral, and was the only true insect which was abundant. Although the productions of the land are thus scanty, if we look to the waters of the surrounding sea, the number of organic beings is indeed infinite. . . .

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The next day I employed myself in examining the very interesting yet simple structure and origin of these islands.

The water being unusually smooth, I waded over the outer flat of dead rock as far as the living mounds of coral, on which the swell of the open sea breaks. In some of the gullies and hollows there were beautiful green and other colored fishes, and the forms and tints of many of the zoophytes [small animals including corals, sponges, etc.] were admirable. It is excusable to grow enthusiastic over the infinite numbers of organic beings with which the sea of the tropics, so prodigal of life, teems; yet I must confess I think those naturalists who have described, in well-known words, the submarine grottoes decked with a thousand beauties have indulged in rather exuberant language.

A pril 6. I accompanied Captain Fitzroy to an island at the head of the lagoon: the channel was exceedingly intricate, winding through fields of delicately branched corals. We saw several turtle, and two boats were then employed in catching them. The water was so clear and shallow that although at first a turtle quickly dives out of sight, yet in a canoe or boat under sail the pursuers after no very long chase come up to it. A man standing ready in the bow at this moment dashes through the water upon the turtle’s back; then clinging with both hands by the shell of its neck, he is carried away till the animal becomes exhausted and is secured. It was quite an interesting chase to see the two boats thus doubling about, and the men dashing head foremost into the water trying to seize their prey . . . .

MARINE ARCHITECTS—THE CORALS

When we arrived at the head of the lagoon, we crossed a narrow islet and found a great surf breaking on the windward coast. I can hardly explain the reason, but there is to my mind much grandeur in the view of the outer shores of these

lagoon islands. There is a simplicity in the barrier-like beach, the margin of green bushes and tall coconuts, the solid flat of dead coral rock strewed here and there with great loose fragments, and the line of furious breakers, all rounding away towards either hand. The ocean throwing its waters over the broad reef appears an invincible, all-powerful enemy; yet we see it resisted, and even conquered, by means which at first seem most weak and inefficient. It is not that the ocean spares the rock of coral; the great fragments scattered over the reef, and heaped on the beach, whence the tall coconut springs, plainly bespeak the unrelenting power of the waves. Nor are any periods of repose granted. The long swell caused by the gentle but steady action of the trade wind, always blowing in one direction over a wide area, causes breakers almost equaling in force those during a gale of wind in the temperate regions, and which never cease to rage. It is impossible to behold these waves without feeling a conviction that an island, though built of the hardest rock, let it be porphyry, granite, or quartz, would ultimately yield and be demolished by such an irresistible power. Yet these low, insignificant coral islets stand and are victorious: for here another power, as an antagonist, takes part in the contest. The organic forces separate the atoms of carbonate of lime, one by one, from the foaming breakers, and unite them into a symmetrical structure. Let the hurricane tear up its thousand huge fragments; yet what will that tell against the accumulated labor of myriads of architects at work night and day, month after month? Thus do we see the soft and gelatinous body of a polypus, through the agency of the vital laws, conquering the great mechanical power of the waves of an ocean which neither the art of man nor the inanimate works of nature could successfully resist.

We did not return on board till late in the evening, for we stayed a long time in the lagoon, examining the fields of coral and the gigantic shells of the chama [similar to a clam] into which, if a man were to put his hand, he would not, as long as the animal lived, be able to withdraw it. . . .

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THE COCONUT-EATING CRAB

I have before alluded to a crab which lives on the coconuts: it is very common on all parts of the dry land, and grows to a monstrous size: it is closely allied or identical with the Birgos latro. The front pair of legs terminate in very strong and heavy pincers, and the last pair are fitted with others weaker and much narrower. It would at first be thought quite impossible for a crab to open a strong coconut covered with the husk, but Mr. Liesk assures me that he has repeatedly seen this effected. The crab begins by tearing the husk, fiber by fiber, and always from that end under which the three eyeholes are situated; when this is completed, the crab commences hammering with its heavy claws on one of the eyeholes till an opening is made. Then turning round its body, by the aid of its posterior and narrow pair of pincers, it extracts the white albuminous substance. I think this is as curious a case of instinct as ever I heard of, and likewise of adaptation in structure between two objects apparently so remote from each other in the scheme of nature as a crab and a coconut tree. The birgos is diurnal in its habits, but every night it is said to pay a visit to the sea, no doubt for the purpose of moistening its branchiae [gills]. The young are likewise hatched, and live for some time, on the coast. These crabs inhabit deep burrows, which they hollow out beneath the roots of trees, and where

they accumulate surprising quantities of the picked fibers of the coconut husk, on which they rest as on a bed. The Malays sometimes take advantage of this and collect the fibrous mass to use as junk [material for making rope]. These crabs are very good to eat; moreover, under the tail of the larger ones there is a great mass of fat which, when melted, sometimes yields as much as a quart bottle full of limpid oil. It has been stated by some authors that the birgos crawls up the coconut trees for the purpose of stealing the nuts: I very much doubt the possibility of this; but with the pandanus the task would be very much easier. I was told by Mr. Liesk that on these islands the birgos lives only on the nuts which have fallen to the ground.

