CHAPTER IX.

Santa Cruz—Expedition up the River—Indians—Immense streams of basaltic lava—Fragments not transported by the River—Excavation of the valley—Condor, habits of—Cordillera—Erratic boulders of great size—Indian relics—Return to the ship—Falkland Islands—Wild horses, cattle, rabbits—Wolf-like fox—Fire made of bones—Manner of hunting wild cattle—Geology—Streams of stones—Scenes of violence—Penguin—Geese—Eggs of Doris—Compound animals.

SANTA CRUZ, PATAGONIA, AND THE FALKLAND ISLANDS.

April 13th, 1834.—The Beagle anchored within the mouth of the Santa Cruz. This river is situated about sixty miles south of Port St. Julian. During the last 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 Fitz Roy 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 consisted of twenty-five souls—a force which would have been sufficient 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 diminished. 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 colour, but with a slight milky tinge, and not so transparent as at first sight would have been expected. 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.

April 19th.—Against so strong a current it was, of course, quite impossible to row or sail: consequently the three boats were fastened together head and stern, two hands left in each, and the rest came on shore to track. As the general arrangements made by Captain Fitz Roy 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 every one, 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 collected 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 20th.—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 neighbourhood. On the next morning (21st) 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 reconnoitred 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 22d.—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 waterfowl 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 amongst 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 24th.—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

* The deserts of Syria are characterized, according to Volney (tom. i., p. 351), by woody bushes, numerous rats, gazelles, and hares. In the landscape of Patagonia, the guanaco replaces the gazelle, and the agouti the hare.

sign, and eventually turned out a true harbinger. At first the clouds were mistaken for the mountains themselves, instead of the masses of vapour condensed by their icy summits.

April 26th.—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 two last 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 were 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-formation, 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.

The basalt is only lava, which has flowed beneath the sea; but the eruptions must have been on the grandest scale. At the point where we first met this formation it was 120 feet in thickness; following up the river course, the surface imperceptibly rose and the mass became thicker, so that at forty miles above the first station it was 320 feet thick. What the thickness may be close to the Cordillera, I have no means of knowing, but the platform there attains a height of about three thousand feet above the level of the sea: we must therefore look to the mountains of that great chain for its source; and worthy of such a source are streams, that have flowed over the gently inclined bed of the sea to a distance of one hundred miles. 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 sea-shells lying in the bed of the river. 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 debacle; but in this case such a supposition would have been quite inadmissible; because, the same step-like plains with existing sea-shells 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 modelled 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.

With the change in the geological structure of the plains the character of the landscape likewise altered. While rambling up some of the narrow and rocky defiles, I could almost have fancied myself transported back again to the barren valleys of the island of St. Jago. Among the basaltic cliffs, I found some plants which I had seen no-

where else, but others I recognised as being wanderers from Tierra del Fuego. These porous rocks serve as a reservoir for the scanty rain-water; and consequently on the line where the igneous and sedimentary formations unite, some small springs (most rare occurrences in Patagonia) burst forth; and they could be distinguished at a distance by the circumscribed patches of bright green herbage.

April 27th.—The bed of the river became rather narrower, and hence the stream more rapid. It here ran at the rate of six knots an hour. From this cause, and from the many great angular fragments, tracking the boats became both dangerous and laborious.

This day I shot a condor. It measured from tip to tip of the wings, eight and a half feet, and from beak to tail, four feet. This bird is known to have a wide geographical range, being found on the west coast of South America, from the Strait of Magellan along the Cordillera as far as eight degrees N. of the equator. The steep cliff near the mouth of the Rio Negro is its northern limit on the Patagonian coast; and they have there wandered about four hundred miles from the great central line of their habitation in the Andes. Further south, among the bold precipices at the head of Port Desire, the condor is not uncommon; yet only a few stragglers occasionally visit the seacoast. A line of cliff near the mouth of the Santa Cruz is frequented by these birds, and about eighty miles up the river, where the sides of the valley are formed by steep basaltic precipices, the condor reappears. From these facts, it seems that the condors require perpendicular cliffs. In Chile, they haunt, during the greater part of the year, the lower country near the shores of the Pacific, and at night several roost together in one tree; but in the early part of summer, they retire to the most inaccessible parts of the inner Cordillera, there to breed in peace.

