

## ON THE EXTINCT ANIMALS OF THE COLONIES OF GREAT BRITAIN.

At the conclusion of my student's career at Paris, in the time of Baron Cuvier, my first application of that great teacher's "Laws of Reconstruction of Extinct Animals from their Fossil Remains" was to those of the British Isles,\* of which study the results, as relating to the Mammals,† Birds, and Reptiles,‡ have been published.

I next turned my attention to the fossil evidences of these classes of animals in the Colonies of the Empire; and I propose to submit to the Royal Colonial Institute, on the present occasion, the chief results in relation to the Cape of Good Hope, Australia, and New Zealand.

### CAPE OF GOOD HOPE.

My present notice of the evidences of extinct animals of the Cape of Good Hope will be limited to those of the Reptilian class, to which the South African crocodiles, tortoises, lizards, and toads are now the animals nearest akin. Of fossil remains of serpents I have received none; nor are any of the fossil reptiles which have reached me from the Cape allied in genera, families, or even orders, to those now existing in the world. All the Cape subjects of my attempts at restoration are from what are commonly termed the "Karoo beds," covering an area of over 200,000 square miles, extending between latitudes  $35^{\circ}$  and  $33^{\circ} 30'$  S. and longitudes  $20^{\circ}$  and  $28^{\circ}$  E. They overlie deposits of Devonian and Carboniferous age, include those answering to European Permian and Trias, and consequently are of older date than the oolites and liassic cliffs in England from which have been derived, among other strange reptilian forms, the numerous kinds of ichthyosaurs and plesiosaurs.

The Cape fossils are embedded and petrified in shales and rocks of quartzose sandstones, the strata of which slightly incline in their southern verge from horizontality. They seem to have been deposited from lacustrine or estuarine waters during a lapse of time which may be conceived from the mountain ranges into

\* Reports of the British Association, Vols. for 1839, 1841, 1842, 1843.

† History of British Fossil Mammals and Birds, 8vo., 1846. (Von Voorst).

‡ History of British Fossil Reptiles, 4to., Parts i.—vi. 1849-1855 (Published by the Author.)

which they are now elevated. The following vertical thickness of the fossiliferous strata has been ascertained: at the "Stormberg Beds," to be 1,800 feet; at the "Beaufort Beds," 1,700 feet; at the "Koonap Beds," 1,500 feet; at the "Upper Ecca Beds," 1,200 feet. These stratified beds, or basins of ancient waters, have been, in the course of their upheaval, traversed by trap dykes, and the consolidating and elevating forces to which the shales have been subject have converted them into the hardest and most intractible rocks that my chisel ever operated on: it "strikes fire" at every blow. The difficulty of extricating the embedded teeth and bones of the strange creatures that haunted the banks and shallows of the ancient lakes or estuaries is enhanced by the near correspondence in colour of the petrified parts to the dark, often black, rock in which they are embedded.

In the year 1838, Mr. Andrew Geddes Bain, employed in the construction of a military road north of Fort Beaufort, observed in parts of the rock he was blasting, portions like teeth and fragments of bone; these he transmitted to the Geological Society of London, and they were referred by the Council to me to report on.\* The result was so novel that Mr. Bain was encouraged to persevere in the collection and transmission of such evidences, and received for that purpose grants of money from the Geological Society and from the Trustees of the British Museum. I kept up communication with Mr. A. G. Bain until his demise, and have continued the same with his son, Mr. Thomas Bain, the present Surveyor of Roads to the Cape Colony.

The rich series of fossil evidences from these gentlemen have been supplemented by specimens transmitted by successive Governors (Sir George Gray, K.C.B., and Sir Henry Barkly, K.C.B.), by H.R.H. the Duke of Edinburgh, by Dr. Guybon Atherstone, of Graham's Town, by Dr. Rubidge, by J. M. Orpen, Esq., Government Surveyor of the Cape, and by several friendly Colonists.

Besides separate "Reports" and "Memoirs" in the "Transactions of the Royal and Geological Societies," the fossils so received have afforded subjects filling 70 plates of a 4to. work of 100 pages of text, † now on the table.

I think the most extraordinary, as it was the first to be restored, of the old Cape reptiles, was a creature attaining the size of a walrus, and which, like that amphibious mammal, had a pair of long,

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\* Quarterly Journal of the Geological Society of London, vol. ix. p. ii.

† Description of the Fossil Reptilia of South Africa. 4to., 2 vols., 1876. By Prof. Owen. Published by the Trustees of the British Museum.

pointed tusks descending from the upper jaw. But it had no other teeth, and it combined the two-tusked character with a lower jaw, edentulous, like that of a tortoise, and a skull exemplifying crocodilian and lacertian structures. Many species of this type, varying in size, came successively to hand, and exemplified the genus called *Dicynodon*. Other two-tusked reptiles required a distinct generic section, called *Ptychognathus*. A third extensive series carried the tortoise likeness further by the absence of tusks, but with the same composite cranial structure as in the *Bidentals*; and, in short, a series of *Reptilia* was brought to light which necessitated the formation of a new order in the class, to which was assigned the denomination of *ANOMODONTIA*.

Now, although no true coal has been met with in the Karoo strata, although present in the older Devonian series, at the Cape, called the Kowie Coal beds, yet remains of a rich series of vegetation on the land traversed or occasionally visited by the Karoo reptiles have been detected. I was not surprised, therefore, to receive evidences of huge herbivorous dragons, akin, although remotely, to our own liassic scelidosaur and the Wealden iguanodons.

The jaws of the *Tapinocephali*, of the *Pareiosauri*, and of the *Anthodons* were armed with close-set series of equal-sized teeth, having crowns adapted to crush and pound vegetable substances, and were associated with modifications of the skull for horizontal grinding movements of the jaws. A significant fact was elicited by scrutiny, and sections of parts, of the back-bone of these *Dinosauria*. The bodies of the vertebræ retained more of the foetal structure than has been met with in any post-triassic herbivorous reptile. Those of *anthodon*, for example, were bi-concave as in fishes, and those of *pareiosaurus* and *tapinocephalus* carried the primitive embryonal character a degree further. The apices of the hollow terminal cones, which nearly meet in the centre in *Anthodon*, communicate in the other genera, exemplifying the persistence in those huge dragons of a continuous, beaded notocord. Hence the necessity of placing them in a distinct section of *Dinosauria*, called "*Tretospondilia*," and it may be, as our restorations become completed, that erpetologists will regard them as the types of an order distinct from the later forms of *Dinosauria*.

In the Trias of Europe had been found the jaws and portions of skull of a fossil creature provided with large flattened crushing teeth, like a pavement covering the palate above, and the correspondingly broad tracts of the under-jaw. These fossils were referred by Agassiz and Meyer to an extinct fish called *Placodus*.

