Seven-Year Sleepers

By
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SEVEN-YEAR SLEEPERS

For many generations past that problematical animal, the toad-in-a-hole (literal, not culinary) has been one of the most familiar and interesting personages of contemporary folk-lore and popular natural history. From time to time he turns up afresh, with his own wonted perennial vigour, on paper at least, in company with the great sea-serpent, the big gooseberry, the shower of frogs, the two-headed calf, and all the other common objects of the country or the seaside in the silly season. No extraordinary natural phenomenon on earth was ever better vouched forin the fashion rendered familiar to us by the Tichborne claimantthat is to say, no other could ever get a larger number of unprejudiced witnesses to swear positively and unreservedly in its favour. Unfortunately, however, swearing alone no longer settles causes offhand, as if by show of hands, 'the Ayes have it,' after the fashion prevalent in the good old days when the whole Hundred used to testify that of its certain knowledge John Nokes did not commit such and such a murder; whereupon John Nokes was forthwith acquitted accordingly. Nowadays, both justice and science have become more exacting; they insist upon the unpleasant and discourteous habit of cross-examining their witnesses (as if they doubted them, forsooth!), instead of accepting the witnesses' own simple assertion that it's all right, and there's no need for making a fuss about it. Did you yourself see the block of stone in which the toad is said to have been found, before the toad himself was actually extracted? Did you examine it all round to make quite sure there was no hole, or crack, or passage in it anywhere? Did you satisfy yourself after the toad was released from his close quarters that no such hole, or crack, or

passage had been dexterously closed up, with intent to deceive, by plaster, cement, or other artificial composition? Did you ever offer the workmen who found it a nominal rewardsay five shillingsfor the first perfectly unanswerable specimen of a genuine unadulterated antediluvian toad? Have you got the toad now present, and can you produce him here in court (on writ of habeas corpus or otherwise), together with all the fragments of the stone or tree from which he was extracted? These are the disagreeable, prying, inquisitorial, I may even say insulting, questions with which a modern man of science is ready to assail the truthful and reputable gentlemen who venture to assert their discovery, in these degenerate days, of the ancient and unsophisticated toad-in-a-hole.

Now, the worst of it is that the gentlemen in question, being unfamiliar with what is technically described as scientific methods of investigation, are very apt to lose their temper when thus cross-questioned, and to reply, after the fashion usually attributed to the female mind, with another question, whether the scientific person wishes to accuse them of downright lying. And as nothing on earth could be further from the scientific person's mind than such an imputation, he is usually fain in the end to give up the social pursuit of postprandial natural history (the subject generally crops up about the same time as the after-dinner coffee), and to let the prehistoric toad go on his own triumphant way, unheeded.

As a matter of fact, nobody ever makes larger allowances for other people, in the estimate of their veracity, than the scientific inquirer. Knowing himself, by painful experience, how extremely difficult a matter it is to make perfectly sure you have observed anything on earth quite correctly, and have eliminated all possible chances of error, he acquires the fixed habit of doubting about one-half of whatever his fellow-creatures tell him in ordinary conversation, without for a single moment venturing to suspect them of deliberate untruthfulness. Children and servants, if they find that anything they have been told is erroneous, immediately jump at the conclusion that the person who told them meant deliberately to deceive them; in their own simple and categorical fashion they answer plumply, 'That's a lie.' But the man of science is only too well acquainted in his own person with the exceeding difficulty of ever getting at the exact truth. He has spent hours of toil, himself, in watching and observing the behaviour of some plant, or animal, or gas, or metal; and after repeated experiments, carefully designed to exclude all possibility of mistake, so far as he can foresee it, he at last believes he has really settled some moot point, and triumphantly publishes his final conclusions in a scientific journal. Ten to one, the very next number of that same journal

contains a dozen supercilious letters from a dozen learned and high-salaried professors, each pointing out a dozen distinct and separate precautions which the painstaking observer neglected to take, and any one of which would be quite sufficient to vitiate the whole body of his observations. There might have been germs in the tube in which he boiled the water (germs are very fashionable just at present); or some of the germs might have survived and rather enjoyed the boiling; or they might have adhered to the under surface of the cork; or the mixture might have been tampered with during the experimenter's temporary absence by his son, aged ten years (scientific observers have no right, apparently, to have sons of ten years old, except perhaps for purposes of psychological research); and so forth, ad infinitum. And the worst of it all is that the unhappy experimenter is bound himself to admit that every one of the objections is perfectly valid, and that he very likely never really saw what with perfect confidence he thought and said he had seen.

This being an unbelieving age, then, when even the book of Deuteronomy is 'critically examined,' let us see how much can really be said for and against our old friend, the toad-in-a-hole; and first let us begin with the antecedent probability, or otherwise, of any animal being able to live in a more or less torpid condition, without air or food, for any considerable period of time together.

A certain famous historical desert snail was brought from Egypt to England as a conchological specimen in the year 1846. This particular mollusk (the only one of his race, probably, who ever attained to individual distinction), at the time of his arrival in London, was really alive and vigorous; but as the authorities of the British Museum, to whose tender care he was consigned, were ignorant of this important fact in his economy, he was gummed, mouth downward, on to a piece of cardboard, and duly labelled and dated with scientific accuracy, 'Helix desertorum, March 25, 1846.' Being a snail of a retiring and contented disposition, however, accustomed to long droughts and corresponding naps in his native sand-wastes, our mollusk thereupon simply curled himself up into the topmost recesses of his own whorls, and went placidly to sleep in perfect contentment for an unlimited period. Every conchologist takes it for granted, of course, that the shells which he receives from foreign parts have had their inhabitants properly boiled and extracted before being exported; for it is only the mere outer shell or skeleton of the animal that we preserve in our cabinets, leaving the actual flesh and muscles of the creature himself to wither unobserved upon its native shores. At the

British Museum the desert snail might have snoozed away his inglorious existence unsuspected, but for a happy accident which attracted public attention to his remarkable case in a most extraordinary manner. On March 7, 1850, nearly four years later, it was casually observed that the card on which he reposed was slightly discoloured; and this discovery led to the suspicion that perhaps a living animal might be temporarily immured within that papery tomb. The Museum authorities accordingly ordered our friend a warm bath (who shall say hereafter that science is unfeeling!), upon which the grateful snail, waking up at the touch of the familiar moisture, put his head cautiously out of his shell, walked up to the top of the basin, and began to take a cursory survey of British institutions with his four eye-bearing tentacles. So strange a recovery from a long torpid condition, only equalled by that of the Seven Sleepers of Ephesus, deserved an exceptional amount of scientific recognition. The desert snail at once awoke and found himself famous. Nay, he actually sat for his portrait to an eminent zoological artist, Mr. Waterhouse; and a woodcut from the sketch thus procured, with a history of his life and adventures, may be found even unto this day in Dr. Woodward's 'Manual of the Mollusca,' to witness if I lie.

I mention this curious instance first, because it is the best authenticated case on record (so far as my knowledge goes) of any animal existing in a state of suspended animation for any long period of time together. But there are other cases of encysted or immured animals which, though less striking as regards the length of time during which torpidity has been observed, are much more closely analogous to the real or mythical conditions of the toad-in-a-hole. That curious West African mud-fish, the Lepidosiren (familiar to all readers of evolutionary literature as one of the most singular existing links between fish and amphibians), lives among the shallow pools and broads of the Gambia, which are dried up during the greater part of the tropical summer. To provide against this annual contingency, the mud-fish retires into the soft clay at the bottom of the pools, where it forms itself a sort of nest, and there hibernates, or rather æstivates, for months together, in a torpid condition. The surrounding mud then hardens into a dry ball; and these balls are dug out of the soil of the rice-fields by the natives, with the fish inside them, by which means many specimens of lepidosiren have been sent alive to Europe, embedded in their natural covering. Here the strange fish is chiefly prized as a zoological curiosity for aquariums, because of its possessing gills and lungs together, to fit it for its double existence; but the unsophisticated West Africans grub it up on their own account as a delicacy, regardless of its claims to scientific consideration as the earliest known ancestor of all existing terrestrial animals. Now, the torpid state of the mud-fish in his hardened ball of clay closely

resembles the real or supposed condition of the toad-in-a-hole; but with one important exception. The mud-fish leaves a small canal or pipe open in his cell at either end to admit the air for breathing, though he breathes (as I shall proceed to explain) in a very slight degree during his æstivation; whereas every proper toad-in-a-hole ought by all accounts to live entirely without either feeding or breathing in any way. However, this is a mere detail; and indeed, if toads-in-a-hole do really exist at all, we must in all probability ultimately admit that they breathe to some extent, though perhaps very slightly, during their long immurement.

And this leads us on to consider what in reality hibernation is. Everybody knows nowadays, I suppose, that there is a very close analogy between an animal and a steam-engine. Food is the fuel that makes the animal engine go; and this food acts almost exactly as coal does in the artificial machine. But coal alone will not drive an engine; a free draught of open air is also required in order to produce combustion. Just in like manner the food we eat cannot be utilised to drive our muscles and other organs unless it is supplied with oxygen from the air to burn it slowly inside our bodies. This oxygen is taken into the system, in all higher animals, by means of lungs or gills. Now, when we are working at all hard, we require a great deal of oxygen, as most of us have familiarly discovered (especially if we are somewhat stout) in the act of climbing hills or running to catch a train. But when we are doing very little work indeed, as in our sleeping hours, during which muscular movement is suspended, and only the general organic life continues, we breathe much more slowly and at longer intervals. However, there is this important difference (generally speaking) between an animal and a steam-engine. You can let the engine run short of coals and come to a dead standstill, without impairing its future possibilities of similar motion; you have only to get fresh coals, after weeks or months of inaction, and light up a fresh fire, when your engine will immediately begin to work again, exactly the same as before. But if an animal organism once fairly runs down, either from want of food or any other causein short, if it diesit very seldom comes to life again.