With respect to their propagation, I was told by the country people in Chile, that the condor makes no sort of nest, but in the months of November and December lays two large white eggs on a shelf of bare rock. It is said that the young condors cannot fly for an entire year; and long after they are able, they continue to roost by night, and hunt by day with their parents. The old birds generally live in pairs; but among the inland basaltic cliffs of the Santa Cruz, I found a spot, where scores must usually haunt. On coming suddenly to the

brow of the precipice, it was a grand spectacle to see between twenty and thirty of these great birds start heavily from their resting-place, and wheel away in majestic circles. From the quantity of dung on the rocks, they must long have frequented this cliff for roosting and breeding. Having gorged themselves with carrion on the plains below, they retire to these favourite ledges to digest their food. From these facts, the condor, like the gallinazo, must to a certain degree be considered as a gregarious bird. In this part of the country they live altogether on the guanacos which have died a natural death, or, as more commonly happens, have been killed by the pumas. I believe, from what I saw in Patagonia, that they do not on ordinary occasions extend their daily excursions to any great distance from their regular sleeping-places.

The condors may oftentimes be seen at a great height, soaring over a certain spot in the most graceful circles. On some occasions I am sure that they do this only for pleasure, but on others, the Chileno countryman tells you that they are watching a dying animal, or the puma devouring its prey. If the condors glide down, and then suddenly all rise together, the Chileno knows that it is the puma which, watching the carcass, has sprung out to drive away the robbers. Besides feeding on carrion, the condors frequently attack young goats and lambs; and the shepherd dogs are trained, whenever they pass over, to run out, and looking upwards to bark violently. The Chilenos destroy and catch numbers. Two methods are used; one is to place a carcass on a level piece of ground within an enclosure of sticks with an opening, and when the condors are gorged, to gallop up on horseback to the entrance, and thus enclose them: for when this bird has not space to run, it cannot give its body sufficient momentum to rise from the ground. The second method is to mark the trees in which, frequently to the number of five or six together, they roost, and then at night to climb up and noose them. They are such heavy sleepers, as I have myself witnessed, that this is not a difficult task. At Valparaiso, I have seen a living condor sold for sixpence, but the common price is eight or ten shillings. One which I saw brought in, had been tied with rope, and was much injured; yet, the moment the line was cut by which its bill was secured, although surrounded by people, it began ravenously to tear a piece of carrion. In a garden at the same place, between twenty and thirty were kept alive. They were

fed only once a week, but they appeared in pretty good health.* The Chileno countrymen assert that the condor will live, and retain its vigour, between five and six weeks without eating: I cannot answer for the truth of this, but it is a cruel experiment, which very likely has been tried.

When an animal is killed in the country, it is well known that the condors, like other carrion-vultures, soon gain intelligence of it, and congregate in an inexplicable manner. In most cases it must not be overlooked, that the birds have discovered their prey, and have picked the skeleton clean, before the flesh is in the least degree tainted. Remembering the experiments of M. Audubon, on the little smelling powers of carrion-hawks, I tried in the above-mentioned garden the following experiment: the condors were tied, each by a rope, in a long row at the bottom of a wall; and having folded up a piece of meat in white paper, I walked backwards and forwards, carrying it in my hand at the distance of about three yards from them, but no notice whatever was taken. I then threw it on the ground, within one yard of an old male bird; he looked at it for a moment with attention, but then regarded it no more. With a stick I pushed it closer and closer, until at last he touched it with his beak; the paper was then instantly torn off with fury, and at the same moment, every bird in the long row began struggling and flapping its wings. Under the same circumstances, it would have been quite impossible to have deceived a dog. The evidence in favour of and against the acute smelling powers of carrion-vultures is singularly balanced. Professor Owen has demonstrated that the olfactory nerves of the turkey-buzzard (Cathartes aura) are highly developed; and on the evening when Mr. Owen's paper was read at the Zoological Society, it was mentioned by a gentleman that he had seen the carrion-hawks in the West Indies on two occasions collect on the roof of a house, when a corpse had become offensive from not having been buried: in this case, the intelligence could hardly have been acquired by sight. On the other hand, besides the experiments of Audubon and that one by myself, Mr. Bachman has tried in the United States many varied plans, showing that neither the turkey-buzzard (the species dissected

* I noticed that several hours before any one of the condors died, all the lice, with which it was infested, crawled to the outside feathers. I was assured that this always happened.