The first specimen of this rare genus that came to my hands, from Germany, showed, however, characters which led me to think it was a reptile, not a fish. It was with much pleasure, therefore, that I found among the Cape fossils an unequivocal and larger extinct reptile, provided with similar crushing teeth, and with these only; forming, likewise, a pavement upon the palate opposed to similar teeth on a broad alveolar tract of the lower jaw. Since describing and figuring this fossil, under the name *Endothiodon*, I have lately received a second species of the same genus, also from the Karoo beds. It is, of course, significant to note that the only analogous form of reptile from localities elsewhere than at the Cape had left its remains in deposits of Triassic age. At the present day, the only known aquatic vertebrates adapted by their teeth to crack and crush shell-fish belong to the class of Fishes: such, for example, are the Wolf-fish (*Anarrhichas*) and the Port Jackson Shark (*Cestracion*).

An extensive series of Reptilia has been brought to light from the Cape fossiliferous beds above specified, which were of a more strictly and decidedly carnivorous nature than the *Dicynodonts*, combining upper tusks of a more piercing and trenchant character opposed to a pair of similar tusks below, crossing in front of the upper pair when the mouth was shut. These killing and holding teeth, like the canines, or laniary teeth, of the lion and dog, were preceded by incisor teeth of a similarly pointed shape, and followed by molar teeth, of the character of those called carnassial or sectorial in Mammalian feræ. This type of dentition, in which the "incisors," "canines," and "molars" can be specified on characters of size, shape, and relative position, had hitherto been unknown, save in the Mammalian class; but it is combined in these extinct Cape creatures with a true Reptilian or cold-blooded cranial and vertebral structure. With this guiding evidence of the Reptilian class of our present series of fossils, I further found associated with such dentition that the teeth were retained, as in Mammals, sufficiently long for the fangs to dwindle and become consolidated at the implanted end; that the humerus, with ridges and processes adapted to as free evolutions of the forepaw as in the lion, also showed a canal for the passage and defence of a brachial artery and nerve, not present in any existing kind of Reptile, but characterising the humerus in many, especially feline carnivorous, Mammalia. Furthermore, that the paws were supported by joints or phalanges in the same numbers, or according to the same formula, as the Mammalian paw.

Detecting many and various modifications of this carnivorous reptilian type, I felt constrained to group them into a distinct order, called THERIODONTIA. This order was exemplified in South Africa by a species and genus (*Titanosuchus ferox*) surpassing the lion in size; by others as large as a leopard (*Lycosaurus pardalis*); and by others, again, as small as a cat or founart (*Galesaurus* and *Procolophon*). I may also note a fact of some significance, that the incisive formula in the Theriodonts is not that of the higher or placental Mammals, but of the lower, more reptile-like, marsupial ones. Thus, *Cynodracon* has  $i \frac{5-5}{4-4}$ , like the opossums (*Didelphis*); *Lycosaurus* has  $i \frac{4-4}{3-3}$ , like *Thylacinus* and *Sarcophilus* (the native hyæna and devil of the Tasmanian colonists); while the placental Carnivora never show more than  $i \frac{3-3}{3-3}$ .

In the existing Reptilia the characters above specified are wanting. They would have been unknown and unsuspected as reptilian ones, save for such researches as are here summarised. If the gap in the series of animals continued from the Triassic to the present period had not been filled up otherwise than by reptiles, the living remnant of that class would have testified to total loss of such gains of organisation as had enriched the predecessors of modern tortoises, lizards, and crocodiles.

We now know, through discovery and study of fossil remains, that not one of the gains which benefited our extinct reptiles has been lost, but has been handed on, and advanced through a higher type of Vertebrates, of which mammalian type we trace the dawn back to the period when Reptiles were at their best, grandest in bulk, most numerous in individuals, most varied in species, best endowed with kinds and powers of locomotion, and with instruments for obtaining and dealing with both animal and vegetable food.

Then obtrudes the question, and will not be parried, Has the transference of structures from the Reptilian to the Mammalian type been a seeming one, delusive, due to accidental coincidences in animal species independently created? Or, was the transference real, consequent on the incoming of modified species by way of descent, and through the operation of a secondary law? Certain it is that the lost reptilian structures defined in this paper are now manifested at the Cape of Good Hope by quadrupeds with a higher condition of cerebral, circulatory, respiratory, and tegumentary

systems. But into these higher generalisations of biological science it is beside my present purpose to enter.

I therefore next proceed to notice the Extinct Animals of the Colony of

#### NEW ZEALAND.

When Cook re-discovered,\* or, for us, virtually discovered New Zealand, in 1769, he was accompanied by Solander, a pupil of Linnæus, and by Joseph Banks, an ardent collector of facts and objects of Natural History. They made every effort, and tried every means of inquiry of the friendly natives, in pursuance of their quest. A dog, resembling that which they had seen in Polynesian islands, and probably introduced into New Zealand by the Maories, was noticed, and a species of rat was obtained, which was fostered for food by the natives. Bats had flown thither, but no wild land-mammals were seen or heard of. Although Captain Cook was enjoined by the "Admiralty Instructions" to bring home "any extraneous fossils" he might meet with, none such were obtained in New Zealand; nor could any information be extracted as to any beast or bird notable for its large size that then existed or had existed in the island. In the Maori "Vocabulary" appended to the "Voyage," neither the word "Moa" nor "Movie" occur. The natives gave no sign that they knew anything of gigantic birds which had served their ancestors for food.

Subsequent expeditions, having Natural History more directly in view, sent out by the French Government, were equally unsuccessful. The accomplished zoologist Lesson accompanied the "Voyage de la *Coquille*" in 1820. MM. Quoy and Gaimard were attached to the *Astrolabe* (1827). The "Zoologie" of both voyages was brought out in detail and with rich illustrations by the French Government, but no clue to the singular extinct Avifauna of New Zealand was obtained. Confirmation was recorded of the small wingless bird, the Kivi, of which Captain Barclay, of the ship *Providence*, had brought to England a skin, in the year 1812; but no idea was suggested of the gigantic race of which that bird has proved to be the sole survivor.

One afternoon in the year 1838, as I was preparing for a lecture, an individual was announced, who unwrapped a bone which he

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\* Abel Tasman reached the west coast of New Zealand in December, 1642. He made no observations on the animals or products of the islands, and departed, after the slaughter by the natives of four of his crew.

stated he had obtained in New Zealand from a native, who told him it was the bone of a great eagle, and for this specimen the man asked the sum of ten guineas. I assured him he had been misinformed, that no bird of flight had a bone of that structure; that it was a "marrow-bone," in shape and size like those brought to table wrapped in a napkin.

To further questions as to its locality, the vendor replied by showing, among other evidences, a jade-stone weapon, which I knew to be peculiar to the New Zealanders, and he still attached so much value to the unpromising fragment, that I consented to try to make out the bone if he would leave it and call the next day.

After "Lecture," I took the bone to the skeleton of the ox, expecting to verify my first surmise; but with much resemblance to the shaft of the thigh-bone, there were precluding differences: from the arm-bone (*humerus*) of the ox, which also affords the tavern delicacy, the discrepancy of shape was more marked. Still, led by the thickness of the wall of the marrow-cavity, I proceeded to compare the bone with similar-sized portions of the skeletons of the various large quadrupeds which might have been introduced and have left remains in New Zealand.