April 12. In the morning we stood out of the lagoon on our passage to the Isle of France. I am glad we have visited these islands: such formations surely rank high amongst the wonderful objects of this world. Captain Fitzroy found no bottom with a line 7,200 feet in length, at the distance of only 2,200 yards from the shore; hence this island forms a lofty submarine mountain, with sides steeper even than those of the most abrupt volcanic cone. The saucer-shaped summit is nearly ten miles across; and every single atom, from the least particle to the largest fragment of rock, in this great pile, which however is small compared with very many other lagoon islands, bears the stamp of having been subjected to organic arrangement. We feel surprised when travelers tell us of the vast dimensions of the pyramids and other great ruins, but how utterly insignificant are the greatest of these when compared to these mountains of stone accumulated by the agency of various minute and tender animals! This is a wonder which does not

at first strike the eye of the body, but, after reflection, the eye of reason.

THEORIES OF CORAL REEF FORMATION

. . . Almost every voyager who has crossed the Pacific has expressed his unbounded astonishment at the lagoon islands, and has attempted some explanation. . . .

The earlier voyagers fancied that the coral-building animals instinctively built up their great circles to afford themselves protection in the inner parts, but so far is this from the truth that those massive kinds to whose growth on the exposed outer shores the very existence of the reef depends cannot live within the lagoon, where other delicately-branching kinds flourish. Moreover, on this view, many species of distinct genera and families are supposed to combine for one end; and of such a combination not a single instance can be found in the whole of nature. The theory that has been most generally received is that atolls are based on submarine craters; but when we consider the form and size of some, the number, proximity, and relative positions of others, this idea loses its plausible character.

. . . A third and better theory was advanced by Chamisso, who thought that from the corals growing more vigorously where exposed to the open sea, as undoubtedly is the case, the outer edges would grow up from the general foundation before any other part, and that this would account for the ring or cup-shaped structure. But we shall immediately see that in this, as well as in the crater theory, a most important consideration has been overlooked ; namely, on what have the reef-building corals, which cannot live at a great depth, based their massive structures?

ATOLL FORMATION

Numerous soundings were carefully taken by Captain Fitz-roy on the steep outside of Keeling atoll, and it was found that within ten fathoms [60 feet] the prepared tallow at the bottom of the lead invariably came up marked with the impressions of living corals, but as perfectly clean as if it had been dropped on a carpet of turf; as the depth increased, the impressions became less numerous, but the adhering particles of sand more and more numerous, until at last it was evident that the bottom consisted of a smooth sandy layer: to carry on the analogy of the turf, the blades of grass grew thinner and thinner til] at last the soil was so sterile that nothing sprang from it. From these observations, confirmed by many others, it may be safely inferred that the utmost depth at which corals can construct reefs is between twenty and thirty fathoms. Now, there are enormous areas in the Pacific and Indian oceans in which every single island is of coral formation, and is raised only to that height to which the waves can throw up fragments, and the winds pile up sand. . . . From the fact of the reef-building corals not living at great depths, it is absolutely certain that throughout these vast areas, wherever there is now an atoll, a foundation must have originally existed within a depth of from twenty to thirty fathoms from the surface. It is improbable in the highest degree that broad, lofty, isolated, steep-sided banks of sediment, arranged in groups and lines hundreds of leagues in length, could have been deposited in the central and profoundest parts of the Pacific and Indian oceans, at an immense distance from any continent, and where the water is perfectly limpid. It is equally improbable that the elevatory forces should have uplifted, throughout the above vast areas,

innumerable great rocky banks within twenty to thirty fathoms, or 120 to 180 feet, of the surface of the sea, and not one single point above that level ; for where on the whole face of the globe can we find a single chain of mountains, even a few hundred miles in length, with their many summits rising within a few feet of a given level, and not one pinnacle above it? If then the foundations whence the atoll-building corals sprang were not formed of sediment, and if they were not lifted up to the required level, they must of necessity have subsided into it; and this at once solves the difficulty. For as mountain after mountain, island after island, slowly sank beneath the water, fresh bases would be successively afforded for the growth of the corals. It is impossible here to enter into all the necessary details, but I venture to defy anyone to explain in any other manner

(FIGURE)

how it is possible that numerous islands should be distributed throughout vast areas—all the islands being low—all being built of corals, absolutely requiring a foundation within a limited depth from the surface.