by Professor Owen) nor the gallinazo find their food by smell. He covered portions of highly offensive offal with a thin canvass cloth, and strewed pieces of meat on it; these the carrion-vultures ate up, and then remained quietly standing, with their beaks within the eighth of an inch of the putrid mass, without discovering it. A small rent was made in the canvass, and the offal was immediately discovered; the canvass was replaced by a fresh piece, and meat again put on it, and was again devoured by the vultures without their discovering the hidden mass on which they were trampling. These facts are attested by the signatures of six gentlemen, besides that of Mr. Bachman.*

Often when lying down to rest on the open plains, on looking upwards, I have seen carrion-hawks sailing through the air at a great height. Where the country is level I do not believe a space of the heavens, of more than fifteen degrees above the horizon, is commonly viewed with any attention by a person either walking or on horseback. If such be the case, and the vulture is on the wing at a height of between three and four thousand feet, before it could come within the range of vision, its distance in a straight line from the beholder's eye, would be rather more than two British miles. Might it not thus readily be overlooked? When an animal is killed by the sportsman in a lonely valley, may he not all the while be watched from above by the sharp-sighted bird? And will not the manner of its descent proclaim throughout the district to the whole family of carrion-feeders, that their prey is at hand?

When the condors are wheeling in a flock round and round any spot, their flight is beautiful. Except when rising from the ground, I do not recollect ever having seen one of these birds flap its wings. Near Lima, I watched several for nearly half an hour, without once taking off my eyes: they moved in large curves, sweeping in circles, descending and ascending without giving a single flap. As they glided close over my head, I intently watched from an oblique position, the outlines of the separate and great terminal feathers of each wing; and these separate feathers, if there had been the least vibratory movement, would have appeared as if blended together; but they were seen distinct against the blue sky. The head and neck were moved frequently, and apparently with force; and the extended wings seemed to form the fulcrum on which the movements of the neck, body, and

* Loudon's Magazine of Nat. Hist., vol. vii.

tail acted. If the bird wished to descend, the wings were for a moment collapsed; and when again expanded with an altered inclination, the momentum gained by the rapid descent seemed to urge the bird upwards with the even and steady movement of a paper kite. In the case of any bird *soaring*, its motion must be sufficiently rapid, so that the action of the inclined surface of its body on the atmosphere may counterbalance its gravity. The force to keep up the momentum of a body moving in a horizontal plane in the air (in which there is so little friction) cannot be great, and this force is all that is wanted. The movement of the neck and body of the condor, we must suppose, is sufficient for this. However this may be, it is truly wonderful and beautiful to see so great a bird, hour after hour, without any apparent exertion, wheeling and gliding over mountain and river.

April 29th.—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. The plain bordering the valley had here attained an elevation of about 1100 feet above the river, and its character was much altered. The well-rounded pebbles of porphyry were mingled with many immense angular fragments of basalt and of primary rocks. The first of these erratic boulders which I noticed, was sixty-seven miles distant from the nearest mountain; another which I measured was five yards square, and projected five feet above the gravel. Its edges were so angular, and its size so great, that I at first mistook it for a rock *in situ*, and took out my compass to observe the direction of its cleavage. The plain here was not quite so level as that nearer the coast, but yet it betrayed no signs of any great violence. Under these circumstances it is, I believe, quite impossible to explain the transportal of these gigantic masses of rock so many miles from their parent-source, on any theory except by that of floating icebergs.

During the two last days we met with signs of horses, and with several small articles which had belonged to the Indians—such as parts of a mantle and a bunch of ostrich feathers—but they appeared to have been lying long on the ground. Between the place where the Indians had so lately crossed the river and this neighbourhood, though

so many miles apart, the country appears to be quite unfrequented. At first, considering the abundance of the guanacos, I was surprised at this; but it is explained by the stony nature of the plains, which would soon disable an unshod horse from taking part in the chace. Nevertheless, in two places in this very central region, I found small heaps of stones, which I do not think could have been accidentally thrown together. They were placed on points, projecting over the edge of the highest lava cliff, and they resembled, but on a small scale, those near Port Desire.

May 4th.—Captain Fitz Roy 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.

5th.—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' labour in ascending. On the 8th, we reached the Beagle after our twenty-one days' expedition. Every one, excepting myself, had cause to be dissatisfied; but to me the ascent afforded a most interesting section of the great tertiary formation of Patagonia.

On March 1st, 1833, and again on March 16th, 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 a 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 Ayres then sold th em 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.

