

The Voyage of the Beagle

by Charles Darwin

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Chapter 5 - Bahia Blanca

The Beagle arrived here on the 24th of August, and a week afterwards sailed for the Plata. With Captain Fitz Roy's consent I was left behind, to travel by land to Buenos Ayres. 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 harbour.

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 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. These 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.

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 according to Mr. Owen, nearest to the Cape Anteater, but in some other respects it approaches to the armadilloes. Fourthly, the Mylodon Darwinii, a closely related genus of little inferior size. Fifthly, another gigantic edental quadruped. Sixthly, a large animal, with an osseous coat in compartments, very like that of an armadillo. Seventhly, an extinct kind of horse, to which I shall have again to refer. Eighthly, a tooth of a Pachydermatous animal, probably the same with the Macrauchenia, a huge beast with a long neck like a camel, which I shall also refer to again. Lastly, the Toxodon, perhaps one of the strangest animals ever discovered: in size it equalled an elephant or megatherium, but the structure of its teeth, as Mr. Owen states, 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 and 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. At the distance of about thirty miles from Punta Alta, in a cliff of red earth, I found several fragments of bones, some of large size. Among them were the teeth of a gnawer, equalling in size and closely resembling those of the Capybara, whose habits have been described; and therefore, probably, an aquatic animal. There was also part of the head of a Ctenomys; the species being different from the Tucutuco, but with a close general resemblance. The red earth, like that of the Pampas, in which these remains were embedded, contains, according to Professor Ehrenberg, eight fresh-water and one salt-water infusorial animalcule; therefore, probably, it was an estuary deposit.

The remains at Punta Alta were embedded in stratified gravel and reddish mud, just such as the sea might now wash up on a shallow bank. They were associated with twenty- three species of shells, of which thirteen are recent and four others very closely related to recent forms. [1] From the bones of the Scelidotherium, including even the knee-cap, being intombed in their proper relative positions, and from the osseous armour of the great armadillo-like animal being so well preserved, together with the bones of one of its legs, we may feel assured that these remains were fresh and united by their ligaments, when deposited in the gravel together with the shells. [2] Hence we have good evidence that the above enumerated gigantic quadrupeds, more different from those of the present day than the oldest of the tertiary quadrupeds of Europe, lived whilst the sea was peopled with most of its present inhabitants;

and we have confirmed that remarkable fact so often insisted on by Mr. Lyell, namely, that the "longevity of the species in the mammalia is upon the whole inferior to that of the testacea." [3]

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 [4] 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 downwards 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 beds including the above fossil remains, stand only from fifteen to twenty feet above the level of high-water; and hence the elevation of the land has been small (without there has been an intercalated period of subsidence, of which we have no evidence) since the great quadrupeds wandered over the surrounding plains; and the external features of the country must then have been very nearly the same as now. What, it may naturally be asked, was the character of the vegetation at that period; was the country as wretchedly sterile as it now is? As so many of the co-embedded shells are the same with those now living in the bay, I was at first inclined to think that the former vegetation was probably similar to the existing one; but this would have been an erroneous inference for some of these same shells live on the luxuriant coast of Brazil; and generally, the character of the inhabitants of the sea are useless as guides to judge of those on the land. Nevertheless, from the following considerations, I do not believe that the simple fact of many gigantic quadrupeds having lived on the plains round Bahia Blanca, is any sure guide that they formerly were clothed with a luxuriant vegetation: I have no doubt that the sterile country a little southward, near the Rio Negro, with its scattered thorny trees, would support many and large quadrupeds.

That large animals require a luxuriant vegetation, has been a general assumption which has passed from one work to another; but I do not hesitate to say that it is completely false, and that it has vitiated the reasoning of geologists on some points of great interest in the ancient history of the world. The prejudice has probably been derived from India, and the Indian islands, where troops of elephants, noble forests, and impenetrable jungles, are associated together in every one's mind. If, however, we refer to any work of travels through the southern parts of Africa, we shall find allusions in almost every page either to the desert character of the country, or to the numbers of large animals inhabiting it. The same thing is rendered evident by the many engravings which have been published of various parts of the interior. When the Beagle was at Cape Town, I made an excursion of some days' length into the country, which at least was sufficient to render that which I had read more fully intelligible.