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I venture, therefore, to affirm that on the theory of the upward growth of the corals during the sinking of the land, all the leading features in those wonderful structures, the lagoon islands or atolls, which have so long excited the attention of voyagers, as well as in the no less wonderful barrier reefs, whether encircling small islands or stretching for hundreds of miles along the shores of a continent, are simply explained.

April 29 — October 2, 1836

Mauritius to England

AT LAST definitely on the way home, the Beagle reached the island of Mauritius in the Indian Ocean east of Madagascar. From here Darwin wrote his sister Caroline a touching letter about his work and his future. His ambition to be and do something worth while, which arose on board the Beagle in Plymouth harbor, led him now to hope that maybe "real geologists" would consider his observations of some use. He wondered if a journal of the voyage would be worth publishing. It was his special good fortune, he thought, that of the naturalists who had traveled, "there have been few, or rather no, Geologists." He was entering "the field unopposed." But what would Henslow think of the merits of his notes? "If he shakes his head in a disapproving manner," he wrote, "I shall then know that I had better at once give up science, for science will have given me up. For I have worked with every grain of energy I possess."

This letter was dated April 29. Less than two months later Darwin was completely reassured. A letter from his sisters reached him at Ascension and reported that Professor Sedgwick had called on his father and said that Charles Darwin "should take a place among the leading scientific men." Years later he wrote: "After reading this letter I clambered over the mountains of Ascension with a bounding step, and made the volcanic rocks resound under my geological hammer."

At St. Helena, where for five days he wanders on foot over most of the island, he is again interested in the variety of causes that can bring about the extinction of species. This time. he notes, it has occurred through man, but indirectly. Darwin is fascinated by the fact that the introduction of goats and hogs has

brought about, 220 years later, a change in the whole

aspect of the island. He seems to be reflecting on the fact that a process operating slowly over a long period of time can then rather abruptly have extraordinary effects.

The last seven pages of the journal, included here in full, are a retrospect of the voyage as a whole and contain some reflections on long voyages in general. Typically, Darwin believes that the pleasures will only counterbalance the evils if the voyager has a "decided taste for some branch of knowledge." He concludes with an appeal to young naturalists in particular "to take all chances" and to start traveling by land or sea.

This book reveals something of what Darwin learned from his five-year voyage. We know that the very challenge of the trip changed him from an intelligent but rather indolent and unambitious young man into a dedicated scientist. What this experience did to his personality he told his wife-to-be, Emma Wedgwood, in a letter of January 20, 1839. "I was thinking this morning how it came, that I, who am fond of talking and am scarcely ever out of spirits, should so entirely rest my notions of happiness on quietness, and a good deal of solitude: but I believe the explanation is very simple . . . , it is that during the five years of my voyage . . . the whole of my pleasure was derived from what passed in my mind, while admiring views by myself, travelling across the wild deserts or glorious forests or pacing the deck of the poor little Beagle at night. Excuse this much egotism,—I give it you because I think you will humanize me, and soon teach me there is greater happiness than building theories and accumulating facts in silence and solitude."

Charles lived happily with Emma for more than forty years, and, although in bad health most of the time, he accomplished an enormous lot of work and never ceased "building theories and accumulating facts."

CHAPTER TWENTY ONE

APRIL 29. In the morning we passed round the northern end of Mauritius, or the Isle of France. From this point of view the aspect of the island equaled the expectations raised by the many well-known descriptions of its beautiful scenery. The sloping plain of the pamplemousses, interspersed with houses, and colored by the large fields of sugar cane of a bright green, composed the foreground. The brilliancy of the green was the more remarkable because it is a color which generally is conspicuous only from a very short distance. Towards the center of the island, groups of wooded mountains rose out of this highly cultivated plain, their summits, as so commonly happens with ancient volcanic rocks, being jagged into the sharpest points. Masses of white clouds were collected around these pinnacles, as if for the sake of pleasing the stranger's eye. The whole island, with its sloping border and central mountains,

 (FIGURE)

was adorned with an air of perfect elegance: the scenery, if I may use such an expression, appeared to the sight harmonious.