In the course of these comparisons I noted certain superficial impressions which recalled to mind similar ones which I had observed on the surface of the bones of some large birds. Thereupon, I proceeded to the skeleton of the ostrich. The "bone" tallied in point of size with the shaft of the thigh-bone in that bird, but was different in shape. In the latter character it was more like the thigh-bone of the cassowary; but it differed in a more important particular from that bone in the ostrich, cassowary, emu, rhea, and eagle, inasmuch as in those birds the femur is "pneumatic," or contains air, whereas the huge bird's bone in question had been filled with marrow, like the thigh-bone of a beast.

I was almost staggered by the conclusion in which I was landed. Could a bird as big as an ostrich, and of a more massive build, have ever found subsistence in so small an island as New Zealand? All analogy seemed against it. The ostrich has the whole continent of Africa for its home, the rhea roams over South America, the emu over Australia, the cassowary over New Guinea!

These considerations, indeed, told more strongly with the then master-ornithologists, my seniors, Vigors and Yarrell, and to whose judgment I looked with due deference. Yet their scepticism was more natural from their not being practically familiar with the force of palæontological evidence. And, as I urged, this

huge bird, if I could be credited, was new to Science, and so might as well have come from New Zealand as from anywhere else. In short, the "Paper" was admitted into the Transactions of the Zoological Society, with one plate, giving four views of "the bone" in question.

On the publication of the volume in 1839, one hundred extra copies of the paper were struck off, and these I distributed in every quarter of the islands of New Zealand where attention to such evidences was likely to be attracted.

At that date their acquisition to Great Britain was mainly promoted by the "New Zealand Company," whose agent, Captain William Wakefield, was zealously carrying out the principles of colonisation advocated by his brother, Edward Gibbon Wakefield. Through J. R. Gowen, Esq., a director of the company, the distribution of my paper was recommended and efficiently carried out by Captain Wakefield.

The missionary promptly worked in the track of the colonist. Imperial recognition became inevitable. First a Governor, then a Bishop, Dr. Selwyn; afterwards a Chief Justice, my friend Sir William Martin, went out. Upon each and all I pressed the claims of the possible big bird of New Zealand to attention according to leisure and opportunity. The years 1840 and 1841 passed, and I began to doubt, but misgiving went no further than as to locality; of the bird itself I may say I was "cock-sure." Toward the close of 1842 came the welcome letter of the Rev. William Cotton, M.A., companion of the Bishop, announcing the discovery of big bones in the North Island, and this was followed by the arrival of a boxful transmitted by a fellow-missionary, now the Right Rev. Bishop Williams, to Dr. Buckland, by whom these specimens were generously confided to me for description. They included a nearly perfect specimen of the bone of which I had received the shaft, and with it the other bones of the hind limb of the same bird. These afforded adequate grounds for defining a genus *Dinornis*, and a species *struthioides*. But what I was not prepared to see, and saw with amazement, were similar evidences of a larger species of the same genus, a *Dinornis ingens*, and other remains of a still larger kind, a *Dinornis giganteus*. But might not these be parts of individuals of the one and the same gigantic bird at different stages of growth? The answer to this question is given by the well-marked characters of immaturity which the bones of the bird's leg display, and especially the third or metatarsal bone, which is a compound one, and does not acquire the consolidation or coalescence of its three or more constituent elements until



maturity is reached. Moreover, with the above evidences of birds of the same genus, surpassing in size any previously known, were others of smaller size, also of full-grown birds. They indicated the former existence in New Zealand of a *Dinornis casuarinus*, a *Dinornis dromioides*, a *Dinornis otidiformis*, so called as agreeing in size respectively with the cassowary, the emu, and the bustard. Of the latter I subsequently received remains justifying its title to a distinct genus, *Aptornis*. All the others belonged to the genus *Dinornis*. Correspondence was kept up with every contributor in New Zealand of specimens and of information bearing upon this new chapter in ornithology. Year by year accessions of fossils reached me; all were of the class of Birds.

No evidence of an extinct mammal or of an extinct reptile has hitherto been obtained from the comparatively recent formation yielding the avian remains. The progress of restoration was in two directions, one in perfecting a knowledge of the entire skeleton of an individual, the other of the specific and generic modifications of these extinct wingless birds. The law of correlation, justifying the affirmation from the first fragment that the bird was terrestrial, incapable of flight, proportionally heavier and more sluggish than the ostrich, was vindicated by discovery of the small and keel-less breast-bone; and by the relatively still smaller scapular arch, which, moreover, indicated an entire want of wings by the presence of a ridge where the socket for the main wing-bone should have been, and where it exists in the ostrich, and also in the apteryx, in which the wing is reduced to the smallest relative dimensions among existing birds. If any still smaller rudiments of a humerus should have existed and have been suspended by ligament to the scapulo-coracoid arch, in *Dinornis*, such specimen has not yet reached me. Means of restoring the skull, the pelvis, the vertebral column, and the entire foot successively arrived.

The next and very remarkable kind of *Dinornis* was characterised by the relative thickness of the bones of the hind limb, and suggested the epithet *Elephantopus*. This elephant-footed bird was as tall as an ostrich, but must have outweighed two at least of that largest of living birds—the *Avium maxima* of Linnæus. But I was favoured, next, to receive remains of a *Dinornis* which as much surpassed in size the *giganteus*, as did this the *ingens*. Deeming then, as now, that the limits of bulk were surely reached, I committed myself to the *nomen specificum* of *Dinornis maximus*. Of this stupendous bird you may see the skeleton in the British Museum. I thought the articulated casts of that of the *Megatherium giganteum* a suitable equivalent, in which the accomplished founder of the

Natural History Museum at Christchurch, Canterbury Province, South Island, concurred. Dr. von Haast has had the same pleasure in adding that evidence of one of the hugest extinct Mammals to his museum at the Antipodes, as I have experienced in the addition, due to his discovery in the Glenmark swamp of the maximised Moa, of the skeleton of that bird in our National Museum at home.\*

The species of *Dinornis* now more or less completely restored are fifteen in number, viz. *struthioides*, *ingens*, *giganteus*, *dromioides*, *casuarinus*, *rheides*, *crassus*, *gravis*, *gracilis*, *geranoides*, *robustus*, *elephantopus*, *curtus*, and *maximus*. The last two exemplify the opposite extremes of size in the extinct genus.

Our knowledge of these extinct wingless birds is not, however, restricted to their osteology. Some have left their remains in caves, and under other conditions, which have enabled us to study and compare portions of their skin, and even their plumage. The feather, as in other flightless birds, had loose barbs, and it was provided with an after-shaft, two feathers growing out of one quill, as in the cassowary. Of the skin of the sole of the foot and of the form and substance of the toes I have had evidence from foot-prints in tidal clay, and from casts of such. I have also received evidence of the eggs of the *Dinornis*. Perhaps one of the richest localities of the remains of these extinct birds of New Zealand was discovered by the Rev. Richard Taylor, M.A., of the Missionary Station at Wanganui, near or along the shore at Waimate. "It appeared," he wrote, "to be a regular necropolis of the race." From this locality was obtained the specimens subsequently obtained by purchase from Mr. Walter Mantell, for the British Museum.