Dr. Andrew Smith, who, at the head of his adventurous party, has lately succeeded in passing the Tropic of Capricorn, informs me that, taking into consideration the whole of the southern part of Africa, there can be no doubt of its being a sterile country. On the southern and south-eastern coasts there are some fine forests, but with these exceptions, the traveller may pass for days together through open plains, covered by a poor and scanty vegetation. It is difficult to convey any accurate idea of degrees of comparative fertility; but it may be safely said that the amount of vegetation supported at any one time [5] by Great Britain, exceeds, perhaps even tenfold, the quantity on an equal area, in the interior parts of Southern Africa. The fact that bullock-waggons can travel in any direction, excepting near the coast, without more than occasionally half an hour's delay in cutting down bushes, gives, perhaps, a more definite notion of the scantiness of the vegetation. Now, if we look to the animals inhabiting these wide plains, we shall find their numbers extraordinarily great, and their bulk immense. We must enumerate the elephant, three species of rhinoceros, and probably, according to Dr. Smith, two others, the hippopotamus, the giraffe, the bos caffer as large as a full-grown bull, and the elan -- but little less, two zebras, and the quaccha, two gnus, and several antelopes even larger than these latter animals. It may be supposed that although the species are numerous, the individuals of each kind are few. By the kindness of Dr. Smith, I am enabled to show that the case is very different. He informs me, that in lat. 24 degs., in one day's march with the bullock-waggons, he saw, without wandering to any great distance on either side, between one hundred and one hundred and fifty rhinoceroses, which belonged to three species:

the same day he saw several herds of giraffes, amounting together to nearly a hundred; and that although no elephant was observed, yet they are found in this district. At the distance of a little more than one hour's march from their place of encampment on the previous night, his party actually killed at one spot eight hippopotamuses, and saw many more. In this same river there were likewise crocodiles. Of course it was a case quite extraordinary, to see so many great animals crowded together, but it evidently proves that they must exist in great numbers. Dr. Smith describes the country passed through that day, as "being thinly covered with grass, and bushes about four feet high, and still more thinly with mimosa-trees." The waggons were not prevented travelling in a nearly straight line.

Besides these large animals, every one the least acquainted with the natural history of the Cape, has read of the herds of antelopes, which can be compared only with the flocks of migratory birds. The numbers indeed of the lion, panther, and hyaena, and the multitude of birds of prey, plainly speak of the abundance of the smaller quadrupeds: one evening seven lions were counted at the same time prowling round Dr. Smith's encampment. As this able naturalist remarked to me, the carnage each day in Southern Africa must indeed be terrific! I confess it is truly surprising how such a number of animals can find support in a country producing so little food. The larger quadrupeds no doubt roam over wide tracts in search of it; and their food chiefly consists of underwood, which probably contains much nutriment in a small bulk. Dr. Smith also informs me that the vegetation has a rapid growth; no sooner is a part consumed, than its place is supplied by a fresh stock. There can be no doubt, however, that our ideas respecting the apparent amount of food necessary for the support of large quadrupeds are much exaggerated: it should have been remembered that the camel, an animal of no mean bulk, has always been considered as the emblem of the desert.

The belief that where large quadrupeds exist, the vegetation must necessarily be luxuriant, is the more remarkable, because the converse is far from true. Mr. Burchell observed to me that when entering Brazil, nothing struck him more forcibly than the splendour of the South American vegetation contrasted with that of South Africa, together with the absence of all large quadrupeds. In his Travels, [6] he has suggested that the comparison of the respective weights (if there were sufficient data) of an equal number of the largest herbivorous quadrupeds of each country would be extremely curious. If we take on the one side, the elephant, [7] hippopotamus, giraffe, bos caffer, elan, certainly three, and probably five species of rhinoceros; and on the American side, two tapirs, the guanaco, three deer, the vicuna, peccari, capybara (after which we must choose from the monkeys to complete the number), and then place these two groups alongside each other, it is not easy to conceive ranks more disproportionate in size. After the above facts, we are compelled to conclude, against anterior probability, [8] that among the mammalia there exists no close relation between the bulk of the species, and the quantity of the vegetation, in the countries which they inhabit.

With regard to the number of large quadrupeds, there certainly exists no quarter of the globe which will bear comparison with Southern Africa. After the different statements which have been given, the extremely desert character of that region will not be disputed. In the European division of the world, we must look back to the tertiary epochs, to find a condition of things among the mammalia, resembling that now existing at the Cape of Good Hope. Those tertiary epochs, which we are apt to consider as abounding to an astonishing degree with large animals, because we find the remains of many ages accumulated at certain spots, could hardly boast of more large quadrupeds than Southern Africa does at present. If we speculate on the condition of the vegetation during these epochs we are at least bound so far to consider existing analogies, as not to urge as absolutely necessary a luxuriant vegetation, when we see a state of things so totally different at the Cape of Good Hope.

We know [9] that the extreme regions of North America, many degrees beyond the limit where the ground at the depth of a few feet remains perpetually congealed, are covered by forests of large and tall trees. In a like manner, in Siberia, we have woods of birch, fir, aspen, and larch, growing in a latitude [10] (64 degs.) where the mean temperature of the air falls below the freezing point, and where the earth is so completely frozen, that the carcass of an animal embedded in it is perfectly preserved. With these facts we must grant, as far as quantity alone of vegetation is concerned, that the great quadrupeds of the later tertiary epochs might, in most parts of Northern Europe and Asia, have lived on the spots where their remains are now found. I do not here speak of the kind of vegetation necessary for their support; because, as there is evidence of physical changes, and as the animals have become extinct, so may we suppose that the species of plants have likewise been changed.