The theatre is worthy of the scenes acted on it. An undulating land, with a desolate and wretched aspect, is everywhere covered by a peaty soil and wiry grass, of one monotonous brown colour. Here and there a peak or ridge of grey quartz rock breaks through the smooth surface. Every one has heard of the climate of these regions; it may be compared to that which is experienced at the height of between one and two thousand feet, on the mountains of North Wales; having however less sunshine and less frost, but more wind and rain.*

16th.—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 hail-storms. 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

* From accounts published since our voyage, and more especially from several interesting letters from Capt. Sulivan, R.N., employed on the survey, it appears that we took an exaggerated view of the badness of the climate of these islands. But when I reflect on the almost universal covering of peat, and on the fact of wheat seldom ripening here, I can hardly believe that the climate in summer is so fine and dry as it has lately been represented.

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.

In the evening we came across a small herd. One of my companions, St. Jago by name, soon separated a fat cow; he threw the bolas, and it struck her legs, but failed in becoming entangled. Then dropping his hat to mark the spot where the balls were left, while at full gallop, he uncoiled his lazo, and after a most severe chace, again came up to the cow, and caught her round the horns. The other Gaucho had gone on ahead with the spare horses, so that St. Jago had some difficulty in killing the furious beast. He managed to get her on a level piece of ground, by taking advantage of her as often as she rushed at him; and when she would not move, my horse, from having been trained, would canter up, and with his chest give her a violent push. But when on level ground it does not appear an easy job for one man to kill a beast mad with terror. Nor would it be so, if the horse, when left to itself without its rider, did not soon learn, for its own safety, to keep the lazo tight; so that, if the cow or ox moves forward, the horse moves just as quickly forward; otherwise, it stands motionless leaning on one side. This horse, however, was a young one, and would not stand still, but gave in to the cow as she struggled. It was admirable to see with what dexterity St. Jago dodged behind the beast, till at last he contrived to give the fatal touch to the main tendon of the hind leg; after which, without much difficulty, he drove his knife into the head of the spinal marrow, and the cow dropped as if struck by lightning. He cut off pieces of flesh with the skin to it, but without any bones, sufficient for our expedition. We then rode on to our sleeping-place, and had for supper 'carne con cuero,' or meat roasted with the skin on it. This is as superior to common beef as venison is to mutton. A large circular piece taken from the back is roasted on the embers with the hide downwards and in the form of a saucer, so that none of the gravy is lost. If any worthy alderman had supped with us that evening, 'carne con cuero,' without doubt, would soon have been celebrated in London.

During the night it rained, and the next day (17th) was very stormy, with much hail and snow. We rode across the island to the neck of land which joins the Rincon del Toro (the great peninsula at the S.W. extremity) to the rest of the island. From the great number

of cows which have been killed, there is a large proportion of bulls. These wander about single, or two and three together, and are very savage. I never saw such magnificent beasts; they equalled in the size of their huge heads and necks the Grecian marble sculptures. Capt. Sulivan informs me that the hide of an average-sized bull weighs forty-seven pounds, whereas a hide of this weight, less thoroughly dried, is considered as a very heavy one at Monte Video. The young bulls generally run away for a short distance; but the old ones do not stir a step, except to rush at man and horse; and many horses have been thus killed. An old bull crossed a boggy stream, and took his stand on the opposite side to us; we in vain tried to drive him away, and failing, were obliged to make a large circuit. The Gauchos in revenge determined to emasculate him and render him for the future harmless. It was very interesting to see how art completely mastered force. One lazo was thrown over his horns as he rushed at the horse, and another round his hind legs: in a minute the monster was stretched powerless on the ground. After the lazo has once been drawn tightly round the horns of a furious animal, it does not at first appear an easy thing to disengage it again without killing the beast; nor, I apprehend, would it be so if the man was by himself. By the aid, however, of a second person throwing his lazo so as to catch both hind legs, it is quickly managed: for the animal, as long as its hind legs are kept outstretched, is quite helpless, and the first man can with his hands loosen his lazo from the horns, and then quietly mount his horse; but the moment the second man, by backing ever so little, relaxes the strain, the lazo slips off the legs of the struggling beast, which then rises free, shakes himself, and vainly rushes at his antagonist.