I say 'very seldom' on purpose, because there are a few cases among the extreme lower animals where a water-haunting creature can be taken out of the water and can be thoroughly dried and desiccated, or even kept for an apparently unlimited period wrapped up in paper or on the slide of a microscope; and yet, the moment a drop of water is placed on top of it, it begins to move and live again exactly as before. This sort of thorough-going suspended animation is the kind we ought to expect from any well-constituted

and proper-minded toad-in-a-hole. Whether anything like it ever really occurs in the higher ranks of animal life, however, is a different question; but there can be no doubt that to some slight extent a body to all intents and purposes quite dead (physically speaking) by long immersion in watera drowned man, for examplemay really be resuscitated by heat and stimulants, applied immediately, provided no part of the working organism has been seriously injured or decomposed. Such people may be said to be pro tem. functionally, though not structurally, dead. The heart has practically ceased to beat, the lungs have ceased to breathe, and physical life in the body is temporarily extinct. The fire, in short, has gone out. But if only it can be lighted again before any serious change in the system takes place, all may still go on precisely as of old.

Many animals, however, find it convenient to assume a state of less complete suspended animation during certain special periods of the year, according to the circumstances of their peculiar climate and mode of life. Among the very highest animals, the most familiar example of this sort of semi-torpidity is to be found among the bears and the dormice. The common European brown bear is a carnivore by descent, who has become a vegetarian in practice, though whether from conscientious scruples or mere practical considerations of expediency, does not appear. He feeds chiefly on roots, berries, fruits, vegetables, and honey, all of which he finds it comparatively difficult to procure during winter weather. Accordingly, as everyone knows, he eats immoderately in the summer season, till he has grown fat enough to supply bear's grease to all Christendom. Then he hunts himself out a hollow tree or rock-shelter, curls himself up quietly to sleep, and snores away the whole livelong winter. During this period of hibernation, the action of the heart is reduced to a minimum, and the bear breathes but very slowly. Still, he does breathe, and his heart does beat; and in performing those indispensable functions, all his store of accumulated fat is gradually used up, so that he wakes in spring as thin as a lath and as hungry as a hunter. The machine has been working at very low pressure all the winter: but it has been working for all that, and the continuity of its action has never once for a moment been interrupted. This is the central principle of all hibernation; it consists essentially of a very long and profound sleep, during which all muscular motion, except that of the heart and lungs, is completely suspended, while even these last are reduced to the very smallest amount compatible with the final restoration of full animal activity.

Thus, even among warm-blooded animals like the bears and dormice,

hibernation actually occurs to a very considerable degree; but it is far more common and more complete among cold-blooded creatures, whose bodies do not need to be kept heated to the same degree, and with whom, accordingly, hibernation becomes almost a complete torpor, the breathing and the action of the heart being still further reduced to very nearly zero. Mollusks in particular, like oysters and mussels, lead very monotonous and uneventful lives, only varied as a rule by the welcome change of being cut out of their shells and eaten alive; and their powers of living without food under adverse circumstances are really very remarkable. Freshwater snails and mussels, in cold weather, bury themselves in the mud of ponds or rivers; and land-snails hide themselves in the ground or under moss and leaves. The heart then ceases perceptibly to beat, but respiration continues in a very faint degree. The common garden snail closes the mouth of his shell when he wants to hibernate, with a slimy covering; but he leaves a very small hole in it somewhere, so as to allow a little air to get in, and keep up his breathing to a slight amount. My experience has been, however, that a great many snails go to sleep in this way, and never wake up again. Either they get frozen to death, or else the respiration falls so low that it never picks itself up properly when spring returns. In warm climates, it is during the summer that mollusks and other mud-haunting creatures go to sleep; and when they get well plastered round with clay, they almost approach in tenacity of life the mildest recorded specimens of the toad-in-a-hole.

For example, take the following cases, which I extract, with needful simplifications, from Dr. Woodward.

'In June 1850, a living pond mussel, which had been more than a year out of water, was sent to Mr. Gray, from Australia. The big pond snails of the tropics have been found alive in logs of mahogany imported from Honduras; and M. Caillaud carried some from Egypt to Paris, packed in sawdust. Indeed, it isn't easy to ascertain the limit of their endurance; for Mr. Laidlay, having placed a number in a drawer for this very purpose, found them alive after five years' torpidity, although in the warm climate of Calcutta. The pretty snails called cyclostomas, which have a lid to their shells, are well known to survive imprisonments of many months; but in the ordinary open-mouthed land-snails such cases are even more remarkable. Several of the enormous tropical snails often used to decorate cottage mantelpieces, brought by Lieutenant Greaves from Valparaiso, revived after being packed, some for thirteen, others for twenty months. In 1849, Mr. Pickering received from Mr. Wollaston a basketful of Madeira snails (of twenty or thirty different kinds), three-fourths

of which proved to be alive, after several months' confinement, including a sea voyage. Mr. Wollaston has himself recorded the fact that specimens of two Madeira snails survived a fast and imprisonment in pill-boxes of two years and a half duration, and that large numbers of a small species, brought to England at the same time, were all living after being inclosed in a dry bag for a year and a half.'

Whether the snails themselves liked their long deprivation of food and moisture we are not informed; their personal tastes and inclinations were very little consulted in the matter; but as they and their ancestors for many generations must have been accustomed to similar long fasts during tropical droughts, in all likelihood they did not much mind it.

The real question, then, about the historical toad-in-a-hole narrows itself down in the end merely to thishow long is it credible that a cold-blooded creature might sustain life in a torpid or hibernating condition, without food, and with a very small quantity of fresh air, supplied (let us say) from time to time through an almost imperceptible fissure? It is well known that reptiles and amphibians are particularly tenacious of life, and that some turtles in particular will live for months, or even for years, without tasting food. The common Greek tortoise, hawked on barrows about the streets of London and bought by a confiding British public under the mistaken impression that its chief fare consists of slugs and cockroaches (it is really far more likely to feed upon its purchaser's choicest seakale and asparagus), buries itself in the ground at the first approach of winter, and snoozes away five months of the year in a most comfortable and dignified torpidity. A snake at the Zoo has even been known to live eighteen months in a voluntary fast, refusing all the most tempting offers of birds and rabbits, merely out of pique at her forcible confinement in a strange cage. As this was a lady snake, however, it is possible that she only went on living out of feminine obstinacy, so that this case really counts for very little.

Toads themselves are well known to possess all the qualities of mind and body which go to make up the career of a successful and enduring anchorite. At the best of times they eat seldom and sparingly, while a forty days' fast, like Dr. Tanner's, would seem to them but an ordinary incident in their everyday existence. In the winter they hibernate by burying themselves in the mud, or by getting down cracks in the ground. It is also undoubtedly true that they creep into holes wherever they can find one, and that in these holes they lie

torpid for a considerable period. On the other hand, there is every reason to believe that they cannot live for more than a certain fixed and relatively short time entirely without food or air. Dr. Buckland tried a number of experiments upon toads in this mannerexperiments wholly unnecessary, considering the trivial nature of the point at issueand his conclusion was that no toad could get beyond two years without feeding or breathing. There can be very little doubt that in this conclusion he was practically correct, and that the real fine old crusted antediluvian toad-in-a-hole is really a snare and a delusion.

That, however, does not wholly settle the question about such toads, because, even though they may not be all that their admirers claim for them, they may yet possess a very respectable antiquity of their own, and may be very far from the category of mere vulgar cheats and impostors. Because a toad is not as old as Methuselah, it need not follow that he may not be as old as Old Parr; because he does not date back to the Flood, it need not follow that he cannot remember Queen Elizabeth. There are some toads-in-a-hole, indeed, which, however we may account for the origin of their legend, are on the very face of it utterly incredible. For example, there is the favourite and immensely popular toad who was extracted from a perfectly closed hole in a marble mantelpiece. The implication of the legend clearly is that the toad was coeval with the marble. But marble is limestone, altered in texture by pressure and heat, till it has assumed a crystalline structure. In other words we are asked to believe that that toad lived through an amount of fiery heat sufficient to burn him up into fine powder, and yet remains to tell the tale. Such a toad as this obviously deserves no credit. His discoverers may have believed in him themselves, but they will hardly get other people to do so.

Still, there are a great many ways in which it is quite conceivable that toads might get into holes in rocks or trees so as to give rise to the common stories about them, and might even manage to live there for a considerable time with very small quantities of food or air. It must be remembered that from the very nature of the conditions the hole can never be properly examined and inspected until after it has been split open and the toad has been extracted from it. Now, if you split open a tree or a rock, and find a toad inside it, with a cavity which he exactly fills, it is extremely difficult to say whether there was or was not a fissure before you broke the thing to pieces with your hatchet or pickaxe. A very small fissure indeed would be quite sufficient to account for the whole delusion; for if the toad could get a little air to breathe slowly during his torpid period, and could find a few dead flies or worms among the water that trickled scantily into his hole, he could manage to drag out a peaceful and

monotonous existence almost indefinitely. Here are a few possible cases, any one of which will quite suffice to give rise to at least as good a toad-in-the-hole as ninety-nine out of a hundred published instances.