The spread of colonies in different parts of both islands of New Zealand, with concomitant growth on my part of correspondence and appeals for search, collection, and transmission of fossil remains, have resulted in a corresponding harvest of such evidences, from which, besides the confirmation and restoration of the above-cited species of *Dinornis*, indications of other extinct wingless or short-winged birds have been received. They have included two kinds of coot, one (*Notornis*) of the size of a turkey, the other (*Aptornis*) nearly as big as a cassowary; a third kind of bird

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\* I am indebted to the Duke of Argyll for the opportunity of comparing, in 1858, the bones of the hind limb transmitted to his Grace by the Rev. Dr. Little from the South Island of New Zealand; which bones are described and figured in the *Trans. of the Zool. Soc.* vol. vi.

(*Onemiornis*) in the leg-bone of which characters like those of a natatorial bird (*Colymbus*) were pointed out,\* was subsequently shown by Dr. Hector, of Wellington, New Zealand, who obtained an entire skeleton in the North Island, to be most nearly allied to a large anserine bird (*Cereopsis*) still living in Australia.† But in the still larger extinct goose of New Zealand, as in the large coots and kivis, the wings had become too small for flight.

The most remarkable exception to this flightless character of the extinct birds of New Zealand was discovered in the Glenmark swamp, in the form of bones having the nearest resemblance to those of the Kahu Harrier-kite of the island (*Circus Gouldi*), but of a size surpassing those of the largest condor or lammer-gayer.‡ I suppose this huge bird of prey may have harried and carried off the chickens of the gigantic Moas, and that the extinction of the *Harpagornis*, as it has been termed by its describer, the accomplished naturalist, Dr. von Haast, may have followed as a consequence that of its prey. So grand a bird of flight could hardly have escaped the notice of the natives with whom Banks and Solander communicated, or of such acute ornithological observers as the monographer of the existing Avifauna of New Zealand, W. L. Buller, Esq., F.R.S., of Wellington. It may be that some lingering tradition of the bird led the Maori, from whom the first indication of the fossils of New Zealand was obtained, to call it "the bone of a great eagle."

More than one story of still existing Moas have found their way into New Zealand newspapers; but, like those of the great sea-serpent, they lack the data requisite for scientific acceptance. In both cases the proper attitude of the naturalist is the "expectant" one.

When the first portions of the skeleton were described and figured in 1847, upon which the former existence of the great flightless coot of New Zealand was affirmed, the *Notornis* was concluded to have passed away as completely as the *Dinornis*. But it fortunately happened that Mr. Walter Mantell, visiting the south-west part of the South Island, in 1849, came upon a party of seal-fishers who had captured the living bird on the shore of Dusky Bay, and had luckily kept the skin after cooking and eating the unique specimen. The skull and leg-bones brought to London with this skin served to identify the species and genus: the skin, beak, and

\* Trans. Zool. Soc. vol. v. (1865).

† Proc. Zool. Soc., 8vo. 1874. "Wingless Birds of New Zealand," 4to vol. i. pp. 238, 365; pls. lxvi.—lxx. xcv. ci.—civ.

‡ Op. cit., vol. i. p. 141; pls. cv. cvii. cvii.

feet confirmed the inference from the fossils. This specimen of the *Notornis Mantelli* was purchased by the British Museum, where it may now be seen.\*

I suppose that any captor who should bring his *Dinornis* alive to London might reckon upon a rich reward from the Council of the Zoological Society.

At present all that I have been able to get, besides the bones, have been brains, † rings of the wind-pipe, ‡ gizzard stones, § eggs, feathers, || and bits of skin, ¶ of unquestionable Moas. But how about the brain, it may be asked, unless you had a fresh bird? A very pertinent question. The brain is represented by a cast of the interior of the cranium. It is relatively smaller than that of the ostrich, which is reckoned the least intelligent of living birds.

My first acquaintance with the eggs of *Dinornis* was founded on the fragments of the shell obtained from ancient cooking-pits.\*\* Thereupon I broke up an ostrich egg into similar fragments; then compared the curves of their outer surface. The long and the short diameters, *i.e.*, the longitudinal and the transverse dimensions of the egg, were thus indicated in the ostrich fragments; by like indications in those of the bits of the *Dinornis* egg-shell, I recomposed the longitudinal and transverse contours of the entire egg, as shown in plate xc. of the undercited work; and such egg I hypothetically referred to the *Dinornis elephantopus*. ††

In the year 1865 the entire egg of a larger species was sent to London, and submitted to my inspection. It fetched £100 at the sale by auction at Stevens's rooms. Its history is as follows. A colonist, digging the foundation of a store at Kaikoura, Canterbury, New Zealand, came upon the skeleton of a Maori, who had been buried in the sitting posture, and upon his lap had been placed, at the interment, this egg. His greenstone adze was also found in the grave. From the superiority of length of this egg to that ascribed to the *Dinornis elephantopus*, with a minor degree of transverse diameter, I conceived it might belong to the taller and less

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\* *Notornis Mantelli* is figured of the natural size as frontispiece to my work (4to. 2 vols. 1879) "On the Extinct Wingless Birds of New Zealand."

† Op. cit., p. 326, pl. xci. fig. 11.

‡ Ib., p. 327, pls. xcii. xciii.

§ Ib., p. 337, pl. xcii. fig. 8.

|| Ib., p. 440, pl. cxiv. figs. 8—11.

¶ Ib., p. 443, pl. lxxi. and pl. cxiv. fig. 7.

\*\* Proceedings of the Zoological Society of London, Part xx., 1852, p. 12.

†† Memoirs on the Wingless Birds of New Zealand, 4to. vol. i. p. 317, pl. xc.

robust species, *Dinornis ingens*.\* I subsequently received from Dr. Hector intelligence of the discovery of an egg of the *Dinornis crassus*, containing some bones of a partly-hatched chick; they included a sternum, pelvis, coraco-scapular arch, showing the unequivocal characteristics of their genus,† but no wing-bones. On these and some other data I have formed an estimate of the size of the egg of the *Dinornis maximus*, at sixteen inches by twelve inches in the two diameters.‡

The living kivi (*Apteryx*) is remarkable for the large proportional size of the egg, of which it lays but one at each procreative season. It is probable that its extinct gigantic kindred could as little afford a relatively greater incubating area to the shelly case of their embryo.

Of the numerous transmissions from divers localities in both islands of New Zealand, not any have included a bone of a land-mammal having any claim to be considered an aboriginal species, or belonging to one which has become extinct, and would have been otherwise unknown. Now and then, though rarely, the bone of a rat, of the Maori dog, and of a seal could be picked out.

New Zealand never had an indigenous Mammalian fauna comparable to the rich Marsupia one of Australia. A bat or two flits in its atmosphere, seals haunt its coasts, and thereupon is occasionally stranded the carcass of a whale.