THE TOWN OF PORT LOUIS

I spent the greater part of the next day in walking about the town and visiting different people. The town is of considerable size, and is said to contain 20,000 inhabitants; the streets are very clean and regular. Although the island has been so many years under the English government, the general character of the place is quite French: Englishmen speak to their servants in French, and the shops are all French; indeed, I should think that Calais or Boulogne was much more Anglified. There is a very pretty little theater, in which operas are excellently performed. We were also surprised at seeing large booksellers' shops with well-stored shelves; music and reading bespeak our approach to the old world of civilization, for in truth both Australia and America are new worlds.

The various races of men walking in the streets afford the most interesting spectacle in Port Louis. Convicts from India are banished here for life; at present there are about 800, and they are employed in various public works. Before seeing these people, I had no idea that the inhabitants of India were such noble-looking figures. Their skin is extremely dark, and many of the older men had large mustaches and beards of a snow-white color; this, together with the fire of their expression, gave them quite an imposing aspect. The greater number had been banished for murder and the worst crimes; others for causes which can scarcely be considered as moral faults, such as for not obeying, from superstitious motives, the English laws. These men are generally quiet and well conducted; from their outward conduct, their cleanliness, and faithful

observance of their strange religious rites, it was impossible to look at them with the same eyes as on our wretched convicts in New South Wales.

May 1, Sunday. I took a quiet walk along the seacoast to the north of the town. The plain in this part is quite uncultivated ; it consists of a field of black lava, smoothed over with coarse grass and bushes, the latter being chiefly mimosas. The scenery may be described as intermediate in character between that of the Galapagos and of Tahiti, but this will convey a definite idea to very few persons. It is a very pleasant country, but it has not the charms of Tahiti or the grandeur of Brazil. . . .

ST. HELENA

May 9. We sailed from Port Louis, and, calling at the Cape of Good Hope, on the 8th of July we arrived off St. Helena. This island, the forbidding aspect of which has been so often described, rises abruptly like a huge black castle from the ocean. Near the town, as if to complete nature's defense, small forts and guns fill up every gap in the rugged rocks. The town runs up a flat and narrow valley; the houses look respectable, and are interspersed with a very few green trees. When approaching the anchorage there was one striking view: an irregular castle perched on the summit of a lofty hill and surrounded by a few scattered fir trees, boldly projected against the sky.

The next day I obtained lodgings within a stone's throw of Napoleon's tomb: it was a capital central situation, whence I could make excursions in every direction. During the four days I stayed here, I wandered over the island from morning to night and examined its geological history. My lodgings were

situated at a height of about two thousand feet; here the weather was cold and boisterous, with constant showers of rain; and every now and then the whole scene was veiled in thick clouds.

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CHANGE IN THE VEGETATION

The history of the changes which the elevated plains of Longwood and Deadwood have undergone, as given in General Beatson's account of the island, is extremely curious. Both plains, it is said, in former times were covered with wood, and were therefore called the Great Wood. So late as the year 1716 there were many trees, but in 1724 the old trees had mostly fallen; and as goats and hogs had been suffered to range about, all the young trees had been killed. It appears also from the official records that the trees were unexpectedly, some years afterwards, succeeded by a wire grass, which spread over the whole surface. General Beatson adds that now this plain "is covered with fine sward, and is become the finest piece of pasture on the island." The extent of surface probably covered by wood at a former period is estimated at no less than two thousand acres; at the present day scarcely a single tree can be found there. It is also said that in 1709 there were quantities of dead trees in Sandy Bay; this place is now so utterly desert that nothing but so well-attested an account could have made me believe that they could ever have grown there. The fact that the goats and hogs destroyed all the young trees as they sprang up, and that in the course of time the old ones, which were safe from their attacks, perished from age, seems clearly made out. Goats were introduced in the year 1502; eighty-six years afterwards, in the time of Cavendish,

it is known that they were exceedingly numerous. More than a century afterwards, in 1731, when the evil was complete and irretrievable, an order was issued that all stray animals should be destroyed. It is very interesting thus to find that the arrival of animals at St. Helena in 1501 did not change the whole aspect of the island until a period of two hundred and twenty years had elapsed: for the goats were introduced in 1502, and in 1724 it is said "the old trees had mostly fallen." There can be little doubt that this great change in the vegetation affected not only the land shells, causing eight species to become extinct, but likewise a multitude of insects.