An adult toad buries himself in the mud by a dry pond, and gets coated with a hard solid coat of sun-baked clay. His nodule is broken open with a spade, and the toad himself is found inside, almost exactly filling the space within the cavity. He has only been there for a few months at the outside; but the clay is as hard as a stone, and to the bucolic mind looks as if it might have been there ever since the Deluge. Good blue lias clay, which dries as solid as limestone, would perform this trick to perfection; and the toad might easily be relegated accordingly to the secondary ages of geology. Observe, however, that the actual toads so found are not the geological toads we should naturally expect under such remarkable circumstances, but the common everyday toads of modern England. This shows a want of accurate scientific knowledge on the part of the toads which is truly lamentable. A toad who really wished to qualify himself for the post ought at least to avoid presenting himself before a critical eye in the foolish guise of an embodied anachronism. He reminds one of the Roman mother in a popular burlesque, who suspects her son of smoking, and vehemently declares that she smells tobacco, but, after a moment, recollects the historical proprieties, and mutters to herself, apologetically, 'No, not tobacco; that's not yet invented.' A would-be silurian or triassic toad ought, in like manner, to remember that in the ages to whose honours he aspires his own amphibian kind was not yet developed. He ought rather to come out in the character of a ceratodus or a labyrinthodon.

Again, another adult toad crawls into the hollow of a tree, and there hibernates. The bark partially closes over the slit by which he entered, but leaves a little crack by which air can enter freely. The grubs in the bark and other insects supply him from time to time with a frugal repast. There is no good reason why, under such circumstances, a placid and contented toad might not manage to prolong his existence for several consecutive seasons.

Once more, the spawn of toads is very small, as regards the size of the individual eggs, compared with the size of the full-grown animal. Nothing would be easier than for a piece of spawn or a tiny tadpole to be washed into some hole in a mine or cave, where there was sufficient water for its developement, and where the trickling drops brought down minute objects of food, enough to keep up its simple existence. A toad brought up under such

peculiar circumstances might pass almost its entire life in a state of torpidity, and yet might grow and thrive in its own sleepy vegetative fashion.

In short, while it would be difficult in any given case to prove to a certainty either that the particular toad-in-a-hole had or had not access to air and food, the ordinary conditions of toad life are exactly those under which the delusive appearance of venerable antiquity would be almost certain frequently to arise. The toad is a nocturnal animal; it lives through the daytime in dark and damp places; it shows a decided liking for crannies and crevices; it is wonderfully tenacious of life; it possesses the power of hibernation; it can live on extremely small quantities of food for very long periods of time together; it buries itself in mud or clay; it passes the early part of its life as a water-haunting tadpole; and last, not least, it can swell out its body to nearly double its natural size by inflating itself, which fully accounts for the stories of toads being taken out of holes every bit as big as themselves. Considering all these things, it would be wonderful indeed if toads were not often found in places and conditions which would naturally give rise to the familiar myth. Throw in a little allowance for human credulity, human exaggeration, and human love of the marvellous, and you have all the elements of a very excellent toad-in-the-hole in the highest ideal perfection.

At the same time I think it quite possible that some toads, under natural circumstances, do really remain in a torpid or semi-torpid condition for a period far exceeding the twenty-four months allowed as the maximum in Dr. Buckland's unpleasant experiments. If the amount of air supplied through a crack or through the texture of the stone were exactly sufficient for keeping the animal alive in the very slightest fashionthe engine working at the lowest possible pressure, short of absolute cessationI see no reason on earth why a toad might not remain dormant, in a moist place, with perhaps a very occasional worm or grub for breakfast, for at least as long a time as the desert snail slept comfortably in the British Museum. Altogether, while it is impossible to believe the stories about toads that have been buried in a mine for whole centuries, and still more impossible to believe in their being disentombed from marble mantelpieces or very ancient geological formations, it is quite conceivable that some toads-in-a-hole may really be far from mere vulgar impostors, and may have passed the traditional seven years of the Indian philosophers in solitary meditation on the syllable Om, or on the equally significant Ko-ax, Ko-ax of the irreverent Attic dramatist. "Certainly not a centenarian, but perhaps a good seven-year sleeper for all that," is the final verdict which the court is disposed to return, after due consideration of

all the probabilities in re the toad-in-a-hole.

A FOSSIL CONTINENT

If an intelligent Australian colonist were suddenly to be translated backward from Collins Street, Melbourne, into the flourishing woods of the secondary geological periodsay about the precise moment of time when the English chalk downs were slowly accumulating, speck by speck, on the silent floor of some long-forgotten Mediterraneanthe intelligent colonist would look around him with a sweet smile of cheerful recognition, and say to himself in some surprise, 'Why, this is just like Australia.' The animals, the trees, the plants, the insects, would all more or less vividly remind him of those he had left behind him in his happy home of the southern seas and the nineteenth century. The sun would have moved back on the dial of ages for a few million summers or so, indefinitely (in geology we refuse to be bound by dates), and would have landed him at last, to his immense astonishment, pretty much at the exact point whence he first started.

In other words, with a few needful qualifications, to be made hereafter, Australia is, so to speak, a fossil continent, a country still in its secondary age, a surviving fragment of the primitive world of the chalk period or earlier ages. Isolated from all the remainder of the earth about the beginning of the tertiary epoch, long before the mammoth and the mastodon had yet dreamt of appearing upon the stage of existence, long before the first shadowy ancestor of the horse had turned tail on nature's rough draft of the still undeveloped and unspecialised lion, long before the extinct dinotheriums and gigantic Irish elks and colossal giraffes of late tertiary times had even begun to run their race on the broad plains of Europe and America, the Australian continent found itself at an early period of its development cut off entirely from all social intercourse with the remainder of our planet, and turned upon itself, like the German philosopher, to evolve its own plants and animals out of its own inner consciousness. The natural consequence was that progress in Australia has been absurdly slow, and that the country as a whole has fallen most woefully behind the times in all matters pertaining to the existence of life upon its surface. Everybody knows that Australia as a whole is a very peculiar and original continent; its peculiarity, however, consists, at bottom, for the most part in the fact that it still remains at very nearly the same early point of development which Europe had attained a couple of million years ago or

thereabouts. "Advance, Australia," says the national motto; and, indeed, it is quite time nowadays that Australia should advance; for, so far, she has been left out of the running for some four mundane ages or so at a rough computation.

Example, says the wisdom of our ancestors, is better than precept; so perhaps, if I take a single example to start with, I shall make the principle I wish to illustrate a trifle clearer to the European comprehension. In Australia, when Cook or Van Diemen first visited it, there were no horses, cows, or sheep; no rabbits, weasels, or cats; no indigenous quadrupeds of any sort except the pouched mammals or marsupials, familiarly typified to every one of us by the mamma kangaroo in Regent's Park, who carries the baby kangaroos about with her, neatly deposited in the sac or pouch which nature has provided for them instead of a cradle. To this rough generalisation, to be sure, two special exceptions must needs be made; namely, the noble Australian black-fellow himself, and the dingo or wild dog whose ancestors no doubt came to the country in the same ship with him, as the brown rat came to England with George I. of blessed memory. But of these two solitary representatives of the later and higher Asiatic fauna 'more anon'; for the present we may regard it as approximately true that aboriginal and unsophisticated Australia in the lump was wholly given over, on its first discovery, to kangaroos, phalangers, dasyures, wombats, and other quaint marsupial animals, with names as strange and clumsy as their forms.

Now, who and what are the marsupials as a family, viewed in the dry light of modern science? Well, they are simply one of the very oldest mammalian families, and therefore, I need hardly say, in the levelling and topsy-turvy view of evolutionary biology, the least entitled to consideration or respect from rational observers. For of course in the kingdom of science the last shall be first, and the first last; it is the oldest families that are accounted the worst, while the best families mean always the newest. Now, the earliest mammals to appear on earth were creatures of distinctly marsupial type. As long ago as the time when the red marl of Devonshire and the blue lias of Lyme Regis were laid down on the bed of the muddy sea that once covered the surface of Dorset and the English Channel, a little creature like the kangaroo rats of Southern Australia lived among the plains of what is now the south of England. In the ages succeeding the deposition of the red marl Europe seems to have been broken up into an archipelago of coral reefs and atolls; and the islands of this ancient oolitic ocean were tenanted by numbers of tiny ancestral marsupials, some of which approached in appearance the pouched ant-eaters of Western

Australia, while others resembled rather the phalangers and wombats, or turned into excellent imitation carnivores, like our modern friend the Tasmanian devil. Up to the end of the time when the chalk deposits of Surrey, Kent, and Sussex were laid down, indeed, there is no evidence of the existence anywhere in the world of any mammals differing in type from those which now inhabit Australia. In other words, so far as regards mammalian life, the whole of the world had then already reached pretty nearly the same point of evolution that poor Australia still sticks at.