When the Maori first landed, he found no kangaroo or other herbivorous beast to yield him flesh. The sole source of that food, the more needed from the absence of the bread-fruit and cocoa-nut trees which he had left at Hawaii, and the colder climate of the land to which he had been driven, was in the various kinds of huge birds incapable of flight. These, it is evident, had overspread both islands. The rich development of ferns, with nutritious elements in unusual proportion in the roots, of which the Maoris still avail themselves for their favourite bread, formed a perennial table for the support of the feathered bipeds, to which divers other kinds of vegetable nourishment were doubtless added.§ Foot-prints on the sea-shore suggest their varying their diet by picking up marine animals. For how many centuries, before the unfeathered biped appeared, the *Dinornithidæ* had roamed supreme over the islands there are no adequate grounds for estimate.

\* Memoirs on the Wingless Birds of New Zealand, 4to., vol. i. p. 318, pl. cxvii.

† *Ib.*, p. 319, pl. cxv.

‡ *Ib.*, p. 320, pl. xcix.

§ See the section "On the Food, Nests and Traditions of the Moas," *Op. cit.*, vol. i. p. 450.

There are evidences of different kinds that the extirpation of the extinct birds of New Zealand was the work of man.\* The question of the origin of these wingless species is a deeper one. Into that I have entered as far as there seemed to be any data for guidance at the conclusion of the work on the subject of the present section of the communication now offered to the Institute.†

#### AUSTRALIA.

I finally proceed briefly to state the chief results of palæontological research in the Colonies of Australia, restricting the present notice to the extinct species of the Mammalian class. The labours of zoologists in the discovery and determination of the existing kinds have made generally known the fact of the prevalence in the Australian continent of the peculiar group called Marsupialia, or pouched beasts; those, viz., which produce their young prematurely as compared with the rest of the class, and transfer them to a skin-bag covering the teats, to which the embryo remains attached till it gains the size and strength of the ordinarily born young in the higher organised or placental Mammalia. But one existing genus of these Marsupials is known elsewhere in the world—the opossums, viz., of America (*Didelphys*, Linn.). Our knowledge of the various modifications of the Didelphs of Linnæus has been derived exclusively from the remnant of that vast Melanesian continent of which Australia, Tasmania, New Guinea, and a few outlying insular fragments now remain. The carnivorous kinds are represented by the Tasmanian Thylacine, of the size of the wolf, by the somewhat smaller Sarcophile or Devil of the Tasmanian colonists, and by still smaller Dasyures or native cats and weasels of Australia. The insectivorous kinds are represented by the bandicoots (*Perameles*, *Myrmecobius*, *Charopus*); the frugivorous species by the arboreal phalangers, koalas, and petaurists; the root-eaters by the burrowing wombats; the grazers and browsers by the numerous and varied family of the saltatory potoroos and kangaroos. The largest existing marsupial in Australia is the Boomer kangaroo (*Macropus major*). The skull of the biggest kangaroo which has come under my observation does not exceed eight inches in length. Such a kangaroo will outweigh by one half the biggest thylacine.

JOHN GOULD, in his beautifully illustrated work on the "Mammals of Australia," gives the length of 2 ft. 2 in. to the wombat of

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\* See the section "On the Food, Nests, and Traditions of the Moas," Op. cit., vol. i. p. 450.

† Op. cit., vol. i. p. 460.

Tasmania (*Phascolomys ursinus*); the bones of the *Phascolomys latifrons* of the Australian continent indicate a somewhat larger animal, but the skull scarcely exceeds 7 in. in length. The skull of the largest of the extinct wombats is more than a foot in length.

Between this and the largest existing wombat were two other species of intermediate dimensions; there were also wombats distinct in kind but resembling in size the two or three existing species; finally, there existed a smaller species in Australia. All these have passed away. Admitting the specific distinction of the two kinds of wombat now living in Australia and that of the sole existing Tasmanian species, fossil remains have made known the former existence of seven kinds which have become extinct. These wombats ranged from the size of a marmot to that of the European bear (*Ursus arctos*), and the distinctive characters of the largest kind are of generic value.

The fossil evidences of kangaroos are more abundant and varied than those of the wombats. I shall limit myself to a brief notice of the larger extinct kinds.

I have referred to the dimensions of the skull of the biggest known existing kangaroo.

The first extinct species represented by the fossils obtained by Sir Thomas Mitchell from the caves of Wellington Valley, had a skull of 10 in. in length. I called it *Macropus Titan*, not anticipating in 1836 to find it but a middle-sized species. Subsequently I received evidences of a kangaroo with a skull 12 in. long; and next of one with a skull as large as that of a full-sized ox, 16 in. in length.

Now these extinct species do not differ merely in magnitude from each other and from the smaller existing kinds, but in modifications of the teeth and in the proportions of the limbs.

As the kangaroos gained in bulk they lost in power of leaping. The hind limbs were less disproportionately long, the fore limbs less disproportionately short. Both pairs took a more equal share in the support and progression of their bulky frames. Nevertheless all the well-marked characteristics of the macropodal foot were retained, the modifications being restricted to those of size and proportion of toes and leg-bones.

So likewise with the teeth. Certain teeth of extinct kinds were shaped for cutting, the same teeth in other kinds for pounding.

Species not exceeding or inferior in size to existing kangaroos manifested specific distinctions in the teeth, in the skull, and in parts of the skeleton. I have had to name and characterise a score of kinds of kangaroo that have existed in Australia and have

passed away; and these extinct species have made known to the zoologist seven generic modifications of the macropodal family, distinct from any of the genera still represented by known living kinds of kangaroo.

The most interesting result of these comparisons of the fossil remains of kangaroos were the indications of a gradual resumption of the more ordinary quadrupedal character in the larger extinct species. This transition I found to be completed in still larger forms which retained, in the main, the macropodal type of dentition, the modifications of the teeth indicating a more strictly herbivorous character of quadruped.

The first of these forms was manifested under three specific modifications, on which have been founded a *Nototherium Mitchelli*, a *Not. Victoriae*, and a *Not. inerme*. Of this genus I have as yet, indeed, obtained little more than portions of the skull and teeth. But a few detached bones of the ankle show a deviation from the kangaroo type of foot toward that of the ordinary character, and an arm-bone indicates a more equal size with stouter proportions of the fore and hind limbs. I infer the *Nototherium* to have resembled in general character a large tapir; but it was essentially a marsupial quadruped.\*

Amongst the cave-fossils submitted to me in 1835 by Sir Thos. Mitchell, and which are described and figured in the "Appendix" to his "Three Expeditions into the Interior of Eastern Australia" (2 vols. 8vo., 1838) was the fore end of one-half of a lower jaw with the implanted end of a fractured tusk. It indicated a beast as big as a hippopotamus. This fossil and a limb-bone sent to Paris, of what I subsequently determined to belong to the same species, had given rise to the notion that a true hippopotamus and an elephant had left their remains in the caves and drift deposits of Australia.†

After an extensive and minute comparison of the tooth-stump from Wellington Valley with every quadruped of similar size having such a tusk at the fore part of the under jaw, I came to the conclusion that it must have belonged to a distinct kind of animal; that the tusk had been one of a pair like the lower incisors in the kangaroos, wombats, and phalangers; and that the fossil, therefore, indicated the former existence in Australia of a marsupial quad-

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\* An entire skull of the *nototherium* has been discovered. It is now in the Museum of Natural History at Sydney, the Trustees of which have transmitted a cast to the British Museum.