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? Capt. Sulivan has taken much pains for me in this inquiry. 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. One Gaucho told Capt. Sulivan that he had watched a stallion for a whole hour, violently kicking and biting a mare till he forced her to leave her foal to its fate. Capt. Sulivan can so far corroborate this curious account, that he has several times found young foals dead, whereas he has never found a dead calf. 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 colours are roan and iron-grey. 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. Capt. 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 colour they differ much; and it is a remarkable circumstance, that in different parts of this one small island, different colours predominate. Round Mount Usborne, at a height of from 1000 to 1500 feet above the sea, about half of some of the herds are mouse or lead-coloured, a tint which is not common in other parts of the island. Near Port Pleasant dark brown prevails, whereas south of Choiseul Sound (which almost divides the island into two parts), white beasts with black heads and feet are the most common: in all parts black, and some spotted animals may be observed. Capt. Sulivan remarks, that the difference in the prevailing colours was so obvious, that in looking for the herds near Port Pleasant, they appeared from a long distance like black spots, whilst

south of Choiseul Sound they appeared like white spots on the hillsides. Capt. Sulivan thinks that the herds do not mingle; and it is a singular fact, that the mouse-coloured cattle, though living on the high land, calve about a month earlier in the season than the other coloured beasts on the lower land. It is interesting thus to find the once domesticated cattle breaking into three colours, of which some one colour would in all probability ultimately prevail over the others, if the herds were left undisturbed for the next several centuries.

The rabbit is another animal which has been introduced, and has succeeded very well; so that they abound over large parts of the island. Yet, like the horses, they are confined within certain limits; for they have not crossed the central chain of hills, nor would they have extended even so far as its base, if, as the Gauchos informed me, small colonies had not been carried there. I should not have supposed that these animals, natives of northern Africa, could have existed in a climate so humid as this, and which enjoys so little sunshine that even wheat ripens only occasionally. It is asserted that in Sweden, which any one would have thought a more favourable climate, the rabbit cannot live out of doors. The first few pair, moreover, had here to contend against pre-existing enemies, in the fox and some large hawks. The French naturalists have considered the black variety a distinct species, and called it Lepus Magellanicus.* They imagined that Magellan, when talking of an animal under the name of 'conejos' in the Strait of Magellan, referred to this species; but he was alluding to a small cavy, which to this day is thus called by the Spaniards. The Gauchos laughed at the idea of the black kind being different from the grey, and they said that at all events it had not extended its range any further than the grey kind; that the two were never found separate; and that they readily bred together, and produced piebald offspring. Of the latter I now possess a specimen, and it is marked about the head differently from the French specific description. This circumstance shows how cautious naturalists

* Lesson's Zoology of the Voyage of the Coquille, tom. i. p. 168. All the early voyagers, and especially Bougainville, distinctly state that the wolf-like fox was the only native animal on the island. The distinction of the rabbit as a species, is taken from peculiarities in the fur, from the shape of the head, and from the shortness of the ears. I may here observe that the difference between the Irish and English hare rests upon nearly similar characters, only more strongly marked.

should be in making species; for even Cuvier, on looking at the skull of one of these rabbits, thought it was probably distinct!

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. Molina, from a similarity in habits, thought that this was the same with his "culpeu;"† but I have seen both, and they are quite distinct. 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.

At night (17th) we slept on the neck of land at the head of Choiseul Sound, which forms the south-west peninsula. The valley was pretty well sheltered from the cold wind; but there was very little brushwood for fuel. The Gauchos, however, soon found what, to my great surprise, made nearly as hot a fire as coals; this was the skeleton of a bullock lately killed, from which the flesh had been picked by the carrion-hawks. They told me that in winter they often killed a

* I have reason, however, to suspect that there is a field-mouse. The common European rat and mouse have roamed far from the habitations of the settlers. The common hog has also run wild on one islet: all are of a black colour: the boars are very fierce, and have great tusks.

† The "culpeu" is the Canis Magellanicus brought home by Captain King from the Strait of Magellan. It is common in Chile.

beast, cleaned the flesh from the bones with their knives, and then with these same bones roasted the meat for their suppers.