St. Helena, situated so remote from any continent, in the midst of a great ocean, and possessing a unique flora, excites our curiosity. The eight land shells, though now extinct, and one living Succinea are peculiar species found nowhere else. . . . Birds and insects, as might have been expected, are very few in number; indeed, I believe all the birds have been introduced within late years. Partridges and pheasanfs' are tolerably abundant: the island is much too English not to be subject to strict game laws. I was told of a more unjust sacrifice to such ordinances than I ever heard of even in England. The poor people formerly used to burn a plant which grows on the coast rocks, and export the soda from its ashes; but a peremptory order came out prohibiting this practice, and giving as a reason that the partridges would have nowhere to build!

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I so much enjoyed my rambles among the rocks and mountains of St. Helena that I felt almost sorry on the morning of the 14th to descend to the town. Before noon I was on board, and the Beagle made sail.

ASCENSION

On the 19th of July we reached Ascension. Those who have beheld a volcanic island situated under an arid climate will at once be able to picture to themselves the appearance of Ascension. They will imagine smooth conical hills of a bright red color, with their summits generally truncated, rising separately out of a level surface of black rugged lava. A principal mound in the center of the island seems the father of the lesser cones. It is called Green Hill, its name being taken from the faintest tinge of that color, which at this time of the year is barely perceptible from the anchorage. To complete the desolate scene, the black rocks on the coast are lashed by a wild and turbulent sea.

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On leaving Ascension we sailed for Bahia, on the coast of Brazil, in order to complete the chronometrical measurement of the world. We arrived there on August 1 and stayed four days, during which I took several long walks. I was glad to find my enjoyment in tropical scenery had not decreased from the want of novelty, even in the slightest degree. . . .

When quietly walking along the shady pathways and admiring each successive view, I wished to find language to express my ideas. Epithet after epithet was found too weak to convey to those who have not visited the intertropical regions the sensation of delight which the mind experiences. I have said that the plants in a hothouse fail to communicate a just idea of the vegetation, yet I must recur to it. The land is one great wild, untidy, luxuriant hothouse, made by nature for herself, but taken possession of by man, who has studded it with gay houses and formal gardens. How great would be the

desire in every admirer of nature to behold, if such were possible, the scenery of another planet! Yet to every person in Europe it may be truly said that at the distance of only a few degrees from his native soil the glories of another world are opened to him. In my last walk I stopped again and again to gaze on these beauties, and endeavored to fix in my mind forever an impression which at the time I knew sooner or later must fail. The form of the orange tree, the coconut, the palm, the mango, the tree fern, the banana, will remain clear and separate; but the thousand beauties which unite these into one perfect scene must fade away; yet they will leave, like a tale heard in childhood, :1 picture full of indistinct but most beautiful figures.

PERNAMBUCO

August 6. In the afternoon we stood out to sea, with the intention of making a direct course to the Cape Verde Islands. Unfavorable winds, however, delayed us, and on the 12th we ran into Pemambuco—a large city on the coast of Brazil, in latitude 8° south. We anchored outside the reef, but in a short time a pilot came on board and took us into the inner harbor, where we lay close to the town.

Pemambuco is built on some narrow and low sandbanks which are separated from each other by shoal channels of salt water. The three parts of the town are connected together by two long bridges built on wooden piles. The town is in all parts disgusting, the streets being narrow, ill-paved, and filthy, the houses tall and gloomy. The season of heavy rains had hardly come to an end, and hence the surrounding country, which is scarcely raised above the level of the sea, was flooded with water; and I failed in all my attempts to take long walks. The flat swampy land on which Pemambuco stands is sur-

rounded, at the distance of a few miles, by a semicircle of low hills, or rather by the edge of a country elevated perhaps two hundred feet above the sea. The old city of Olinda stands on one extremity of this range. One day I took a canoe and proceeded up one of the channels to visit it; I found the old town, from its situation, both sweeter and cleaner than that of Pemambuco. I must here commemorate what happened for the first time during our nearly five years' wandering, namely, having met with a want of politeness; I was refused in a sullen manner at two different houses, and obtained with difficulty from a third, permission to pass through their gardens to an uncultivated hill for the purpose of viewing the country. I feel glad that this happened in the land of the Brazilians, for I bear them no good will—a land also of slavery and therefore of moral debasement. A Spaniard would have felt ashamed at the very thought of refusing such a request, or of behaving to a stranger with rudeness. The channel by which we went to and returned from Olinda was bordered on each side by mangroves, which sprang like a miniature forest out of the greasy mud banks. The bright green color of these bushes always reminded me of the rank grass in a churchyard; both are nourished by putrid exhalations; the one speaks of death past, and the other too often of death to come.