These remarks, I may be permitted to add, directly bear on the case of the Siberian animals preserved in ice. The firm conviction of the necessity of a vegetation possessing a character of tropical luxuriance, to support such large animals, and the impossibility of reconciling this with the proximity of perpetual congelation, was one chief cause of the several theories of sudden revolutions of climate, and of overwhelming catastrophes, which were invented to account for their entombment. I am far from supposing that the climate has not changed since the period when those animals lived, which now lie buried in the ice. At present I only wish to show, that as far as quantity of food alone is concerned, the ancient rhinoceroses might have roamed over the steppes of central Siberia (the northern parts probably being under water) even in their present condition, as well as the living rhinoceroses and

elephants over the Karros of Southern Africa.

I will now give an account of the habits of some of the more interesting birds which are common on the wild plains of Northern Patagonia: and first for the largest, or South American ostrich. The ordinary habits of the ostrich are familiar to every one. 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 Blas, 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 appear 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. Captain Sturt, [\[11\]](#) when descending the Murrumbidgee, in Australia, saw two emus in the act of swimming.

The inhabitants of the country readily distinguish, even at a distance, the cock bird from the hen. The former is larger and darker-coloured, [\[12\]](#) 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 that they have been known to attack a man on horseback, trying to kick and leap on him. My informer pointed out to me an old man, whom he had seen much terrified by one chasing him. I observe in Burchell's travels in South Africa, that he remarks, "Having killed a male ostrich, and the feathers being dirty, it was said by the Hottentots to be a nest bird." I understand that the male emu in the Zoological Gardens takes charge of the nest: this habit, therefore, is common to the family.

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. [\[13\]](#) Although this habit at first appears very strange, I think the cause may be explained in a simple manner. The number of eggs in the nest varies from twenty to forty, and even to fifty; and according to Azara, some times to seventy or eighty. Now, although it is most probable, from the number of eggs found in one district being so extraordinarily great in proportion to the parent birds, and likewise from the state of the ovarium of the hen, that she may in the course of the season lay a large number, yet the time required must be very long. Azara states, [\[14\]](#) that a female in a state of domestication laid seventeen eggs, each at the interval of three days one from another. If the hen was obliged to hatch her own eggs, before the last was laid the first probably would be addled; but if each laid a few eggs at successive periods, in different nests, and several hens, as is stated to be the case, combined together, then the eggs in one collection would be nearly of the same age. If the number of eggs in one of these nests is, as I believe, not greater on an average than the number laid by one female in the season, then there must be as many nests as females, and each cock bird will have its fair share of the labour of incubation; and that during a period when the females probably could not sit, from not having finished laying. [\[15\]](#) I have before mentioned the great numbers of huachos, or deserted eggs; so that in one day's hunting twenty were found in this state. It appears odd that so many should be wasted. Does it not arise from the difficulty of several females associating together, and finding a male ready to undertake the office of incubation? It is evident that there must at first be some degree of association between at least two females; otherwise the eggs would remain scattered over the wide plain, at distances far too great to allow of the male collecting them into one nest: some authors have believed that the scattered eggs were deposited for the young birds to feed on. This can hardly be the case in America, because the huachos, although often found addled and putrid, are generally whole.

When at the Rio Negro in Northern Patagonia, I repeatedly heard the Gauchos talking of a very rare bird which they called Avestruz Petise. They described it as being less than the common ostrich (which is there abundant), but with a very close general resemblance. They said its colour was dark and mottled, and that its legs were shorter, and feathered lower down than those of the common

ostrich. It is more easily caught by the bolas than the other species. The few inhabitants who had seen both kinds, affirmed they could distinguish them apart from a long distance. The eggs of the small species appeared, however, more generally known; and it was remarked, with surprise, that they were very little less than those of the Rhea, but of a slightly different form, and with a tinge of pale blue. This species occurs most rarely on the plains bordering the Rio Negro; but about a degree and a half further south they are tolerably abundant. When at Port Desire, in Patagonia (lat. 48 degs.), Mr. Martens shot an ostrich; and I looked at it, forgetting at the moment, in the most unaccountable manner, the whole subject of the Petises, and thought it was a not full-grown bird of the common sort. It was cooked and eaten before my memory returned. Fortunately the head, neck, legs, wings, many of the larger feathers, and a large part of the skin, had been preserved; and from these a very nearly perfect specimen has been put together, and is now exhibited in the museum of the Zoological Society. Mr. Gould, in describing this new species, has done me the honour of calling it after my name.