About the beginning of the tertiary period, however, just after the chalk was all deposited, and just before the comparatively modern clays and sandstones of the London basin began to be laid down, an arm of the sea broke up the connection which once subsisted between Australia and the rest of the world, probably by a land bridge, viâ Java, Sumatra, the Malay peninsula, and Asia generally. 'But how do you know,' asks the candid inquirer, 'that such a connection ever existed at all?' Simply thus, most laudable investigatorbecause there are large land mammals in Australia. Now, large land mammals do not swim across a broad ocean. There are none in New Zealand, none in the Azores, none in Fiji, none in Tahiti, none in Madeira, none in Teneriffenone, in short, in any oceanic island which never at any time formed part of a great continent. How could there be, indeed? The mammals must necessarily have got there from somewhere; and whenever we find islands like Britain, or Japan, or Newfoundland, or Sicily, possessing large and abundant indigenous quadrupeds, of the same general type as adjacent continents, we see at once that the island must formerly have been a mere peninsula, like Italy or Nova Scotia at the present day. The very fact that Australia incloses a large group of biggish quadrupeds, whose congeners once inhabited Europe and America, suffices in itself to prove beyond question that uninterrupted land communication must once have existed between Australia and those distant continents.

In fact, to this day a belt of very deep sea, known as Wallace's Line, from the great naturalist who first pointed out its far-reaching zoological importance, separates what is called by science 'the Australian province' on the southwest from 'the Indo-Malayan province' to the north and east of it. This belt of deep sea divides off sharply the plants and animals of the Australian type from those of the common Indian and Burmese pattern. South of Wallace's Line we now find several islands, big and small, including New Guinea, Australia, Tasmania, the Moluccas, Celebes, Timor, Amboyna, and Banda. All these lands, whose precise geographical position on the map must of course be

readily remembered, in this age of school boards and universal examination, by every pupil-teacher and every Girton girl, are now divided by minor straits of much shallower water; but they all stand on a great submarine bank, and obviously formed at one time parts of the same wide Australian continent, because animals of the Australian type are still found in every one of them. No Indian or Malayan animal, however, of the larger sort (other than birds) is to be discovered anywhere south of Wallace's Line. That narrow belt of deep sea, in short, forms an ocean barrier which has subsisted there without alteration ever since the end of the secondary period. From that time to this, as the evidence shows us, there has never been any direct land communication between Australia and any part of the outer world beyond that narrow line of division.

Some years ago, in fact, a clever hoax took the world by surprise for a moment, under the audacious title of 'Captain Lawson's Adventures in New Guinea.' The gallant captain, or his unknown creator in some London lodging, pretended to have explored the Papuan jungles, and there to have met with marvellous escapes from terrible beasts of the common tropical Asiatic patternrhinoceroses, tigers, monkeys, and leopards. Everybody believed the new Munchausen at first, except the zoologists. Those canny folks saw through the wicked hoax on the very first blush of it. If there were rhinoceroses in Papua, they must have got there by an overland route. If there had ever been a land connection between New Guinea and the Malay region, then, since Australian animals range into New Guinea, Malayan animals would have ranged into Australia, and we should find Victoria and New South Wales at the present day peopled by tapirs, orang-outangs, wild boars, deer, elephants, and squirrels, like those which now people Borneo, instead of, or side by side with, the kangaroos, wombats, and other marsupials, which, as we know, actually form the sole indigenous mammalian population of Greater Britain beneath the Southern Cross. Of course, in the end, the mysterious and tremendous Captain Lawson proved to be a myth, an airy nothing upon whom imagination had bestowed a local habitation (in New Guinea) and a name (not to be found in the Army List). Wallace's Line was saved from reproach, and the intrusive rhinoceros was banished without appeal from the soil of Papua.

After the deep belt of open sea was thus established between the bigger Australian continent and the Malayan region, however, the mammals of the great mainlands continued to develop on their own account, in accordance with the strictest Darwinian principles, among the wider plains of their own habitats. The competition there was fiercer and more general; the struggle for

life was bloodier and more arduous. Hence, while the old-fashioned marsupials continued to survive and to evolve slowly along their own lines in their own restricted southern world, their collateral descendants in Europe and Asia and America or elsewhere went on progressing into far higher, stronger, and better adapted formsthe great central mammalian fauna. In place of the petty phalangers and pouched ant-eaters of the oolitic period, our tertiary strata in the larger continents show us a rapid and extraordinary development of the mammalian race into monstrous creatures, some of them now quite extinct, and some still holding their own undisturbed in India, Africa, and the American prairies. The palæotherium and the deinoceras, the mastodon and the mammoth, the huge giraffes and antelopes of sunnier times, succeed to the ancestral kangaroos and wombats of the secondary strata. Slowly the horses grow more horse-like, the shadowy camel begins to camelise himself, the buffaloes acquire the rudiments of horns, the deer branch out by tentative steps into still more complicated and more complicated antlers. Side by side with this wonderful outgrowth of the mammalian type, in the first plasticity of its vigorous youth, the older marsupials die away one by one in the geological record before the faces of their more successful competitors; the new carnivores devour them wholesale, the new ruminants eat up their pastures, the new rodents outwit them in the modernised forests. At last the pouched creatures all disappear utterly from all the world, save only Australia, with the solitary exception of a single advanced marsupial family, the familiar opossum of plantation melodies. And the history of the opossum himself is so very singular that it almost deserves to receive the polite attention of a separate paragraph for its own proper elucidation.

For the opossums form the only members of the marsupial class now living outside Australia; and yet, what is at least equally remarkable, none of the opossums are found per contra in Australia itself. They are, in fact, the highest and best product of the old dying marsupial stock, specially evolved in the great continents through the fierce competition of the higher mammals then being developed on every side of them. Therefore, being later in point of time than the separation, they could no more get over to Australia than the elephants and tigers and rhinoceroses could. They are the last bid for life of the marsupial race in its hopeless struggle against its more developed mammalian cousins. In Europe and Asia the opossums lived on lustily, in spite of competition, during the whole of the Eocene period, side by side with hog-like creatures not yet perfectly piggish, with nondescript animals, half horse half tapir, and with hornless forms of deer and antelopes, unprovided, so far, with the first rudiment of budding antlers. But in the succeeding age they seem to disappear from the eastern continent, though in the western, thanks to their

hand-like feet, opposable thumb, and tree-haunting life, they still drag out a precarious existence in many forms from Virginia to Chili, and from Brazil to California. It is worth while to notice, too, that whereas the kangaroos and other Australian marsupials are proverbially the very stupidest of mammals, the opossums, on the contrary, are well known to those accurate observers of animal psychology, the plantation negroes, to be the very cleverest, cunningest, and slyest of American quadrupeds. In the fierce struggle for life of the crowded American lowlands, the opossum was absolutely forced to acquire a certain amount of Yankee smartness, or else to be improved off the face of the earth by the keen competition of the pouchless mammals.

Up to the day, then, when Captain Cook and Sir Joseph Banks, landing for the first time on the coast of New South Wales, saw an animal with short front limbs, huge hind legs, a monstrous tail, and a curious habit of hopping along the ground (called by the natives a kangaroo), the opossums of America were the only pouched mammals known to the European world in any part of the explored continents. Australia, severed from all the rest of the earthpenitus toto orbe divisaever since the end of the secondary period, remained as yet, so to speak, in the secondary age so far as its larger life-elements were concerned, and presented to the first comers a certain vague and indefinite picture of what 'the world before the flood' must have looked like. Only it was a very remote flood; an antediluvian age separated from our own not by thousands, but by millions, of seasons.

To this rough approximate statement, however, sundry needful qualifications must be made at the very outset. No statement is ever quite correct until you have contradicted in minute detail about two-thirds of it.

In the first place there are a good many modern elements in the indigenous population of Australia; but then they are elements of the stray and casual sort one always finds even in remote oceanic islands. They are waifs wafted by accident from other places. For example, the flora is by no means exclusively an ancient flora, for a considerable number of seeds and fruits and spores of ferns always get blown by the wind, or washed by the sea, or carried on the feet or feathers of birds, from one part of the world to another. In all these various ways, no doubt, modern plants from the Asiatic region have invaded Australia at different times, and altered to some extent the character and aspect of its original native vegetation. Nevertheless, even in the matter of its plants and trees, Australia must still be considered a very old-fashioned and stick-in-

the-mud continent. The strange puzzle-monkeys, the quaint-jointed casuarinas (like horsetails grown into big willows), and the park-like forests of blue gum-trees, with their smooth stems robbed of their outer bark, impart a marvellously antiquated and unfamiliar tone to the general appearance of Australian woodland. All these types belong by birth to classes long since extinct in the larger continents. The scrub shows no turfy greensward; grasses, which elsewhere carpet the ground, were almost unknown till introduced from Europe; in the wild lands, bushes, and undershrubs of ancient aspect cover the soil, remarkable for their stiff, dry, wiry foliage, their vertically instead of horizontally flattened leaves, and their general dead blue-green or glaucous colour. Altogether, the vegetation itself, though it contains a few more modern forms than the animal world, is still essentially antique in type, a strange survival from the forgotten flora of the chalk age, the oolite, and even the lias.