18th.—It rained during nearly the whole day. At night we managed, however, with our saddle-cloths to keep ourselves pretty well dry and warm; but the ground on which we slept was on each occasion nearly in the state of a bog, and there was not a dry spot to sit down on after our day's ride. I have in another part stated how singular it is that there should be absolutely no trees on these islands, although Tierra del Fuego is covered by one large forest. The largest bush in the island (belonging to the family of Compositæ) is scarcely so tall as our gorse. The best fuel is afforded by a green little bush about the size of common heath, which has the useful property of burning while fresh and green. It was very surprising to see the Gauchos, in the midst of rain and everything soaking wet, with nothing more than a tinder-box and piece of rag, immediately make a fire. They sought beneath the tufts of grass and bushes for a few dry twigs, and these they rubbed into fibres; then surrounding them with coarser twigs, something like a bird's nest, they put the rag with its spark of fire in the middle and covered it up. The nest being then held up to the wind, by degrees it smoked more and more, and at last burst out in flames. I do not think any other method would have had a chance of succeeding with such damp materials.

19th.—Each morning, from not having ridden for some time previously, I was very stiff. I was surprised to hear the Gauchos, who have from infancy almost lived on horseback, say that, under similar circumstances, they always suffer. St. Jago told me, that having been confined for three months by illness, he went out hunting wild cattle, and in consequence, for the next two days, his thighs were so stiff that he was obliged to lie in bed. This shows that the Gauchos, although they do not appear to do so, yet really must exert much muscular effort in riding. The hunting wild cattle, in a country so difficult to pass as this is on account of the swampy ground, must be very hard work. The Gauchos say they often pass at full speed over ground which would be impassable at a slower pace; in the same manner as a man is able to skate over thin ice. When hunting, the party endeavours to get as close as possible to the herd without being discovered. Each man carries four or five pair of the bolas; these he throws one after the other at as many cattle, which, when once

entangled, are left for some days, till they become a little exhausted by hunger and struggling. They are then let free and driven towards a small herd of tame animals, which have been brought to the spot on purpose. From their previous treatment, being too much terrified to leave the herd, they are easily driven, if their strength last out, to the settlement.

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.

The geological structure of these islands is in most respects simple. The lower country consists of clay-slate and sandstone, containing fossils, very closely related to, but not identical with, those found in the Silurian formations of Europe; the hills are formed of white granular quartz rock. The strata of the latter are frequently arched with perfect symmetry, and the appearance of some of the masses is in consequence most singular. Pernety* has devoted several pages to the description of a Hill of Ruins, the successive strata of which he has justly compared to the seats of an amphitheatre. The quartz rock must have been quite pasty when it underwent such remarkable flexures without being shattered into fragments. As the quartz insensibly passes into the sandstone, it seems probable that the former owes its origin to the sandstone having been heated to such a degree that it became viscid, and upon cooling crystallized. While in the soft state it must have been pushed up through the overlying beds.

In many parts of the island the bottoms of the valleys are covered in an extraordinary manner by myriads of great loose angular fragments of the quartz rock, forming "streams of stones." These have

* Pernety, Voyage aux Isles Malouines, p. 526.

been mentioned with surprise by every voyager since the time of Pernety. The blocks are not waterworn, their angles being only a little blunted; they vary in size from one or two feet in diameter to ten, or even more than twenty times as much. They are not thrown together into irregular piles, but are spread out into level sheets or great streams. It is not possible to ascertain their thickness, but the water of small streamlets can be heard trickling through the stones many feet below the surface. The actual depth is probably great, because the crevices between the lower fragments must long ago have been filled up with sand. The width of these sheets of stones varies from a few hundred feet to a mile; but the peaty soil daily encroaches on the borders, and even forms islets wherever a few fragments happen to lie close together. In a valley south of Berkeley Sound, which some of our party called the "great valley of fragments," it was necessary to cross an uninterrupted band half a mile wide, by jumping from one pointed stone to another. So large were the fragments, that being overtaken by a shower of rain, I readily found shelter beneath one of them.

Their little inclination is the most remarkable circumstance in these "streams of stones." On the hill-sides I have seen them sloping at an angle of ten degrees with the horizon; but in some of the level, broad-bottomed valleys, the inclination is only just sufficient to be clearly perceived. On so rugged a surface there was no means of measuring the angle; but to give a common illustration, I may say that the slope would not have checked the speed of an English mail-coach. In some places, a continuous stream of these fragments followed up the course of a valley, and even extended to the very crest of the hill. On these crests huge masses, exceeding in dimensions any small building, seemed to stand arrested in their headlong course: there, also, the curved strata of the archways lay piled on each other, like the ruins of some vast and ancient cathedral. In endeavouring to describe these scenes of violence one is tempted to pass from one simile to another. We may imagine that streams of white lava had flowed from many parts of the mountains into the lower country, and that when solidified they had been rent by some enormous convulsion into myriads of fragments. The expression "streams of stones," which immediately occurred to every one, conveys the same idea. These

scenes are on the spot rendered more striking by the contrast of the low, rounded forms of the neighbouring hills.