Among the Patagonian Indians in the Strait of Magellan, we found a half Indian, who had lived some years with the tribe, but had been born in the northern provinces. I asked him if he had ever heard of the Avestruz Petise? He answered by saying, " Why, there are none others in these southern countries." He informed me that the number of eggs in the nest of the petise is considerably less than in that of the other kind, namely, not more than fifteen on an average, but he asserted that more than one female deposited them. At Santa Cruz we saw several of these birds. They were excessively wary: I think they could see a person approaching when too far off to be distinguished themselves. In ascending the river few were seen; but in our quiet and rapid descent, many, in pairs and by fours or fives, were observed. It was remarked that this bird did not expand its wings, when first starting at full speed, after the manner of the northern kind. In conclusion I may observe, that the *Struthio rhea* inhabits the country of La Plata as far as a little south of the Rio Negro in lat. 41 degs., and that the *Struthio Darwinii* takes its place in Southern Patagonia; the part about the Rio Negro being neutral territory. M. A. d'Orbigny, [16] when at the Rio Negro, made great exertions to procure this bird, but never had the good fortune to succeed. Dobrizhoffer [17] long ago was aware of there being two kinds of ostriches, he says, "You must know, moreover, that Emus differ in size and habits in different tracts of land; for those that inhabit the plains of Buenos Ayres and Tucuman are larger, and have black, white and grey feathers; those near to the Strait of Magellan are smaller and more beautiful, for their white feathers are tipped with black at the extremity, and their black ones in like manner terminate in white."

A very singular little bird, *Tinochorus rumicivorus*, is here common: in its habits and general appearance, it nearly equally partakes of the characters, different as they are, of the quail and snipe. The *Tinochorus* is found in the whole of southern South America, wherever there are sterile plains, or open dry pasture land. It frequents in pairs or small flocks the most desolate places, where scarcely another living creature can exist. Upon being approached they squat close, and then are very difficult to be distinguished from the ground. When feeding they walk rather slowly, with their legs wide apart. They dust themselves in roads and sandy places, and frequent particular spots, where they may be found day after day: like partridges, they take wing in a flock. In all these respects, in the muscular gizzard adapted for vegetable food, in the arched beak and fleshy nostrils, short legs and form of foot, the *Tinochorus* has a close affinity with quails. But as soon as the bird is seen flying, its whole appearance changes; the long pointed wings, so different from those in the gallinaceous order, the irregular manner of flight, and plaintive cry uttered at the moment of rising, recall the idea of a snipe. The sportsmen of the Beagle unanimously called it the short-billed snipe. To this genus, or rather to the family of the Waders, its skeleton shows that it is really related.

The *Tinochorus* is closely related to some other South American birds. Two species of the genus *Attagis* are in almost every respect ptarmigans in their habits; one lives in Tierra del Fuego, above the limits of the forest land; and the other just beneath the snow-line on the Cordillera of Central Chile. A bird of another closely allied genus, *Chionis alba*, is an inhabitant of the antarctic regions; it feeds on sea-weed and shells on the tidal rocks. Although not web footed, from some unaccountable habit, it is frequently met with far out at sea. This small family of birds is one of those which, from its varied relations to other families, although at present offering only difficulties to the systematic naturalist, ultimately may assist in revealing the grand scheme, common to the present and past ages, on which organized beings have been created.

The genus *Furnarius* contains several species, all small birds, living on the ground, and inhabiting open dry countries. In structure they cannot be compared to any European form. Ornithologists have generally included them among the creepers, although opposed to that family in every habit. The best known species is the common oven-bird of La Plata, the Casara or housemaker of the Spaniards. The nest, whence it takes its name, is placed in the most exposed situations, as on the top of a post, a bare rock, or on a cactus. It is composed of mud and bits of straw, and has strong thick walls: in shape it precisely resembles an oven, or depressed beehive. The opening is large and arched, and directly in front, within the nest, there is a partition, which reaches nearly to the roof, thus forming a passage or antechamber to the true nest.

Another and smaller species of *Furnarius* (*F. cunicularius*), resembles the oven-bird in the general reddish tint of its plumage, in a

peculiar shrill reiterated cry, and in an odd manner of running by starts. From its affinity, the Spaniards call it Casarita (or little housebuilder), although its nidification is quite different. The Casarita builds its nest at the bottom of a narrow cylindrical hole, which is said to extend horizontally to nearly six feet under ground. Several of the country people told me, that when boys, they had attempted to dig out the nest, but had scarcely ever succeeded in getting to the end of the passage. The bird chooses any low bank of firm sandy soil by the side of a road or stream. Here (at Bahia Blanca) the walls round the houses are built of hardened mud, and I noticed that one, which enclosed a courtyard where I lodged, was bored through by round holes in a score of places. On asking the owner the cause of this he bitterly complained of the little casarita, several of which I afterwards observed at work. It is rather curious to find how incapable these birds must be of acquiring any notion of thickness, for although they were constantly flitting over the low wall, they continued vainly to bore through it, thinking it an excellent bank for their nests. I do not doubt that each bird, as often as it came to daylight on the opposite side, was greatly surprised at the marvellous fact.