† See Lyell, Principles of Geology, 8vo., ed. 1835, p. 143.



ruped as big as a rhinoceros or hippopotamus; but, being of a distinct genus and species, I described and figured it as representing a new form—a *Diprotodon australis*.

But what would this problematical Diprotodon, guessed at by a bit of a tooth, turn out to be?

Now, here I may remark that there is no chase in the sporting world so exciting, so replete with interest, so satisfactory when events prove one to have been on the right scent, as that of a huge beast which no mortal eye will ever see alive, and which, perhaps, no mortal eye ever did behold!

Such a chase is not ended in a day, a week, or a season. One's interest is revived and roused year by year, as bit by bit of the petrified portions of the skeleton come to hand; and thirty such years elapsed ere I was able to outline a restoration of *Diprotodon australis*, such as is shown in the Plate of the work\* now submitted to the Institute.

The dental formula of the diprotodon is that of the notothere and of the kangaroo, viz.,  $i \frac{3-3}{1-1}, c \frac{0-0}{0-0}, m \frac{5-5}{5-5}, = 28$ . The true molars have the crown cleft into two strong transverse ridges, also the fundamental pattern of those teeth in the kangaroos. But the skull of the diprotodon is a yard in length.† The thigh-bone might well suggest to the Parisian palæontologist the idea of an elephantine quadruped. The fore limbs and hind limbs are of equal length. The animal must have trod the ground like a heavy pachydermal brute. Yet there are multiplied proofs in its skeleton that it carried its young in a pouch, and that it belonged to the prevalent characteristic type of suckling beasts in Australia—that it was, in fact, the giant of the Marsupial order.

In wild nature a balance is maintained between the flesh-makers and the flesh-eaters. The teleologist expatiates upon the beneficence of the check interposed by Providence upon the undue increase of the vegetable feeders through the contemporaneous existence of their devourers.‡ In Australia, at the present period, the wild or native browsers and grazers are in excess.

The native or aboriginal carnivora are now too few and too feeble to keep the herds of kangaroos in due check. The largest

\* Researches on the Fossil Remains of the Extinct Mammals of Australia with a notice of the Extinct Marsupials of England, 4to. 2 vols. 1877. (Erxleben, 2, Henrietta-street, Brunswick-square.)

† See Frontispiece of the above work.

‡ Buckland, Bridgewater Treatise, vol. i. p. 129.

known existing native carnivore in Australia is the so-called "native cat" (*Dasyurus macrourus*).

In the smaller adjacent insular tract of "Van Dieman's Land," or Tasmania, although there be no kangaroo exceeding the Australian rufous kind in size, there are two kinds of indigenous Marsupial carnivora larger and more destructive than any known to exist in the more extensive continent. One of these is the so-called "devil," the other the native hyæna. The zoologist substitutes for the colonial vernacular appellatives his descriptive Greek compounds. *Sarcophilus*, or "flesh-lover," designates the mischievous, untameable brute which might weigh down a jackal, though of more compact and robust build. *Thylacinus*, or "pouched wolf," or "hyæna" is the name by which the larger striped sheep-worrier is known to science.

Strange that neither of these "checks" should exist in the wider field, to operate upon the manifold herds of marsupial herbivores of the larger continent! Stranger still if the balance or check had never been interposed during the old times, when the larger kinds of kangaroo and their huge, even gigantic congeners browsed the scrub or grazed the prairie over the length and breadth of the Australian continent.

The following is the account which the palæontologist has to render on this subject. Mitchell's gatherings in the breccia clefts and hollows of the limestone rocks in Eastern Australia included remains of both *Sarcophilus* and *Thylacinus*, corresponding in bulk and specific characters with the species still existing in Tasmania. Considering the size of these carnivores, their audacity, the damage which the larger one inflicts upon the flocks of the Tasmanian colonist, and the stupid pertinacity with which the smaller "devil" devastates his poultry-yard, it is not likely that either species would have escaped the notice of the Australian settler if it had lingered on to be a pest, or an ally, to any of the great colonies of that continent.

I conclude, therefore, that both the species have become extinct in Australia, and that they formerly existed there as they still exist in Tasmania. Moreover, in addition to the cave-specimens, I have received evidences of both *Thylacinus* and *Sarcophilus* from the drift deposits and beds of rivers in several and distant parts of Australia. And these fossils, besides testifying to species indistinguishable by tooth and bone from the Tasmanian kinds, indicate others of larger size, which have never been observed living. Of *Sarcophilus*, of which the present ursine kind might be matched by a jackal, I have had evidence of a species (*Sarcophilus lanianus*)

as big as a leopard. Of *Thylacinus* I have also fossils of a larger than the existing kind, equalling a panther in power (*Thylacinus major*). Neither of these extinct Australian carnivores, however, bore the proportion to the nototheres and diprotodons which the South African lion bears to the buffaloes, elands, and other great herbivores upon which it preys.

Something still seemed wanting in the proportion of the beasts of prey to the beasts which converted the grass and herbage of the field into flesh in these ancient epochs of Australian life.

Now, among the fossils submitted to me by Major Mitchell, in 1835, was a tooth, which from its resemblance to that called the "carnassial," or "flesh-cutter," in the lion's jaw, raised a suspicion that there had existed in Australia a carnivore exceeding in size the largest of the extinct *Thylacines*. But a comparison of this solitary fossil with all the modifications of the teeth in the various existing kinds of *Marsupialia*, had made me acquainted with a somewhat similarly shaped sectorial tooth in certain small phytivorous and mixed-feeding genera. I could not, therefore, give undue weight to other resemblances supporting only a conjecture. Additional discoveries might supply the required test, and were to be waited for. If the large fossil sectorial tooth in question was the premolar of a gigantic phalanger or potoroo, it must have been preceded by teeth shaped for cutting and nibbling, and have been followed by several large flat or ridged broad molars for crushing and grinding. If the large sectorial tooth was a premolar of a carnivore, it must have been preceded by teeth for piercing and holding, and have been followed by molars small in size and few in number, tubercular in shape, and adapted at best for pounding gristle or tendon.

Pending, therefore, the possible acquisition of specimens yielding the required dental evidence, I contented myself with giving figures of the tooth in question,\* in order to attract attention to any fossils which might show such a tooth associated with more of the animal's dentition.