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SLAVERY

On the 19th of August we finally left the shores of Brazil. I thank God I shall never again visit a slave country. To this day, if I hear a distant scream, it recalls with painful vividness my feelings when, passing a house near Pemambuco, I heard the most pitiable moans and could not but suspect that some

poor slave was being tortured, yet knew that I was as powerless as a child even to remonstrate. I suspected that these moans were from a tortured slave, for I was told that this was the case in another instance. Near Rio de Janeiro I lived opposite to an old lady who kept screws to crush the fingers of her female slaves. I have stayed in a house where a young household mulatto daily and hourly was reviled, beaten, and persecuted enough to break the spirit of the lowest animal. I have seen a little boy, six or seven years old, struck thrice with a horsewhip (before I could interfere) on his naked head for having handed me a glass of water not quite clean; I saw his father tremble at a mere glance from his master's eye. These latter cruelties were witnessed by me in a Spanish colony, in which it has always been said that slaves are better treated than by the Portuguese, English, or other European nations. I have seen at Rio de Janeiro a powerful Negro afraid to ward off a blow directed, as he thought, at his face. I was present when a kind-hearted man was on the point of separating forever the men, women, and little children of a large number of families who had long lived together. I will not even allude to the many heart-sickening atrocities which I authentically heard of—nor would I have mentioned the above revolting details had I not met with several people so blinded by the constitutional gaiety of the Negro as to speak of slavery as a tolerable evil. Such people have generally visited at the houses of the upper classes, where the domestic slaves are usually well treated; and they have not, like myself, lived amongst the lower classes. Such inquirers will ask slaves about their condition; they forget that the slave must indeed be dull who does not calculate on the chance of his answer reaching his master's ears.

It is argued that self-interest will prevent excessive cruelty,

as if self-interest protected our domestic animals, which are far less likely than degraded slaves to stir up the rage of their savage masters. It is an argument long since protested against with noble feeling, and strikingly exemplified, by the ever illustrious Humboldt. It is often attempted to palliate slavery by comparing the state of slaves with our poorer countrymen. If the misery of our poor be caused not by the laws of nature, but by our institutions, great is our sin; but how this bears on slavery I cannot see. As well might the use of the thumb-screw be defended in one land by showing that men in another land suffered from some dreadful disease. Those who look tenderly at the slaveowner, and with a cold heart at the slave, never seem to put themselves into the position of the latter; what a cheerless prospect, with not even a hope of change! Picture to yourself the chance, ever hanging over you, of your wife and your little children—those objects which nature urges even the slave to call his own—being torn from you and sold like beasts to the first bidder! And these deeds are done and palliated by men who profess to love their neighbors as themselves, who believe in God and pray that His will be done on earth ! It makes one's blood boil, yet heart tremble, to think that we Englishmen and our American descendants, with their boastful cry of liberty, have been and are so guilty; but it is a consolation to reflect that we at least have made a greater sacrifice than ever made by any nation to expiate our sin.

On the last day of August we anchored for the second time at Porto Praya in the Cape Verde archipelago; thence we proceeded to the Azores, where we stayed six days. On the 2nd of October we made for the shores of England; and at Falmouth I left the Beagle, having lived on board the good little vessel nearly five years.

RETROSPECT OF THE VOYAGE

Our voyage having come to an end, I will take a short retrospect of the advantages and disadvantages, the pains and pleasures, of our circumnavigation of the world. If a person asked my advice before undertaking a long voyage, my answer would depend upon his possessing a decided taste for some branch of knowledge which could by this means be advanced. No doubt it is a high satisfaction to behold various countries and the many races of mankind, but the pleasures gained at the time do not counterbalance the evils. It is necessary to look forward to a harvest, however distant that may be, when some fruit will be reaped, some good effected.

Many of the losses which must be experienced are obvious, such as that of the society of every old friend, and of the sight of those places with which every dearest remembrance is so intimately connected. These losses, however, are at the time partly relieved by the exhaustless delight of anticipating the long-wished-for day of return. If, as poets say, life is a dream, I am sure in a voyage these are the visions which best serve to pass away the long night. Other losses, although not at first felt, tell heavily after a period: these are the want of room, of seclusion, of rest; the jading feeling of constant hurry; the privation of small luxuries; the loss of domestic society, and even of music and the other pleasures of imagination. When such trifles are mentioned, it is evident that the real grievances. excepting from accidents, of a sea life are at an end. The short space of sixty years has made an astonishing difference in the facility of distant navigation. Even in the time of Cook, a man who left his fireside for such expeditions underwent severe privations. A yacht now, with every luxury of life, can circum-

navigate the globe. Besides the vast improvements in ships and naval resources, the whole western shores of America are thrown open, and Australia has become the capital of a rising continent. How different are the circumstances to a man shipwrecked at the present day in the Pacific, to what they were in the time of Cook! Since his voyage a hemisphere has been added to the civilized world.