I have already mentioned nearly all the mammalia common in this country. Of armadilloes three species occur namely, the *Dasyopus minutus* or *_pichy_*, the *D. villosus* or *_peludo_*, and the *_apar_*. The first extends ten degrees further south than any other kind; a fourth species, the *_Mulita_*, does not come as far south as Bahia Blanca. The four species have nearly similar habits; the *_peludo_*, however, is nocturnal, while the others wander by day over the open plains, feeding on beetles, larvae, roots, and even small snakes. The *_apar_*, commonly called *_mataco_*, is remarkable by having only three moveable bands; the rest of its tessellated covering being nearly inflexible. It has the power of rolling itself into a perfect sphere, like one kind of English woodlouse. In this state it is safe from the attack of dogs; for the dog not being able to take the whole in its mouth, tries to bite one side, and the ball slips away. The smooth hard covering of the *_mataco_* offers a better defence than the sharp spines of the hedgehog. The *_pichy_* prefers a very dry soil; and the sand-dunes near the coast, where for many months it can never taste water, is its favourite resort: it often tries to escape notice, by squatting close to the ground. In the course of a day's ride, near Bahia Blanca, several were generally met with. The instant one was perceived, it was necessary, in order to catch it, almost to tumble off one's horse; for in soft soil the animal burrowed so quickly, that its hinder quarters would almost disappear before one could alight. It seems almost a pity to kill such nice little animals, for as a Gaucho said, while sharpening his knife on the back of one, "Son tan mansos" (they are so quiet).

Of reptiles there are many kinds: one snake (a *Trigonocephalus*, or *Cophias* [18]), 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 distinctly 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 pupil 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 colour. 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 colour 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 Maldonado, 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 were many kinds, but only one (*Proctotretus multimaculatus*) remarkable from its habits. It lives on the bare sand near the sea coast, and from its mottled colour, 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.

I will here add a few remarks on the hybernation of animals in this part of South America. When we first arrived at Bahia Blanca, September 7th, 1832, we thought nature had granted scarcely a living creature to this sandy and dry country. By digging, however, in the ground, several insects, large spiders, and lizards were found in a half-torpid state. On the 15th, a few animals began to appear, and by the 18th (three days from the equinox), everything announced the commencement of spring. The plains were ornamented by the flowers of a pink wood-sorrel, wild peas, cenotherae, and geraniums; and the birds began to lay their eggs. Numerous Lamellicorn and Heteromorous insects, the latter remarkable for their deeply sculptured bodies, were slowly crawling about; while the lizard tribe, the constant inhabitants of a sandy soil, darted about in every direction. During the first eleven days, whilst nature was dormant, the mean temperature taken from observations made every two hours on board the Beagle, was 51 degs.; and in the middle of the day the thermometer seldom ranged above 55 degs. On the eleven succeeding days, in which all living things became so animated, the mean was 58 degs., and the range in the middle of the day 7 between 60 and 70 degs. Here, then, an increase of seven degrees in mean temperature, but a greater one of extreme heat, was sufficient to awake the functions of life. At Monte Video, from which we had just before sailed, in the twenty-three days included between the 26th of July and the 19th of August, the mean temperature from 276 observations was 58.4 degs.; the mean hottest day being 65.5 degs., and the coldest 46 degs. The lowest point to which the thermometer fell was 41.5 degs., and occasionally in the middle of the day it rose to 69 or 70 degs. Yet with this high temperature, almost every beetle, several genera of spiders, snails, and land-shells, toads and lizards were all lying torpid beneath stones. But we have seen that at Bahia Blanca, which is four degrees southward and therefore with a climate only a very little colder, this same temperature with a rather less extreme heat, was sufficient to awake all orders of animated beings. This shows how nicely the stimulus required to arouse hybernating animals is governed by the usual climate of the district, and not by the absolute heat. It is well known that within the tropics, the hybernation, or more properly aestivation, of animals is determined not by the temperature, but by the times of drought. Near Rio de Janeiro, I was at first surprised to observe, that, a few days after some little depressions had been filled with water, they were peopled by numerous full-grown shells and beetles, which must have been lying dormant. Humboldt has related the strange accident of a hovel having been erected over a spot where a young crocodile lay buried in the hardened mud. He adds, "The Indians often find enormous boas, which they call Uji or water serpents, in the same lethargic state. To reanimate them, they must be irritated or wetted with water."