Again, to winged animals, such as birds and bats and flying insects, the ocean forms far less of a barrier than it does to quadrupeds, to reptiles, and to fresh-water fishes. Hence Australia has, to some extent, been invaded by later types of birds and other flying creatures, who live on there side by side with the ancient animals of the secondary pattern. Warblers, thrushes, flycatchers, shrikes, and crows must all be comparatively recent immigrants from the Asiatic mainland. Even in this respect, however, the Australian life-region still bears an antiquated and undeveloped aspect. Nowhere else in the world do we find those very oldest types of birds represented by the cassowaries, the emus, and the mooruk of New Britain. The extreme term in this exceedingly ancient set of creature is given us by the wingless bird, the apteryx or kiwi of New Zealand, whose feathers nearly resemble hair, and whose grotesque appearance makes it as much a wonder in its own class as the puzzle-monkey and the casuarina are among forest trees. No feathered creatures so closely approach the lizard-tailed birds of the oolite or the toothed birds of the cretaceous period as do these Australian and New Zealand emus and apteryxes. Again, while many characteristic Oriental families are quite absent, like the vultures, woodpeckers, pheasants and bulbuls, the Australian region has many other fairly ancient birds, found nowhere else on the surface of our modern planet. Such are the so-called brush turkeys and mound builders, the only feathered things that never sit upon their own eggs, but allow them to be hatched, after the fashion of reptiles, by the heat of the sand or of fermenting vegetable matter. The piping crows, the honeysuckers, the lyre-birds, and the more-porks are all peculiar to the Australian region. So are the wonderful and æsthetic bower-birds. Brush-tongued lories, black cockatoos, and gorgeously coloured pigeons, though somewhat less antique, perhaps, in type, give a special character to the bird-life of the country. And in New Guinea, an

isolated bit of the same old continent, the birds of paradise, found nowhere else in the whole world, seem to recall some forgotten Eden of the remote past, some golden age of Saturnian splendour. Poetry apart, into which I have dropped for a moment like Mr. Silas Wegg, the birds of paradise are, in fact, gorgeously dressed crows, specially adapted to forest life in a rich fruit-bearing tropical country, where food is abundant and enemies unknown.

Last of all, a certain small number of modern mammals have passed over to Australia at various times by pure chance. They fall into two classesthe rats and mice, who doubtless got transported across on floating logs or balks of timber; and the human importations, including the dog, who came, perhaps on their owners' canoes, perhaps on the wreck and débris of inundations. Yet even in these cases again, Australia still maintains its proud pre-eminence as the most antiquated and unprogressive of continents. For the Australian black-fellow must have got there a very long time ago indeed; he belongs to an extremely ancient human type, and strikingly recalls in his jaws and skull the Neanderthal savage and other early prehistoric races; while the woolly-headed Tasmanian, a member of a totally distinct human family, and perhaps the very lowest sample of humanity that has survived to modern times, must have crossed over to Tasmania even earlier still, his brethren on the mainland having no doubt been exterminated later on when the stone-age Australian black-fellows first got cast ashore upon the continent inhabited by the yet more barbaric and helpless negrito race. As for the dingo, or Australian wild dog, only half domesticated by the savage natives, he represents a low ancestral dog type, half wolf and half jackal, incapable of the higher canine traits, and with a suspicious, ferocious, glaring eye that betrays at once his uncivilisable tendencies.

Omitting these later importations, howeverthe modern plants, birds, and human beingsit may be fairly said that Australia is still in its secondary stage, while the rest of the world has reached the tertiary and quaternary periods. Here again, however, a deduction must be made, in order to attain the necessary accuracy. Even in Australia the world never stands still. Though the Australian animals are still at bottom the European and Asiatic animals of the secondary age, they are those animals with a difference. They have undergone an evolution of their own. It has not been the evolution of the great continents; but it has been evolution all the same; slower, more local, narrower, more restricted, yet evolution in the truest sense. One might compare the difference to the difference between the civilisation of Europe and the civilisation of Mexico or Peru. The Mexicans, when Cortez blotted out their indigenous

culture, were still, to be sure, in their stone age; but it was a very different stone age from that of the cave-dwellers or mound builders in Britain. Even so, though Australia is still zoologically in the secondary period, it is a secondary period a good deal altered and adapted in detail to meet the wants of special situations.

The oldest types of animals in Australia are the ornithorhynchus and the echidna, the 'beast with a bill,' and the 'porcupine ant-eater' of popular natural history. These curious creatures, genuine living fossils, occupy in some respects an intermediate place between the mammals on the one hand and the birds and lizards on the other. The echidna has no teeth, and a very bird-like skull and body; the ornithorhynchus has a bill like a duck's, webbed feet, and a great many quaint anatomical peculiarities which closely ally it to the birds and reptiles. Both, in fact, are early arrested stages in the development of mammals from the old common vertebrate ancestor; and they could only have struggled on to our own day in a continent free from the severe competition of the higher types which have since been evolved in Europe and Asia. Even in Australia itself the ornithorhynchus and echidna have had to put up perforce with the lower places in the hierarchy of nature. The first is a burrowing and aquatic creature, specialised in a thousand minute ways for his amphibious life and queer subterranean habits; the second is a spiny hedgehog-like nocturnal prowler, who buries himself in the earth during the day, and lives by night on insects which he licks up greedily with his long ribbon-like tongue. Apart from the specialisations brought about by their necessary adaptation to a particular niche in the economy of life, these two quaint and very ancient animals probably preserve for us in their general structure the features of an extremely early descendant of the common ancestor from whom mammals, birds, and reptiles alike are originally derived.

The ordinary Australian pouched mammals belong to far less ancient types than ornithorhynchus and echidna, but they too are very old in structure, though they have undergone an extraordinary separate evolution to fit them for the most diverse positions in life. Almost every main form of higher mammal (except the biggest ones) has, as it were, its analogue or representative among the marsupial fauna of the Australasian region fitted to fill the same niche in nature. For instance, in the blue gum forests of New South Wales a small animal inhabits the trees, in form and aspect exactly like a flying squirrel. Nobody who was not a structural and anatomical naturalist would ever for a moment dream of doubting its close affinity to the flying squirrels of the American woodlands. It has just the same general outline, just the same bushy

tail, just the same rough arrangement of colours, and just the same expanded parachute-like membrane stretching between the fore and hind limbs. Why should this be so? Clearly because both animals have independently adapted themselves to the same mode of life under the same general circumstances. Natural selection, acting upon unlike original types, but in like conditions, has produced in the end very similar results in both cases. Still, when we come to examine the more intimate underlying structure of the two animals, a profound fundamental difference at once exhibits itself. The one is distinctly a true squirrel, a rodent of the rodents, externally adapted to an arboreal existence; the other is equally a true phalanger, a marsupial of the marsupials, which has independently undergone on his own account very much the same adaptation, for very much the same reasons. Just so a dolphin looks externally very like a fish, in head and tail and form and movement; its flippers closely resemble fins; and nothing about it seems to differ very markedly from the outer aspect of a shark or a codfish. But in reality it has no gills and no swim-bladder; it lays no eggs; it does not own one truly fish-like organ. It breathes air, it possesses lungs, it has warm blood, it suckles its young; in heart and brain and nerves and organisation it is a thoroughgoing mammal, with an acquired resemblance to the fishy form, due entirely to mere similarity in place of residence.

Running hastily through the chief marsupial developments, one may say that the wombats are pouched animals who take the place of rabbits or marmots in Europe, and resemble them both in burrowing habits and more or less in shape, which closely approaches the familiar and ungraceful guinea-pig outline. The vulpine phalanger does duty for a fox; the fat and sleepy little dormouse phalanger takes the place of a European dormouse. Both are so ridiculously like the analogous animals of the larger continents that the colonists always call them, in perfect good faith, by the familiar names of the old-country creatures. The koala poses as a small bear; the cuscus answers to the racoons of America. The pouched badgers explain themselves at once by their very name, like the Plyants, the Pinchwifes, the Brainsicks, and the Carelesses of the Restoration comedy. The 'native rabbit' of Swan River is a rabbit-like bandicoot; the pouched ant-eater similarly takes the place of the true ant-eaters of other continents. By way of carnivores, the Tasmanian devil is a fierce and savage marsupial analogue of the American wolverine; a smaller species of the same type usurps the name and place of the marten; and the dog-headed Thylacinus is in form and figure precisely like a wolf or a jackal. The pouched weasels are very weasel-like; the kangaroo rats and kangaroo mice run the true rats and mice a close race in every particular. And it is worth notice, in this connection, that the one marsupial family which

could compete with higher American life, the opossums, are really, so to speak, the monkey development of the marsupial race. They have opposable thumbs, which make their feet almost into hands; they have prehensile tails, by which they hang from branches in true monkey fashion; they lead an arboreal omnivorous existence; they feed off fruits, birds' eggs, insects, and roots; and altogether they are just active, cunning, intelligent, tree-haunting marsupial spider-monkeys.

Australia has also one still more ancient denizen than any of these, a living fossil of the very oldest sort, a creature of wholly immemorial and primitive antiquity. The story of its discovery teems with the strangest romance of natural history. To those who could appreciate the facts of the case it was just as curious and just as interesting as though we were now to discover somewhere in an unknown island or an African oasis some surviving mammoth, some belated megatherium, or some gigantic and misshapen liassic saurian. Imagine the extinct animals of the Crystal Palace grounds suddenly appearing to our dazzled eyes in a tropical ramble, and you can faintly conceive the delight and astonishment of naturalists at large when the barramunda first 'swam into their ken' in the rivers of Queensland. To be sure, in size and shape this 'extinct fish,' still living and grunting quietly in our midst, is comparatively insignificant beside the 'dragons of the prime' immortalised in a famous stanza by Tennyson: but, to the true enthusiast, size is nothing; and the barramunda is just as much a marvel and a monster as the Atlantosaurus himself would have been if he had suddenly walked upon the stage of time, dragging fifty feet of lizard-like tail in a train behind him. And this is the plain story of that marvellous discovery of a 'missing link' in our own pedigree.