If a person suffer much from seasickness, let him weigh it heavily in the balance. I speak from experience; it is no trifling evil, cured in a week. If, on the other hand, he take pleasure in naval tactics, he will assuredly have full scope for his taste. But it must be borne in mind how large a proportion of the time during a long voyage is spent on the water, as compared with the days in harbor. And what are the boasted glories of the illimitable ocean? A tedious waste, a desert of water, as the Arabian calls it. No doubt there are some delightful scenes. A moonlight night, with the clear heavens and the dark glittering sea, and the white sails filled by the soft air of a gently blowing trade wind ; a dead calm, with the heaving surface polished like a mirror, and all still except the occasional flapping of the canvas. It is well once to behold a squall with its rising arch and coming fury, or the heavy gale of wind and mountainous waves. I confess, however, my imagination had painted something more grand, more terrific in the full-grown storm. It is an incomparably finer spectacle when beheld on shore, where the waving trees, the wild flight of the birds, the dark shadows and bright lights, the rushing of the torrents, all proclaim the strife of the unloosed elements. At sea the albatross and little petrel fly as if the storm were their proper sphere, the water rises and sinks as if fulfilling its usual task, the ship alone and its inhabitants seem the objects of wrath.

On a forlorn and weatherbeaten coast the scene is indeed different, but the feelings partake more of horror than of wild delight.

EN JOYMENT OF SCENERY

Let us now look at the brighter side of the past time. The pleasure derived from beholding the scenery and the general aspect of the various countries we have visited has decidedly been the most constant and highest source of enjoyment. It is probable that the picturesque beauty of many parts of Europe exceeds anything which we beheld. But there is a growing pleasure in comparing the character of the scenery in different countries, which to a certain degree is distinct from merely admiring its beauty. It depends chiefly on an acquaintance with the individual parts of each view: I am strongly induced to believe that, as in music the person who understands every note will, if he also possesses a proper taste, more thoroughly enjoy the whole, so he who examines each part of a fine view may also thoroughly comprehend the full and combined effect. Hence, a traveler should be a botanist, for in all views plants form the chief embellishment. Group masses of naked rock even in the wildest forms, and they may for a time afford a sublime spectacle, but they will soon grow monotonous. Paint them with bright and varied colors, as in Northern Chile, they will become fantastic; clothe them with vegetation, they must form a decent, if not a beautiful, picture.

When I say that the scenery of parts of Europe is probably superior to anything which we beheld, I except, as a class by itself, that of the intertropical zones. The two classes cannot be compared together; but I have already often enlarged on the

grandeur of those regions. As the force of impressions generally depends on preconceived ideas, I may add that mine were taken from the vivid descriptions in the Personal Narrative of Humboldt, which far exceed in merit anything else which I have read. Yet with these high-wrought ideas, my feelings were far from partaking of a tinge of disappointment on my first and final landing on the shores of Brazil.

Among the scenes which are deeply impressed on my mind, none exceed in sublimity the primeval forests undefaced by the hand of man, whether those of Brazil, where the powers of life are predominant, or those of Tierra del Fuego, where death and decay prevail. Both are temples filled with the varied productions of the God of Nature: no one can stand in these solitudes unmoved, and not feel that there is more in man than the mere breath of his body. In calling up images of the past, I find that the plains of Patagonia frequently cross before my eyes; yet these plains are pronounced by all wretched and useless. They can be described only by negative characters; without habitations, without water, without trees, without mountains, they support merely a few dwarf plants. Why then, and the case is not peculiar to myself, have these arid wastes taken so firm a hold on my memory? Why have not the still more level, the greener and more fertile Pampas, which are serviceable to mankind, produced an equal impression? I can scarcely analyze these feelings; but it must be partly owing to the free scope given to the imagination. The plains of Patagonia are boundless, for they are scarcely passable, and hence unknown; they bear the stamp of having lasted, as they are now, for ages, and there appears no limit to their duration through future time. If, as the ancients supposed, the flat earth was surrounded by an impassable breadth of water, or by deserts

heated to an intolerable excess, who would not look at these last boundaries to man's knowledge with deep but ill-defined sensations?

Lastly, of natural scenery, the views from lofty mountains, though certainly in one sense not beautiful, are very memorable. When looking down from the highest crest of the Cordillera, the mind, undisturbed by minute details, was filled with the stupendous dimensions of the surrounding masses.