I will only mention one other animal, a zoophyte (I believe *Virgularia Patagonica*), a kind of sea-pen. It consists of a thin, straight, fleshy stem, with alternate rows of polypi on each side, and surrounding an elastic stony axis, varying in length from eight inches to two feet. The stem at one extremity is truncate, but at the other is terminated by a vermiform fleshy appendage. The stony axis which gives strength to the stem may be traced at this extremity into a mere vessel filled with granular matter. At low water hundreds of these zoophytes might be seen, projecting like stubble, with the truncate end upwards, a few inches above the surface of the muddy sand. When touched or pulled they suddenly drew themselves in with force, so as nearly or quite to disappear. By this action, the highly elastic axis must be bent at the lower extremity, where it is naturally slightly curved; and I imagine it is by this elasticity alone that the zoophyte is enabled to rise again through the mud. Each polypus, though closely united to its brethren, has a distinct mouth, body, and tentacula. Of these polypi, in a large specimen, there must be many thousands; yet we see that they act by one movement: they have also one central axis connected with a system of obscure circulation, and the ova are produced in an organ distinct from the separate individuals. [19] Well may one be allowed to ask, what is an individual? It is always interesting to discover the foundation of the strange tales of the old voyagers; and I have no doubt but that the habits of this *Virgularia* explain one such case. Captain Lancaster, in his voyage [20] in 1601, narrates that on the sea-sands of the Island of Sombrero, in the East Indies, he "found a small twig growing up like a young tree, and on offering to pluck it up it shrinks down to the ground, and sinks, unless held very hard. On being plucked up, a great worm is found to be its root, and as the tree groweth in greatness, so doth the worm diminish, and as soon as the worm is entirely turned into a tree it rooteth in the earth, and so becomes great. This transformation is one of the strangest wonders that I saw in all my travels: for if this tree is plucked up, while young, and the leaves and bark stripped off, it becomes a hard stone when dry, much like white coral: thus is this worm twice transformed into different natures. Of these we gathered and brought home many."

During my stay at Bahia Blanca, while waiting for the Beagle, the place was in a constant state of excitement, from rumours of wars and victories, between the troops of Rosas and the wild Indians. One day an account came that a small party forming one of the postas on the line to Buenos Ayres, had been found all murdered. The next day three hundred men arrived from the Colorado, under the command of Commandant Miranda. A large portion of these men were Indians (mansos, or tame), belonging to the tribe of the Cacique Bernantio. They passed the night here; and it was impossible to conceive anything more wild and savage than the scene of their bivouac. Some drank till they were intoxicated; others swallowed the steaming blood of the cattle slaughtered for their suppers, and then, being sick from drunkenness, they cast it up again, and were besmeared with filth and gore.

Nam simul expletus dapibus, vinoque sepultus Cervicem inflexam posuit, jacuitque per antrum Immensus, sanie eructans, ac frusta cruenta Per somnum commixta mero.

In the morning they started for the scene of the murder, with orders to follow the "rastros," or tracks, even if it led them to Chile. We subsequently heard that the wild Indians had escaped into the great Pampas, and from some cause the track had been missed. One glance at the rastros tells these people a whole history. Supposing they examine the track of a thousand horses, they will soon guess the number of mounted ones by seeing how many have cantered; by the depth of the other impressions, whether any horses were loaded with cargoes; by the irregularity of the footsteps, how far tired; by the manner in which the food has been cooked, whether the pursued travelled in haste; by the general appearance, how long it has been since they passed. They consider a rastro of ten days or a fortnight, quite recent enough to be hunted out. We also heard that Miranda struck from the west end of the Sierra Ventana, in a direct line to the island of Cholechel, situated seventy leagues up the Rio Negro. This is a distance of between two and three hundred miles, through a country completely unknown. What other troops in the world are so independent? With the sun for their guide, mare's flesh for food, their saddle-cloths for beds, -- as long as there is a little water, these men would penetrate to the end of the world.

A few days afterwards I saw another troop of these banditti-like soldiers start on an expedition against a tribe of Indians at the small Salinas, who had been betrayed by a prisoner cacique. The Spaniard who brought the orders for this expedition was a very intelligent man. He gave me an account of the last engagement at which he was present. Some Indians, who had been taken prisoners, gave information of a tribe living north of the Colorado. Two hundred soldiers were sent; and they first discovered the Indians by a cloud of dust from their horses' feet, as they chanced to be travelling. The country was mountainous and wild, and it must have been far in the interior, for the Cordillera were in sight. The Indians, men, women, and children, were about one hundred and ten in number, and they were nearly all taken or killed, for the soldiers sabred every man. The Indians are now so terrified that they offer no resistance in a body, but each flies, neglecting even his wife and children; but when overtaken, like wild animals, they fight against any number to the last moment. One dying Indian seized with his teeth the thumb of his adversary, and allowed his own eye to be forced out sooner than relinquish his hold. Another, who was wounded, feigned death, keeping a knife ready to strike one more fatal blow. My informer said, when he was pursuing an Indian, the man cried out for mercy, at the same time that he was covertly loosing the bolas from his waist, meaning to whirl it round his head and so strike his pursuer. "I however struck him with my sabre to the ground, and then got off my horse, and cut his throat with my knife." This is a dark picture; but how much more shocking is the unquestionable fact, that all the women who appear above twenty years old are massacred in cold blood! When I exclaimed that this appeared rather inhuman, he answered, "Why, what can be done? they breed so!"