I was interested by finding on the highest peak of one range (about 700 feet above the sea) a great arched fragment, lying on its convex side, or back downwards. Must we believe that it was fairly pitched up in the air, and thus turned? Or, with more probability, that there existed formerly a part of the same range more elevated than the point on which this monument of a great convulsion of nature now lies. As the fragments in the valleys are neither rounded nor the crevices filled up with sand, we must infer that the period of violence was subsequent to the land having been raised above the waters of the sea. In a transverse section within these valleys, the bottom is nearly level, or rises but very little towards either side. Hence the fragments appear to have travelled from the head of the valley; but in reality it seems more probable that they have been hurled down from the nearest slopes; and that since, by a vibratory movement of overwhelming force,* the fragments have been levelled into one continuous sheet. If during the earthquake† which in 1835 overthrew Concepcion, in Chile, it was thought wonderful that small bodies should have been pitched a few inches from the ground, what must we say to a movement which has caused fragments many tons in weight, to move onwards like so much sand on a vibrating board, and find their level? I have seen, in the Cordillera of the Andes, the evident marks where stupendous mountains have been broken into pieces like so much thin crust, and the strata thrown on their vertical edges; but never did any scene, like these "streams of stones," so forcibly convey to my mind the idea of a convulsion, of which in historical records we might in vain seek for any counterpart: yet the progress of knowledge will probably some day give a simple explanation of this phenomenon, as it already has of the so long-thought

* "Nous n'avons pas été moins saisis d'étonnement Ã la vÃ»e de l'innombrable quantité de pierres de toutes grandeurs, bouleversées les unes sur les autres, et cependant rangées, comme si elles avoient été amoncelées négligemment pour remplir des ravins. On ne se lassoit pas d'admirer les effets prodigieux de la nature."—*Pernety*, p. 526.

† An inhabitant of Mendoza, and hence well capable of judging, assured me that, during the several years he had resided on these islands, he had never felt the slightest shock of an earthquake.

inexplicable transportal of the erratic boulders, which are strewed over the plains of Europe.

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 waterfowl 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 wilfully cruel. Another day, having placed myself between a penguin (Aptenodytes 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 backwards. 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 night-time. In diving, its little wings are used as fins; but on the land, as front legs. When crawling, it may be said on four legs, through the tussucks 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 any one at first sight to be sure that it was not a fish leaping for sport.

Two kinds of geese frequent the Falklands. The upland species (Anas Magellanica) is common, in pairs and in small flocks, throughout the island. They do not migrate, but build on the small outlying islets. This is supposed to be from fear of the foxes: and it is perhaps from the same cause that these birds, though very tame by day, are shy and wild in the dusk of the evening. They live entirely on veg-

etable matter. The rock-goose, so called from living exclusively on the sea-beach (Anas antarctica), is common both here and on the west coast of America, as far north as Chile. In the deep and retired channels of Tierra del Fuego, the snow-white gander, invariably accompanied by his darker consort, and standing close by each other on some distant rocky point, is a common feature in the landscape.

In these islands a great loggerheaded 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, loggerheaded 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 Deinornis, possess only rudimentary representatives of wings. The steamer is able to dive only to a very short distance. It feeds entirely on shell-fish 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.

In Tierra del Fuego, as well as at the Falkland Islands, I made many observations on the lower marine animals,* but they are of little gen-

* I was surprised to find, on counting the eggs of a large white Doris (this sea slug was three and a half inches long), how extraordinarily numerous they were. From two to five eggs (each three-thousandths of an inch in diameter) were contained in a spherical little case. These were arranged two deep in transverse rows forming a ribbon. The ribbon adhered by its edge to the rock in an oval spire. One which I found, measured nearly

eral interest. I will mention only one class of facts, relating to certain zoophytes in the more highly organized division of that class. Several genera (Flustra, Eschara, Cellaria, Crisia, and others) agree in having singular moveable organs (like those of Flustra avicularia, found in the European seas) attached to their cells. The organ, in the greater number of cases, very closely resembles the head of a vulture; but the lower mandible can be opened much wider than in a real bird's beak. The head itself possesses considerable powers of movement, by means of a short neck. In one zoophyte the head itself was fixed, but the lower jaw free: in another it was replaced by a triangular hood, with a beautifully-fitted trap-door, which evidently answered to the lower mandible. In the greater number of species, each cell was provided with one head, but in others each cell had two.