In the course of a few years I received the requisite evidence. First, in the form of a lower jaw, from the bed of the Condamine river, Queensland; next, in that of a mutilated skull, from the bed of a lake eighty miles south-west of Melbourne; and subsequently, by more perfect specimens demonstrative of the super-carnivorous character of the dentition of the extinct beast, which thereupon

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\* Plate xxxii. figs. 10 and 11, of Appendix to the "Three Expeditions," &c. 8vo. 1838.

I called *Thylacoleo*, or pouched lion. Teeth [like the canine tusks of the lion precede the carnassial tooth first discovered; that tooth is followed, also as in the lion, by one small tubercular tooth in the upper jaw, opposed to two smaller tuberculars in the lower jaw; the carnassial of that jaw worked upon the upper one like a shear-blade, and the extensive and smoothly worn surfaces are matched by those of the flesh-cutters in old lions and hyænas of the present day.

Thus it appears that Australia was formerly inhabited by mammals of the peculiar marsupial type, not only varied for predatory and herb-eating life, but exhibiting their type under dimensions as varied as are the higher or placental wild beasts of the larger continents of the globe. Creatures nearest of kin to the Australian forms, and, like them, marsupial, have indeed lived and bred on land which now forms part of the island of Great Britain. Fossil remains of a carnivorous mammal with a dentition most nearly like that of *Thylacoleo*, have been discovered at Purbeck, on the Dorsetshire coast. Fossil remains of an insectivorous marsupial, many-toothed like the Australian *Myrmecobius*, have been found in Oxfordshire, in the slates of Stonesfield. Both these localities are of the middle or "Mesozoic" period in geology, and I may give an idea of their antiquity by saying that not a particle of the chalk cliffs or "bushless downs" in England had been formed, when the old pre-Britannic continent flourished, which, in its vegetation, its shells, the fishes of its sea-shore, and the beasts of its fields, bore the nearest resemblance, in fauna and flora, to the antipodean seat of our present flourishing Australian Colonies. We are now superseding there the oolitic types, which alone presented themselves to the naturalists of Cook's voyage, by the higher forms of vegetable and animal life that have lent themselves, or been by man, adapted to his special needs, in Asia and Europe.

But the kangaroo, which Banks and Solander first saw, and thought to be a huge bird as it hopped out of their ken into the scrub, was actually the largest marsupial quadruped that at that date existed in Australia.

At what period became extinct those huger forms of marsupial life which palæontology has made known to us? To what cause is due the extinction in Australia of the diprotodons, the nototheres, the thylacoleons, the phascolones or gigantic wombats, the palorchestes, procoptodonts, protemnodonts, sthenurans, with the thylacynes and sarcophiles which alone of all the preceding Marsupials still linger on in life in the neighbouring island of Tasmania?

No other extirpating cause has suggested itself to my mind save the hostile agency of man. No evidence of diluvial catastrophe or of climatal change has been discovered to account for the disappearance, for example, of the *Macropus Titan* and the survival of *Macropus major*.

To a race of men depending, like the "black fellows," for subsistence on the chase, the largest and most conspicuous kinds of wild beasts first fall a prey. Their dog, the half-wild dingo, assists in this work. The smaller kinds, with swifter powers of locomotion, more easily conceal themselves and escape.

True it is that, as yet, no evidence of the ancestry of the existing aborigines of Australia has been detected in the caverns which have yielded fossil remains of their hypothetical prey. But such caves, if explored with due care, skill, and method, may bring to light, as they have done in England, indubitable evidences of the pre-Adamitic or pre-historic men of Australia: the extensive shell-mounds attest the enormous period during which these primitive people roamed over that continent.\*

In conclusion, I may remark that, at the commencement of my application of anatomical knowledge, fifty years ago, to the reconstruction of extinct species, not one such of the classes here treated of was known to have lived in any of the three great Colonies which I have selected for this evening's discourse.

What, then, may be expected from analogous researches and collections of the fossil remains in the caves, drifts, and tertiary deposits of New Guinea! As we learnt from the admirable paper to which I was privileged to listen at a former meeting of this Institute, we may infer from the varied configuration of New Guinea, from its mountain ranges and concomitant streams and rivers, its caverns, doubtless opening into defiles and valleys, its latitudes, involving conditions and stimulants of life surpassing those under which the beasts flourished on whose remains Colonial palæontology has been hitherto exercised, that there is a promise of results which will exceed in novelty, in singularity, and variety of vertebrate structures all that has been contributed from Australia and New Zealand towards a philosophical comprehension of the scheme and origin and progress of animated nature.

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\* In 1869, the Parliament of New South Wales voted the sum of £200 in aid "of a careful and systematic exploration of the Limestone Caves of Wellington Valley."

## DISCUSSION.

The CHAIRMAN: I am sure that we must, one and all, have listened with the most profound interest and attention to the learned and exhaustive Paper, which has been read to us to-night by our distinguished friend, Professor Owen. We all know that the subject on which he has discoursed this evening (especially the palæontology of New Zealand), is one which he has made especially his own, and in which his researches have been crowned with the most remarkable success. The results which have been achieved by his inquiries are such as have surpassed the expectations of those who were concerned with the first discovery made in the fossil remains of New Zealand and Australia. I am able to carry my recollection back to the period when the first fragments were brought to Sydney from New Zealand of those marvellous birds, whose remains have been so graphically described by Professor Owen. I recollect with what interest we watched the reports which came from that illustrious inquirer, and how the interest we all felt was deepened by each successive addition he made to our knowledge of these extraordinary remains of the extinct fauna of those countries. Professor Owen has alluded to the vague reports and traditions associated with those remains. Some of those I have heard, and at times made upon so apparently good an authority, that they would lead to the inference that those marvellous creatures have actually lived within probably the lifetime of persons now existing. I have heard from evidence, which appeared to me at the time tolerably conclusive, that the bones of the *Dinornis* had been found with portions of the tendons and cartilages adhering, implying that the animal to which they belonged must recently have been in a living state. Nay, I have been indeed pleased that amongst the earlier settlers of New Zealand there were not lacking credible witnesses who affirmed that they had seen the *Dinornis* itself actually alive. However, as Professor Owen has justly observed, the proper attitude of the natural philosopher and the scientific man is the expectant one; still I think it is possible that the remains of the fossil fauna may be found indicating much more recent existence than that hitherto assigned to them. To those who take an interest in geological speculations, the most interesting fact which has been, I think, developed by these inquiries is, the circumstance that in the living as well as in the extinct flora of New Holland, we have the analogues of plants and animals characteristic of ancient deposits in Europe. In these new and remote lands, which have