In the oldest secondary rocks of Britain and elsewhere there occur in abundance the teeth of a genus of ganoid fishes known as the Ceratodi. (I apologise for ganoid, though it is not a swear-word). These teeth reappear from time to time in several subsequent formations, but at last slowly die out altogether; and of course all naturalists naturally concluded that the creature to which they belonged had died out also, and was long since numbered with the dodo and the mastodon. The idea that a Ceratodus could still be living, far less that it formed an important link in the development of all the higher animals, could never for a moment have occurred to anybody. As well expect to find a palæolithic man quietly chipping flints on a Pacific atoll, or to discover the ancestor of all horses on the isolated and crag-encircled summit of Roraima, as to unearth a real live Ceratodus from a modern estuary. In 1870, however, Mr.

Krefft took away the breath of scientific Europe by informing it that he had found the extinct ganoid swimming about as large as life, and six feet long, without the faintest consciousness of its own scientific importance, in a river in Queensland at the present day. The unsophisticated aborigines knew it as barramunda; the almost equally ignorant white settlers called it with irreverent and unfilial contempt the flat-head. On further examination, however, the despised barramunda proved to be a connecting link of primary rank between the oldest surviving group of fishes and the lowest air-breathing animals like the frogs and salamanders. Though a true fish, it leaves its native streams at night, and sets out on a foraging expedition after vegetable food in the neighbouring woodlands. There it browses on myrtle leaves and grasses, and otherwise behaves itself in a manner wholly unbecoming its piscine antecedents and aquatic education. To fit it for this strange amphibious life, the barramunda has both lungs and gills; it can breathe either air or water at will, or, if it chooses, the two together. Though covered with scales, and most fish-like in outline, it presents points of anatomical resemblance both to salamanders and lizards; and, as a connecting bond between the North American mud-fish on the one hand and the wonderful lepidosiren on the other, it forms a true member of the long series by which the higher animals generally trace their descent from a remote race of marine ancestors. It is very interesting, therefore, to find that this living fossil link between fish and reptiles should have survived only in the fossil continent, Australia. Everywhere else it has long since been beaten out of the field by its own more developed amphibian descendants; in Australia alone it still drags on a lonely existence as the last relic of an otherwise long-forgotten and extinct family.

A VERY OLD MASTER

The work of art which lies before me is old, unquestionably old; a good deal older, in fact, than Archbishop Ussher (who invented all out of his own archiepiscopal head the date commonly assigned for the creation of the world) would by any means have been ready to admit. It is a bas-relief by an old master, considerably more antique in origin than the most archaic gem or intaglio in the Museo Borbonico at Naples, the mildly decorous Louvre in Paris, or the eminently respectable British Museum, which is the glory of our own smoky London in the spectacled eyes of German professors, all put together. When Assyrian sculptors carved in fresh white alabaster the flowing curls of Sennacherib's hair, just like a modern coachman's wig, this work of primæval art was already hoary with the rime of ages. When Memphian artists

were busy in the morning twilight of time with the towering coiffure of Ramses or Sesostris, this far more ancient relic of plastic handicraft was lying, already fossil and forgotten, beneath the concreted floor of a cave in the Dordogne. If we were to divide the period for which we possess authentic records of man's abode upon this oblate spheroid into ten epochsan epoch being a good high-sounding word which doesn't commit one to any definite chronology in particularthen it is probable that all known art, from the Egyptian onward, would fall into the tenth of the epochs thus loosely demarcated, while my old French bas-relief would fall into the first. To put the date quite succinctly, I should say it was most likely about 244,000 years before the creation of Adam according to Ussher.

The work of the old master is lightly incised on reindeer horn, and represents two horses, of a very early and heavy type, following one another, with heads stretched forward, as if sniffing the air suspiciously in search of enemies. The horses would certainly excite unfavourable comment at Newmarket. Their 'points' are undoubtedly coarse and clumsy: their heads are big, thick, stupid, and ungainly; their manes are bushy and ill-defined; their legs are distinctly feeble and spindle-shaped; their tails more closely resemble the tail of the domestic pig than that of the noble animal beloved with a love passing the love of women by the English aristocracy. Nevertheless there is little (if any) reason to doubt that my very old master did, on the whole, accurately represent the ancestral steed of his own exceedingly remote period. There were once horses even as is the horse of the prehistoric Dordonian artist. Such clumsy, big-headed brutes, dun in hue and striped down the back like modern donkeys, did actually once roam over the low plains where Paris now stands, and browse off lush grass and tall water-plants around the quays of Bordeaux and Lyons. Not only do the bones of the contemporary horses, dug up in caves, prove this, but quite recently the Russian traveller Prjevalsky (whose name is so much easier to spell than to pronounce) has discovered a similar living horse, which drags on an obscure existence somewhere in the high table-lands of Central Asia. Prjevalsky's horse (you see, as I have only to write the word, without uttering it, I don't mind how often or how intrepidly I use it) is so singularly like the clumsy brutes that sat, or rather stood, for their portraits to my old master that we can't do better than begin by describing him in propria persona.

The horse family of the present day is divided, like most other families, into two factions, which may be described for variety's sake as those of the true horses and the donkeys, these latter including also the zebras, quaggas, and

various other unfamiliar creatures whose names, in very choice Latin, are only known to the more diligent visitors at the Sunday Zoo. Now everybody must have noticed that the chief broad distinction between these two great groups consists in the feathering of the tail. The domestic donkey, with his near congeners, the zebra and co., have smooth short-haired tails, ending in a single bunch or fly-whisk of long hairs collected together in a tufted bundle at the extreme tip. The horse, on the other hand, besides having horny patches or callosities on both fore and hind legs, while the donkeys have them on the fore legs only, has a hairy tail, in which the long hairs are almost equally distributed from top to bottom, thus giving it its peculiarly bushy and brushy appearance. But Prjevalsky's horse, as one would naturally expect from an early intermediate form, stands halfway in this respect between the two groups, and acts the thankless part of a family mediator; for it has most of its long tail-hairs collected in a final flourish, like the donkey, but several of them spring from the middle distance, as in the genuine Arab, though never from the very top, thus showing an approach to the true horsey habit without actually attaining that final pinnacle of equine glory. So far as one can make out from the somewhat rude handicraft of my prehistoric Phidias the horse of the quaternary epoch had much the same caudal peculiarity; his tail was bushy, but only in the lower half. He was still in the intermediate stage between horse and donkey, a natural mule still struggling up aspiringly toward perfect horsehood. In all other matters the two creaturesthe cave man's horse and Prjevalsky'sclosely agree. Both display large heads, thick necks, coarse manes, and a general disregard of 'points' which would strike disgust and dismay into the stout breasts of Messrs. Tattersall. In fact over a T.Y.C. it may be confidently asserted, in the pure Saxon of the sporting papers, that Prjevalsky's and the cave man's lot wouldn't be in it. Nevertheless a candid critic would be forced to admit that, in spite of clumsiness, they both mean staying.

So much for the two sitters; now let us turn to the artist who sketched them. Who was he, and when did he live? Well, his name, like that of many other old masters, is quite unknown to us; but what does that matter so long as his work itself lives and survives? Like the Comtists he has managed to obtain objective immortality. The work, after all, is for the most part all we ever have to go upon. 'I have my own theory about the authorship of the Iliad and Odyssey,' said Lewis Carroll (of 'Alice in Wonderland') once in Christ Church common room: 'it is that they weren't really written by Homer, but by another person of the same name.' There you have the Iliad in a nutshell as regards the authenticity of great works. All we know about the supposed Homer (if anything) is that he was the reputed author of the two unapproachable Greek epics; and all we know directly about my old master, viewed personally, is that

he once carved with a rude flint flake on a fragment of reindeer horn these two clumsy prehistoric horses. Yet by putting two and two together we can make, not four, as might be naturally expected, but a fairly connected history of the old master himself and what Mr. Herbert Spencer would no doubt playfully term 'his environment.'

The work of art was dug up from under the firm concreted floor of a cave in the Dordogne. That cave was once inhabited by the nameless artist himself, his wife, and family. It had been previously tenanted by various other early families, as well as by bears, who seem to have lived there in the intervals between the different human occupiers. Probably the bears ejected the men, and the men in turn ejected the bears, by the summary process of eating one another up. In any case the freehold of the cave was at last settled upon our early French artist. But the date of his occupancy is by no means recent; for since he lived there the long cold spell known as the Great Ice Age, or Glacial Epoch, has swept over the whole of Northern Europe, and swept before it the shivering descendants of my poor prehistoric old master. Now, how long ago was the Great Ice Age? As a rule, if you ask a geologist for a definite date, you will find him very chary of giving you a distinct answer. He knows that the chalk is older than the London clay, and the oolite than the chalk, and the red marl than the oolite; and he knows also that each of them took a very long time indeed to lay down, but exactly how long he has no notion. If you say to him, 'Is it a million years since the chalk was deposited?' he will answer, like the old lady of Prague, whose ideas were excessively vague, 'Perhaps.' If you suggest five millions, he will answer oracularly once more, 'Perhaps'; and if you go on to twenty millions, 'Perhaps,' with a broad smile, is still the only confession of faith that torture will wring out of him. But in the matter of the Glacial Epoch, a comparatively late and almost historical event, geologists have broken through their usual reserve on this chronological question and condescended to give us a numerical determination. And here is how Dr. Croll gets at it.