Every one here is fully convinced that this is the most just war, because it is against barbarians. Who would believe in this age that such atrocities could be committed in a Christian civilized country? The children of the Indians are saved, to be sold or given away as servants, or rather slaves for as long a time as the owners can make them believe themselves slaves; but I believe in their treatment there is little to complain of.

In the battle four men ran away together. They were pursued, one was killed, and the other three were taken alive. They turned out to be messengers or ambassadors from a large body of Indians, united in the common cause of defence, near the Cordillera. The tribe to which they had been sent was on the point of holding a grand council, the feast of mare's flesh was ready, and the dance prepared: in the morning the ambassadors were to have returned to the Cordillera. They were remarkably fine men, very fair, above six feet high, and all under thirty years of age. The three survivors of course possessed very valuable information and to extort this they were placed in a line. The two first being questioned, answered, "No se" (I do not know), and were one after the other shot. The third also said "No se;" adding, "Fire, I am a man, and can die!" Not one syllable would they breathe to injure the united cause of their country! The conduct of the above-mentioned cacique was very different; he saved his life by betraying the intended plan of warfare, and the point of union in the Andes. It was believed that there were already six or seven hundred Indians together, and that in summer their numbers would be doubled. Ambassadors were to have been sent to the Indians at the small Salinas, near Bahia Blanca, whom I have mentioned that this same cacique had betrayed. The communication, therefore, between the Indians, extends from the Cordillera to the coast of the Atlantic.

General Rosas's plan is to kill all stragglers, and having driven the remainder to a common point, to attack them in a body, in the summer, with the assistance of the Chilenos. This operation is to be repeated for three successive years. I imagine the summer is chosen as the time for the main attack, because the plains are then without water, and the Indians can only travel in particular directions. The escape of the Indians to the south of the Rio Negro, where in such a vast unknown country they would be safe, is prevented by a treaty with the Tehuelches to this effect; -- that Rosas pays them so much to slaughter every Indian who passes to the south of the river, but if they fail in so doing, they themselves are to be exterminated. The war is waged chiefly against the Indians near the Cordillera; for many of the tribes on this eastern side are fighting with Rosas. The general, however, like Lord Chesterfield, thinking that his friends may in a future day become his enemies, always places them in the front ranks, so that their numbers may be

thinned. Since leaving South America we have heard that this war of extermination completely failed.

Among the captive girls taken in the same engagement, there were two very pretty Spanish ones, who had been carried away by the Indians when young, and could now only speak the Indian tongue. From their account they must have come from Salta, a distance in a straight line of nearly one thousand miles. This gives one a grand idea of the immense territory over which the Indians roam: yet, great as it is, I think there will not, in another half-century, be a wild Indian northward of the Rio Negro. The warfare is too bloody to last; the Christians killing every Indian, and the Indians doing the same by the Christians. It is melancholy to trace how the Indians have given way before the Spanish invaders. Schirdel [21] says that in 1535, when Buenos Ayres was founded, there were villages containing two and three thousand inhabitants. Even in Falconer's time (1750) the Indians made inroads as far as Luxan, Areco, and Arrecife, but now they are driven beyond the Salado. Not only have whole tribes been exterminated, but the remaining Indians have become more barbarous: instead of living in large villages, and being employed in the arts of fishing, as well as of the chase, they now wander about the open plains, without home or fixed occupation.

I heard also some account of an engagement which took place, a few weeks previously to the one mentioned, at Cholechel. This is a very important station on account of being a pass for horses; and it was, in consequence, for some time the head-quarters of a division of the army. When the troops first arrived there they found a tribe of Indians, of whom they killed twenty or thirty. The cacique escaped in a manner which astonished every one. The chief Indians always have one or two picked horses, which they keep ready for any urgent occasion. On one of these, an old white horse, the cacique sprung, taking with him his little son. The horse had neither saddle nor bridle. To avoid the shots, the Indian rode in the peculiar method of his nation namely, with an arm round the horse's neck, and one leg only on its back. Thus hanging on one side, he was seen patting the horse's head, and talking to him. The pursuers urged every effort in the chase; the Commandant three times changed his horse, but all in vain. The old Indian father and his son escaped, and were free. What a fine picture one can form in one's mind, -- the naked, bronze-like figure of the old man with his little boy, riding like a Mazeppa on the white horse, thus leaving far behind him the host of his pursuers!

I saw one day a soldier striking fire with a piece of flint, which I immediately recognised as having been a part of the head of an arrow. He told me it was found near the island of Cholechel, and that they are frequently picked up there. It was between two and three inches long, and therefore twice as large as those now used in Tierra del Fuego: it was made of opaque cream-coloured flint, but the point and barbs had been intentionally broken off. It is well known that no Pampas Indians now use bows and arrows. I believe a small tribe in Banda Oriental must be excepted; but they are widely separated from the Pampas Indians, and border close on those tribes that inhabit the forest, and live on foot. It appears, therefore, that these arrow-heads are antiquarian [22] relics of the Indians, before the great change in habits consequent on the introduction of the horse into South America.