Of individual objects, perhaps nothing is more certain to create astonishment than the first sight in his native haunt of a barbarian—of man in his lowest and most savage state. One's mind hurries back over past centuries and then asks: could our progenitors have been men like these—men whose very signs and expressions are less intelligible to us than those of the domesticated animals; men who do not possess the instinct of those animals, nor yet appear to boast of human reason, or at least of arts consequent on that reason? I do not believe it is possible to describe or paint the difference between savage and civilized man. It is the difference between a wild and tame animal: and part of the interest in beholding a savage is the same which would lead everyone to desire to see the lion in his desert, the tiger tearing his prey in the jungle, or the rhinoceros wandering over the wild plains of Africa.

Among the other most remarkable spectacles which we have beheld may be ranked the Southern Cross, the cloud of Magellan, and the other constellations of the southern hemisphere-the water spout—the glacier leading its blue stream of ice, overhanging the sea in a bold precipice—a lagoon island raised by the reef-building corals—an active volcano—and the overwhelming effects of a violent earthquake. These latter phenomena, perhaps, possess for me a peculiar interest, from

their intimate connection with the geological structure of the world. The earthquake, however, must be to everyone a most impressive event: the earth, considered from our earliest childhood as the type of solidity, has oscillated like a thin crust beneath our feet; and in seeing the labored works of man in a moment overthrown, we feel the insignificance of his boasted power.

It has been said that the love of the chase is an inherent delight in man—a relic of an instinctive passion. If so, I am sure the pleasure of living in the open air, with the sky for a roof and the ground for a table, is part of the same feeling; it is the savage returning to his wild and native habits. I always look back to our boat cruises, and my land journeys, when through unfrequented countries, with an extreme delight which no scenes of civilization could have created. I do not doubt that every traveler must remember the glowing sense of happiness which he experienced when he first breathed in a foreign clime where the civilized man had seldom or never trod.

There are several other sources of enjoyment in a long voyage which are of a more reasonable nature. The map of the world ceases to be a blank; it becomes a picture full of the most varied and animated figures. Each part assumes its proper dimensions: continents are not looked at in the light of islands, or islands considered as mere specks which are, in truth, larger than many kingdoms of Europe. Africa or North and South America are well-sounded names and easily pronounced, but it is not until having sailed for weeks along small portions of their shores that one is thoroughly convinced what vast spaces on our immense world these names imply.

From seeing the present state, it is impossible not to look

forward with high expectations to the future progress of nearly an entire hemisphere. The march of improvement consequent on the introduction of Christianity throughout the South Sea probably stands by itself on the records of history. It is the more striking when we remember that, only sixty years since, Cook, whose excellent judgment none will dispute, could foresee no prospect of a change. Yet these changes have now been effected by the philanthropic spirit of the British nation.

In the same quarter of the globe Australia is rising, or indeed may be said to have risen, into a grand center of civilization which, at some not very remote period, will rule as empress over the southern hemisphere. It is impossible for an Englishman to behold these distant colonies without a high pride and satisfaction. To hoist the British flag seems to draw with it, as a certain consequence, wealth, prosperity, and civilization.

WHY NATURALISTS SHOULD TRAVEL

In conclusion, it appears to me that nothing can be more improving to a young naturalist than a journey in distant countries. It both sharpens and partly allays that want and craving which, as Sir Herschel remarks, a man experiences although every corporeal sense be fully satisfied. The excitement from the novelty of objects and the chance of success stimulate him to increased activity. Moreover, as a number of isolated facts soon become uninteresting, the habit of comparison leads to generalization. On the other hand, as the traveler stays but a short time in each place, his descriptions must generally consist of mere sketches, instead of detailed observations. Hence arises, as I have found to my cost, a con-

stant tendency to fill up the wide gaps of knowledge by inaccurate and superficial hypotheses.

But I have too deeply enjoyed the voyage not to recommend any naturalist, although he must not expect to be so fortunate in his companions as I have been, to take all chances, and to start on travels by land if possible, if otherwise on a long voyage. He may feel assured he will meet with no difficulties or dangers, excepting in rare cases, nearly so bad as he beforehand anticipates. In a moral point of view, the effect ought to be to teach him good-humored patience, freedom from selfishness, the habit of acting for himself, and of making the best of every occurrence. In short, he ought to partake of the characteristic qualities of most sailors. Traveling ought also to teach him distrust; but at the same time he will discover how many truly kind-hearted people there are with whom he never before had, or ever again will have, any further communication, who yet are ready to offer him the most disinterested assistance.