Every now and again, geological evidence goes to show us, a long cold spell occurs in the northern or southern hemisphere. During these long cold spells the ice cap at the poles increases largely, till it spreads over a great part of what are now the temperate regions of the globe, and makes ice a mere drug in the market as far south as Covent Garden or the Halles at Paris. During the greatest extension of this ice sheet in the last glacial epoch, in fact, all England except a small south-western corner (about Torquay and Bournemouth) was completely covered by one enormous mass of glaciers, as is still the case with

almost the whole of Greenland. The ice sheet, grinding slowly over the hills and rocks, smoothed and polished and striated their surfaces in many places till they resembled the roches moutonnées similarly ground down in our own day by the moving ice rivers of Chamouni and Grindelwald. Now, since these great glaciations have occurred at various intervals in the world's past history, they must depend upon some frequently recurring cause. Such a cause, therefore, Dr. Croll began ingeniously to hunt about for.

He found it at last in the eccentricity of the earth's orbit. This world of ours, though usually steady enough in its movements, is at times decidedly eccentric. Not that I mean to impute to our old and exceedingly respectable planet any occasional aberrations of intellect, or still less of morals (such as might be expected from Mars and Venus); the word is here to be accepted strictly in its scientific or Pickwickian sense as implying merely an irregularity of movement, a slight wobbling out of the established path, a deviation from exact circularity. Owing to a combination of astronomical revolutions, the precession of the equinoxes and the motion of the aphelion (I am not going to explain them here; the names alone will be quite sufficient for most people; they will take the rest on trust)owing to the combination of these profoundly interesting causes, I say, there occur certain periods in the world's life when for a very long time together (10,500 years, to be quite precise) the northern hemisphere is warmer than the southern, or vice versa. Now, Dr. Croll has calculated that about 250,000 years ago this eccentricity of the earth's orbit was at its highest, so that a cycle of recurring cold and warm epochs in either hemisphere alternately then set in; and such cold spells it was that produced the Great Ice Age in Northern Europe. They went on till about 80,000 years ago, when they stopped short for the present, leaving the climate of Britain and the neighbouring continent with its existing inconvenient Laodicean temperature. And, as there are good reasons for believing that my old master and his contemporaries lived just before the greatest cold of the Glacial Epoch, and that his immediate descendants, with the animals on which they feasted, were driven out of Europe, or out of existence, by the slow approach of the enormous ice sheet, we may, I think, fairly conclude that his date was somewhere about B.C. 248,000. In any case we must at least admit, with Mr. Andrew Lang, the laureate of the twenty-five thousandth century, that

He lived in the long long agoes;

'Twas the manner of primitive man.

The old master, then, carved his bas-relief in pre-Glacial Europe, just at the

moment before the temporary extinction of his race in France by the coming on of the Great Ice Age. We can infer this fact from the character of the fauna by which he was surrounded, a fauna in which species of cold and warm climates are at times quite capriciously intermingled. We get the reindeer and the mammoth side by side with the hippopotamus and the hyena; we find the chilly cave bear and the Norway lemming, the musk sheep and the Arctic fox in the same deposits with the lion and the lynx, the leopard and the rhinoceros. The fact is, as Mr. Alfred Russel Wallace has pointed out, we live to-day in a zoologically impoverished world, from which all the largest, fiercest, and most remarkable animals have lately been weeded out. And it was in all probability the coming on of the Ice Age that did the weeding. Our Zoo can boast no mammoth and no mastodon. The sabre-toothed lion has gone the way of all flesh; the deinotherium and the colossal ruminants of the Pliocene Age no longer browse beside the banks of Seine. But our old master saw the last of some at least among those gigantic quadrupeds; it was his hand or that of one among his fellows that scratched the famous mammoth etching on the ivory of La Madelaine and carved the figure of the extinct cave bear on the reindeer-horn ornaments of Laugerie Basse. Probably, therefore, he lived in the period immediately preceding the Great Ice Age, or else perhaps in one of the warm interglacial spells with which the long secular winter of the northern hemisphere was then from time to time agreeably diversified.

And what did the old master himself look like? Well, painters have always been fond of reproducing their own lineaments. Have we not the familiar young Raffael, painted by himself, and the Rembrandt, and the Titian, and the Rubens, and a hundred other self-drawn portraits, all flattering and all famous? Even so primitive man has drawn himself many times over, not indeed on this particular piece of reindeer horn, but on several other media to be seen elsewhere, in the original or in good copies. One of the best portraits is that discovered in the old cave at Laugerie Basse by M. Elie Massénat, where a very early pre-Glacial man is represented in the act of hunting an aurochs, at which he is casting a flint-tipped javelin. In this, as in all other pictures of the same epoch, I regret to say that the ancient hunter is represented in the costume of Adam before the fall. Our old master's studies, in fact, are all in the nude. Primitive man was evidently unacquainted as yet with the use of clothing, though primitive woman, while still unclad, had already learnt how to heighten her natural charms by the simple addition of a necklace and bracelets. Indeed, though dresses were still wholly unknown, rouge was even then extremely fashionable among French ladies, and lumps of the ruddle with which primitive woman made herself beautiful for ever are now to be discovered in the corner of the cave where she had her little prehistoric

boudoir. To return to our hunter, however, who for aught we know to the contrary may be our old master himself in person, he is a rather crouching and semi-erect savage, with an arched back, recalling somewhat that of the gorilla, a round head, long neck, pointed beard, and weak, shambling, ill-developed legs. I fear we must admit that pre-Glacial man cut, on the whole, a very sorry and awkward figure.

Was he black? That we don't certainly know, but all analogy would lead one to answer positively, Yes. White men seem, on the whole, to be a very recent and novel improvement on the original evolutionary pattern. At any rate he was distinctly hairy, like the Ainos, or aborigines of Japan, in our own day, of whom Miss Isabella Bird has drawn so startling and sensational a picture. Several of the pre-Glacial sketches show us lank and gawky savages with the body covered with long scratches, answering exactly to the scratches which represent the hanging hair of the mammoth, and suggesting that man then still retained his old original hairy covering. The few skulls and other fragments of skeletons now preserved to us also indicate that our old master and his contemporaries much resembled in shape and build the Australian black fellows, though their foreheads were lower and more receding, while their front teeth still projected in huge fangs, faintly recalling the immense canines of the male gorilla. Quite apart from any theoretical considerations as to our probable descent (or ascent) from Mr. Darwin's hypothetical 'hairy arboreal quadrumanous ancestor,' whose existence may or may not be really true, there can be no doubt that the actual historical remains set before us pre-Glacial man as evidently approaching in several important respects the higher monkeys.

It is interesting to note too that while the Men of the Time still retained (to be frankly evolutionary) many traces of the old monkey-like progenitor, the horses which our old master has so cleverly delineated for us on his scrap of horn similarly retained many traces of the earlier united horse-and-donkey ancestor. Professor Huxley has admirably reconstructed for us the pedigree of the horse, beginning with a little creature from the Eocene beds of New Mexico, with five toes to each hind foot, and ending with the modern horse, whose hoof is now practically reduced to a single and solid-nailed toe. Intermediate stages show us an Upper Eocene animal as big as a fox, with four toes on his front feet and three behind; a Miocene kind as big as a sheep, with only three toes on the front foot, the two outer of which are smaller than the big middle one; and finally a Pliocene form, as big as a donkey, with one stout middle toe, the real hoof, flanked by two smaller ones, too short by far to

reach the ground. In our own horse these lateral toes have become reduced to what are known by veterinaries as splint bones, combined with the canon in a single solidly morticed piece. But in the pre-Glacial horses the splint bones still generally remained quite distinct, thus pointing back to the still earlier period when they existed as two separate and independent side toes in the ancestral quadruped. In a few cave specimens, however, the splints are found united with the canons in a single piece, while conversely horses are sometimes, though very rarely, born at the present day with three-toed feet, exactly resembling those of their half-forgotten ancestor, the Pliocene hipparion.

The reason why we know so much about the horses of the cave period is, I am bound to admit, simply and solely because the man of the period ate them. Hippophagy has always been popular in France; it was practised by pre-Glacial man in the caves of Périgord, and revived with immense enthusiasm by the gourmets of the Boulevards after the siege of Paris and the hunger of the Commune. The cave men hunted and killed the wild horse of their own times, and one of the best of their remaining works of art represents a naked hunter attacking two horses, while a huge snake winds itself unperceived behind close to his heel. In this rough prehistoric sketch one seems to catch some faint antique foreshadowing of the rude humour of the 'Petit Journal pour Rire.' Some archæologists even believe that the horse was domesticated by the cave men as a source of food, and argue that the familiarity with its form shown in the drawings could only have been acquired by people who knew the animal in its domesticated state; they declare that the cave man was obviously horsey. But all the indications seem to me to show that tame animals were quite unknown in the age of the cave men. The mammoth certainly was never domesticated; yet there is a famous sketch of the huge beast upon a piece of his own ivory, discovered in the cave of La Madelaine by Messrs. Lartet and Christy, and engraved a hundred times in works on archæology, which forms one of the finest existing relics of pre-Glacial art. In another sketch, less well known, but not unworthy of admiration, the early artist has given us with a few rapid but admirable strokes his own reminiscence of the effect produced upon him by the sudden onslaught of the hairy brute, tusks erect and mouth wide open, a perfect glimpse of elephantine fury. It forms a capital example of early impressionism, respectfully recommended to the favourable attention of Mr. J.M. Whistler.