[1] Since this was written, M. Alcide d'Orbigny has examined these shells, and pronounces them all to be recent.

[2] M. Aug. Bravard has described, in a Spanish work ('Observaciones Geologicas,' 1857), this district, and he believes that the bones of the extinct mammals were washed out of the underlying Pampean deposit, and subsequently became embedded with the still existing shells; but I am not convinced by his remarks. M. Bravard believes that the whole enormous Pampean deposit is a sub-aerial formation, like sand-dunes: this seems to me to be an untenable doctrine.

[3] Principles of Geology, vol. iv. p. 40.

[4] This theory was first developed in the Zoology of the Voyage of the Beagle, and subsequently in Professor Owen's Memoir on *Myiodon robustus*.

[5] I mean this to exclude the total amount which may have been successively produced and consumed during a given period.

[6] Travels in the Interior of South Africa, vol. ii. p. 207

[7] The elephant which was killed at Exeter Change was estimated (being partly weighed) at five tons and a half. The elephant actress, as I was informed, weighed one ton less; so that we may take five as the average of a full-grown elephant. I was told at the Surry Gardens, that a hippopotamus which was sent to England cut up into pieces was estimated at three tons and a half; we will call it three. From these premises we may give three tons and a half to each of the five rhinoceroses; perhaps a ton to the giraffe, and half to the bos caffer as well as to the elan (a large ox weighs from 1200 to 1500 pounds). This will give an average (from the above estimates) of 2.7 of a ton for the ten largest herbivorous animals of Southern Africa. In South America, allowing 1200 pounds for the two tapirs together, 550 for the guanaco and vicuna, 500 for three deer, 300 for the capybara, peccari, and a monkey, we shall have

an average of 250 pounds, which I believe is overstating the result. The ratio will therefore be as 6048 to 250, or 24 to 1, for the ten largest animals from the two continents.

[8] If we suppose the case of the discovery of a skeleton of a Greenland whale in a fossil state, not a single cetaceous animal being known to exist, what naturalist would have ventured conjecture on the possibility of a carcass so gigantic being supported on the minute crustacea and mollusca living in the frozen seas of the extreme North?

[9] See Zoological Remarks to Capt. Back's Expedition, by Dr. Richardson. He says, "The subsoil north of latitude 56 degs. is perpetually frozen, the thaw on the coast not penetrating above three feet, and at Bear Lake, in latitude 64 degs., not more than twenty inches. The frozen substratum does not of itself destroy vegetation, for forests flourish on the surface, at a distance from the coast."

[10] See Humboldt, *Fragments Asiaticques*, p. 386: Barton's *Geography of Plants*: and Malte Brun. In the latter work it is said that the limit of the growth of trees in Siberia may be drawn under the parallel of 70 degs.

[11] Sturt's *Travels*, vol. ii. p. 74.

[12] A Gucho assured me that he had once seen a snow-white or Albino variety, and that it was a most beautiful bird.

[13] Burchell's *Travels*, vol. i. p. 280.

[14] Azara, vol. iv. p. 173.

[15] Lichtenstein, however, asserts (*Travels*, vol. ii. p. 25) that the hens begin sitting when they have laid ten or twelve eggs; and that they continue laying, I presume, in another nest. This appears to me very improbable. He asserts that four or five hens associate for incubation with one cock, who sits only at night.

[16] When at the Rio Negro, we heard much of the indefatigable labours of this naturalist. M. Aleide d'Orbigny, during the years 1825 to 1833, traversed several large portions of South America, and has made a collection, and is now publishing the results on a scale of magnificence, which at once places himself in the list of American travellers second only to Humboldt.

[17] *Account of the Abipones*, A.D. 1749, vol. i. (English Translation) p. 314

[18] M. Bibron calls it *T. crepitans*.

[19] The cavities leading from the fleshy compartments of the extremity, were filled with a yellow pulpy matter, which, examined under a microscope, presented an extraordinary appearance. The mass consisted of rounded, semi-transparent, irregular grains, aggregated together into particles of various sizes. All such particles, and the separate grains, possessed the power of rapid movement; generally revolving around different axes, but sometimes progressive. The movement was visible with a very weak power, but even with the highest its cause could not be perceived. It was very different from the circulation of the fluid in the elastic bag, containing the thin extremity of the axis. On other occasions, when dissecting small marine animals beneath the microscope, I have seen particles of pulpy matter, some of large size, as soon as they were disengaged, commence revolving. I have imagined, I know not with how much truth, that this granulo-pulpy matter was in process of being converted into ova. Certainly in this zoophyte such appeared to be the case.

[20] Kerr's *Collection of Voyages*, vol. viii. p. 119.

[21] Purchas's *Collection of Voyages*. I believe the date was really 1537.

[22] Azara has even doubted whether the Pampas Indians ever used bows.

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