The young cells at the end of the branches of these corallines contain quite immature polypi, yet the vulture-heads attached to them, though small, are in every respect perfect. When the polypus was removed by a needle from any of the cells, these organs did not appear in the least affected. When one of the vulture-like heads was cut off from a cell, the lower mandible retained its power of opening and closing. Perhaps the most singular part of their structure is, that when there were more than two rows of cells on a branch, the central cells were furnished with these appendages, of only one-fourth the size of the outside ones. Their movements varied according to the species; but in some I never saw the least motion; while others, with the lower mandible generally wide open, oscillated backwards and forwards at the rate of about five seconds each turn; others moved rapidly and by starts. When touched with a needle, the beak generally seized the point so firmly, that the whole branch might be shaken.

These bodies have no relation whatever with the production of the eggs or gemmules, as they are formed before the young polypi appear in the cells at the end of the growing branches; as they move

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twenty inches in length and half in breadth. By counting how many balls were contained in a tenth of an inch in the row, and how many rows in an equal length of the ribbon, on the most moderate computation there were six hundred thousand eggs. Yet this Doris was certainly not very common: although I was often searching under the stones, I saw only seven individuals. *No fallacy is more common with naturalists, than that the numbers of an individual species depend on its powers of propagation*.

independently of the polypi, and do not appear to be in any way connected with them; and as they differ in size on the outer and inner rows of cells, I have little doubt, that in their functions, they are related rather to the horny axis of the branches than to the polypi in the cells. The fleshy appendage at the lower extremity of the sea-pen (described at Bahia Blanca) also forms part of the zoophyte, as a whole, in the same manner as the roots of a tree form part of the whole tree, and not of the individual leaf or flower-buds.

In another elegant little coralline (Crisia?), each cell was furnished with a long-toothed bristle, which had the power of moving quickly. Each of these bristles and each of the vulture-like heads generally moved quite independently of the others, but sometimes all on both sides of a branch, sometimes only those on one side, moved together coinstantaneously; sometimes each moved in regular order one after another. In these actions we apparently behold as perfect a transmission of will in the zoophyte, though composed of thousands of distinct polypi, as in any single animal. The case, indeed, is not different from that of the sea-pens, which, when touched, drew themselves into the sand on the coast of Bahia Blanca. I will state one other instance of uniform action, though of a very different nature, in a zoophyte closely allied to Clytia, and therefore very simply organized. Having kept a large tuft of it in a basin of salt-water, when it was dark I found that as often as I rubbed any part of a branch, the whole became strongly phosphorescent with a green light: I do not think I ever saw any object more beautifully so. But the remarkable circumstance was, that the flashes of light always proceeded up the branches, from the base towards the extremities.

The examination of these compound animals was always very interesting to me. What can be more remarkable than to see a plant-like body producing an egg, capable of swimming about and of choosing a proper place to adhere to, which then sprouts into branches, each crowded with innumerable distinct animals, often of complicated organizations? The branches, moreover, as we have just seen, sometimes possess organs capable of movement and independent of the polypi. Surprising as this union of separate individuals in a common stock must always appear, every tree displays the same fact, for buds must be considered as individual plants. It is, however, natural to consider a polypus, furnished with a mouth, intestines, and other

organs, as a distinct individual, whereas the individuality of a leaf-bud is not easily realised; so that the union of separate individuals in a common body is more striking in a coralline than in a tree. Our conception of a compound animal, where in some respects the individuality of each is not completed, may be aided, by reflecting on the production of two distinct creatures by bisecting a single one with a knife, or where Nature herself performs the task of bisection. We may consider the polypi in a zoophyte, or the buds in a tree, as cases where the division of the individual has not been completely effected. Certainly in the case of trees, and judging from analogy in that of corallines, the individuals propagated by buds seem more intimately related to each other, than eggs or seeds are to their parents. It seems now pretty well established that plants propagated by buds all partake of a common duration of life; and it is familiar to every one, what singular and numerous peculiarities are transmitted with certainty, by buds, layers, and grafts, which by seminal propagation never or only casually reappear.