The reindeer, however, formed the favourite food and favourite model of the pre-Glacial artists. Perhaps it was a better sitter than the mammoth; certainly it

is much more frequently represented on these early prehistoric bas-reliefs. The high-water mark of palæolithic art is undoubtedly to be found in the reindeer of the cave of Thayngen, in Switzerland, a capital and spirited representation of a buck grazing, in which the perspective of the two horns is better managed than a Chinese artist would manage it at the present day. Another drawing of two reindeer fighting, scratched on a fragment of schistose rock and unearthed in one of the caves of Périgord, though far inferior to the Swiss specimen in spirit and execution, is yet not without real merit. The perspective, however, displays one marked infantile trait, for the head and legs of one deer are seen distinctly through the body of another. Cave bears, fish, musk sheep, foxes, and many other extinct or existing animals are also found among the archaic sculptures. Probably all these creatures were used as food; and it is even doubtful whether the artistic troglodytes were not also confirmed cannibals. To quote Mr. Andrew Lang once more on primitive man, 'he lived in a cave by the seas; he lived upon oysters and foes.' The oysters are quite undoubted, and the foes may be inferred with considerable certainty.

I have spoken of our old master more than once under this rather question-begging style and title of primitive man. In reality, however, the very facts which I have here been detailing serve themselves to show how extremely far our hero was from being truly primitive. You can't speak of a distinguished artist, who draws the portraits of extinct animals with grace and accuracy, as in any proper sense primordial. Grant that our good troglodytes were indeed light-hearted cannibals; nevertheless they could design far better than the modern Esquimaux or Polynesians, and carve far better than the civilised being who is now calmly discoursing about their personal peculiarities in his own study. Between the cave men of the pre-Glacial age and the hypothetical hairy quadrumanous ancestor aforesaid there must have intervened innumerable generations of gradually improving intermediate forms. The old master, when he first makes his bow to us, naked and not ashamed, in his Swiss or French grotto, flint scalpel in hand and necklet of bear's teeth dropping loosely on his hairy bosom, is nevertheless in all essentials a completely evolved human being, with a whole past of slowly acquired culture lying dimly and mysteriously behind him. Already he had invented the bow with its flint-tipped arrow, the neatly chipped javelin-head, the bone harpoon, the barbed fish-hook, the axe, the lance, the dagger, and the needle. Already he had learnt how to decorate his implements with artistic skill, and to carve the handles of his knives with the figures of animals. I have no doubt that he even knew how to brew and to distil; and he was probably acquainted with the noble art of cookery as applied to the persons of his human fellow creatures. Such a personage cannot reasonably be called primitive; cannibalism, as

somebody has rightly remarked, is the first step on the road to civilisation.

No, if we want to get at genuine, unadulterated primitive man we must go much further back in time than the mere trifle of 250,000 years with which Dr. Croll and the cosmic astronomers so generously provide us for pre-Glacial humanity. We must turn away to the immeasurably earlier fire-split flints which the Abbé Bourgeoisundaunted mortal!ventured to discover among the Miocene strata of the calcaire de Beauce. Those flints, if of human origin at all, were fashioned by some naked and still more hairy creature who might fairly claim to be considered as genuinely primitive. So rude are they that, though evidently artificial, one distinguished archæologist will not admit they can be in any way human; he will have it that they were really the handiwork of the great European anthropoid ape of that early period. This, however, is nothing more than very delicate hair-splitting; for what does it matter whether you call the animal that fashioned these exceedingly rough and fire-marked implements a man-like ape or an ape-like human being? The fact remains quite unaltered, whichever name you choose to give to it. When you have got to a monkey who can light a fire and proceed to manufacture himself a convenient implement, you may be sure that man, noble man, with all his glorious and admirable facultiescannibal or otherwiseis lurking somewhere very close just round the corner. The more we examine the work of our old master, in fact, the more does the conviction force itself upon us that he was very far indeed from being primitivethat we must push back the early history of our race not for 250,000 winters alone, but perhaps for two or three million years into the dim past of Tertiary ages.

But if pre-Glacial man is thus separated from the origin of the race by a very long interval indeed, it is none the less true that he is separated from our own time by the intervention of a vast blank space, the space occupied by the coming on and passing away of the Glacial Epoch. A great gap cuts him off from what we may consider as the relatively modern age of the mound-builders, whose grassy barrows still cap the summits of our southern chalk downs. When the great ice sheet drove away palæolithic manthe man of the caves and the unwrought flint axesfrom Northern Europe, he was still nothing more than a naked savage in the hunting stage, divinely gifted for art, indeed, but armed only with roughly chipped stone implements, and wholly ignorant of taming animals or of the very rudiments of agriculture. He knew nothing of the use of metalsaurum irrepertum spernere fortiorand he had not even learnt how to grind and polish his rude stone tomahawks to a finished edge. He couldn't make himself a bowl of sun-baked pottery, and, if he had discovered

the almost universal art of manufacturing an intoxicating liquor from grain or berries (for, as Byron, with too great anthropological truth, justly remarks, 'man, being reasonable, must get drunk'), he at least drank his aboriginal beer or toddy from the capacious horn of a slaughtered aurochs. That was the kind of human being who alone inhabited France and England during the later pre-Glacial period.

A hundred and seventy thousand years elapse (as the play-bills put it), and then the curtain rises afresh upon neolithic Europe. Man meanwhile, loitering somewhere behind the scenes in Asia or Africa (as yet imperfectly explored from this point of view), had acquired the important arts of sharpening his tomahawks and producing hand-made pottery for his kitchen utensils. When the great ice sheet cleared away he followed the returning summer into Northern Europe, another man, physically, intellectually, and morally, with all the slow accumulations of nearly two thousand centuries (how easily one writes the words! how hard to realise them!) upon his maturer shoulders. Then comes the age of what older antiquaries used to regard as primitive antiquitythe age of the English barrows, of the Danish kitchen middens, of the Swiss lake dwellings. The men who lived in it had domesticated the dog, the cow, the sheep, the goat, and the invaluable pig; they had begun to sow small ancestral wheat and undeveloped barley; they had learnt to weave flax and wear decent clothing: in a word, they had passed from the savage hunting condition to the stage of barbaric herdsmen and agriculturists. That is a comparatively modern period, and yet I suppose we must conclude with Dr. James Geikie that it isn't to be measured by mere calculations of ten or twenty centuries, but of ten or twenty thousand years. The perspective of the past is opening up rapidly before us; what looked quite close yesterday is shown to-day to lie away off somewhere in the dim distance. Like our paleolithic artists, we fail to get the reindeer fairly behind the ox in the foreground, as we ought to do if we saw the whole scene properly foreshortened.

On the table where I write there lie two paper-weights, preserving from the fate of the sibylline leaves the sheets of foolscap to which this essay is now being committed. One of them is a very rude flint hatchet, produced by merely chipping off flakes from its side by dexterous blows, and utterly unpolished or unground in any way. It belongs to the age of the very old master (or possibly even to a slightly earlier epoch), and it was sent me from Ightham, in Kent, by that indefatigable unearther of prehistoric memorials, Mr. Benjamin Harrison. That flint, which now serves me in the office of a paper-weight, is far ruder, simpler, and more ineffective than any weapon or implement at present in use

among the lowest savages. Yet with it, I doubt not, some naked black fellow by the banks of the Thames has hunted the mammoth among unbroken forest two hundred thousand years ago and more; with it he has faced the angry cave bear and the original and only genuine British lion (for everybody knows that the existing mongrel heraldic beast is nothing better than a bastard modification of the leopard of the Plantagenets). Nay, I have very little doubt in my own mind that with it some æsthetic ancestor has brained and cut up for his use his next-door neighbour in the nearest cavern, and then carved upon his well-picked bones an interesting sketch of the entire performance. The Du Mauriers of that remote age, in fact, habitually drew their society pictures upon the personal remains of the mammoth or the man whom they wished to caricature in deathless bone-cuts. The other paper-weight is a polished neolithic tomahawk, belonging to the period of the mound-builders, who succeeded the Glacial Epoch, and it measures the distance between the two levels of civilisation with great accuracy. It is the military weapon of a trained barbaric warrior as opposed to the universal implement and utensil of a rude, solitary, savage hunter. Yet how curious it is that even in the midst of this 'so-called nineteenth century,' which perpetually proclaims itself an age of progress, men should still prefer to believe themselves inferior to their original ancestors, instead of being superior to them! The idea that man has risen is considered base, degrading, and positively wicked; the idea that he has fallen is considered to be immensely inspiring, ennobling, and beautiful. For myself, I have somehow always preferred the boast of the Homeric Glaucus that we indeed maintain ourselves to be much better men than ever were our fathers.