been recently taken possession of by the British race, in the Southern Hemisphere, we now behold with our own eyes living forms of animals, birds, and fishes, which must have existed countless myriads of ages ago in the oolitic deposits of England. I think Dr. Buckland's description, in the *Bridgewater Treatise*, gave the first account of the remains of marsupial animals having been discovered in the Stonesfield Slate, of Oxfordshire. Since then the evidence has been multiplied of the existence of these remains in various parts of England. I venture to hope, and throw out the suggestion, that our learned friend and illustrious associate may, on some future occasion, extend his discussion, and enlarge upon an inquiry full of the deepest interest, in which it may be shown how many of the types of living organisms, that as the Cestracean representatives of some of the oldest geological deposits in the world, are still to be found inhabiting the plains, and rivers, and sea-coasts of Australia. There are, however, many other species of animals which have but recently become extinct, of which the Dodo of Madagascar is an example. There are portions of that bird in the Ashmolean Museum at Oxford. But I am myself acquainted with the history of a bird, the Nestor parrot, of which I saw the last two living specimens. This beautiful ground parrot is found on Phillip's Island (and nowhere else), in the neighbourhood of Norfolk Island. It was then in great abundance, and unfortunately its destruction became an object of sport and amusement to the officers stationed at Norfolk Island. Two of the specimens were brought to Sydney, and were in the possession of Mr. Macleay, the Colonial Secretary, and I believe their skins are now in the British Museum. There is thus an instance presented within the memory of thousands of persons, and in my own memory, of a beautiful bird which has entirely disappeared from the earth. Therefore I venture to throw out the suggestion that Professor Owen may kindly undertake to enlarge upon those and other cognate subjects connected with the fauna and flora in Australia; and I am sure if he will do so we shall listen to him with not less instruction and delight than we have this evening. (Cheers.) There are several gentlemen present who could speak, and who desire, no doubt, to offer a few remarks on this Paper, to which it is impossible for us, having regard to the late hour of the evening, to do anything like justice. Sir Henry Barkly, who has administered as Governor so many of these great Colonies, and who has always been ready to aid in any way the enlargement of our knowledge of the natural history of those distant portions of the Empire, will, I have no doubt, address you on this occasion.

SIR HENRY BARKLY: We must all feel, I think, that Professor Owen has paid a very high compliment to the Royal Colonial Institute in reading before it to-night a specially-composed Paper on the palæontology of some of the principal Colonies, for it shows that he credits us with not confining our interests in the Colonies to their commercial and financial prosperity only, but that we extend it to everything connected with the scientific and intellectual advancement of the Colonies. (Hear, hear.) There is, I think, one reason why this Institute is deserving certainly of the compliment he has paid it, that is, for the unflinching support which they have given to the proposal for the establishment of a Colonial Museum in London, in which, I presume, a place will be found not merely for exhibiting the actual products of the Colonies, but for those relics of the past which are so useful in throwing light on the physical formation and the geology of a country. (Hear, hear.) I do not wish to detain you on these points, however. I rose for the purpose of asking my learned friend for some information on a point of Australian palæontology, which has been suggested by this Paper, or rather, if I may venture so far as to say so, by an omission in his Paper. When informing us very truly that the existing indigenous carnivora of Australia were not sufficient to keep down the various kinds of kangaroos, the Paper mentioned that the largest carnivora at the present day—the largest aboriginal carnivora, I mean—was the native cat; and it dwelt also on the apparently strange fact that the Tasmanian devil and the pouched wolf, which still exist in that island, had not been known to exist within the historic period on the large continent of Australia. I do not know that it is by any means certain that the Tasmanian devil does not still exist in some remote corner of Australia. At least, I recollect when I resided in Victoria reading a paragraph to that effect in the papers—it was perhaps in the “gooseberry” season—stating that the Tasmanian devil had been seen by someone; and I think I could cite passages from the published works of that distinguished botanist and traveller, Baron Von Mueller, in which he states that he met with the Tasmanian devil during his exploration of the Gippsland Alps at a great elevation above the sea. However that may be, there is a cause which is not adverted to in the Paper, which will account for the rarity, if not for the extinction of these larger marsupial beasts of prey—namely, the existence of the Dingo, or wild dog. These dogs, hunting in large packs, were quite sufficient to destroy any beasts of prey. In the early history of Victoria they were in such numbers that the settlers had to poison them off to protect their sheep; and



it is to that cause alone that the great abundance of kangaroos, which have become a nuisance in the present day, is to be attributed. I would ask Professor Owen whether, as he has omitted any mention of the Dingo in his list of the aboriginal carnivora of Australia, he is of opinion that it is an introduced animal, and, if so, whether he is aware that a great deal of evidence to the contrary has been adduced, from the fact of its remains having been found at a great depth below the surface, associated, in one case at least, not merely with those of the extinct Diprotodon and those of the *Sarcophilus ursinus* and the pouched wolf, but with those of the marsupial lion. I should like to know whether he does not credit these facts, or whether, in spite of them, he considers from its not being a marsupial animal, that it must have been introduced into Australia at some time by the human race.

MR. LABILLIERE: With regard to the Dingo, I have heard it stated in Australia that it was imported as recently as the seventeenth century by some of the Dutch explorers who touched the coast of Australia.

MR. BONWICK: I am quite sure that all who have traversed the waters of the Southern Ocean must have been delighted this evening to hear what has come from our distinguished friend, the father of New Zealand and Australian geology, and who has been most worthily followed by other scientific men of the Colonies. We in the Colonies not only respect him for what he has done for us in science, in showing us the way in which we should go, but we have recognised in his writings that kind interest in his fellow-man which endears him, not only to the colonists, but to his countrymen in general. (Hear, hear.) I only wish at this late hour to tell a simple story. It may serve as an encouragement to some interested in the association of science with education in this country. A boy attending my school near Melbourne received his first geological instruction there. He went some time after to a more distant part of Australia—Northern Queensland. When travelling with another young man, along the wonderful plains by the banks of the Flinders River, he came upon some bones. These attracted his attention, and he collected some of them. The discovery of these fossils by Mr. Carson, and his friend, Mr. Sutherland, has been the means of furnishing evidence to the learned of Europe of the existence of mesozoic formations in Australia.

MR. FREDK. YOUNG: I am afraid I must be held responsible for putting the names of one or two gentlemen on the Chairman's list, in order that they may give us the benefit of their experiences with regard to this scientific lecture; but I fear that the spell of Professor

Owen's name is such that they are a little reluctant, although present, to come forward. (A laugh.) I wish I could persuade them to do so, because I think it would be important to hear what our friends who come from the Colonies are able to say on the deeply interesting subject before us. (Hear, hear.)

MR. ARTHUR LOCKER (editor of the *Graphic*): I am going to ask a question of Professor Owen. I have lived for some years out in the Australian Colonies. I have often heard of an animal called a Bunyip, which was said to inhabit the waters of the Murray, and I have heard people declare that they have known men to have bathed there who have been pulled under the water by the beast. It was described as an amphibious creature, and having the properties of a mammal, covered with feathers, and a fish. I only wish to know whether there is any scientific evidence on that point?

THE CHAIRMAN (in answer to Mr. Locker) said: With regard to the Bunyip, that mythical animal, I recollect a skull, with the skin and flesh attached, was brought to Sydney many years ago. It was said to have been discovered in one of the water holes in the neighbourhood of the Murrumbidgee, and its peculiarity was that it was a one-eyed creature—a veritable Polypheme. This mysterious object, however, my friend, Mr. William Sharp, a distinguished naturalist, on examination at once discovered to be the head of an immature and monstrous calf. (Laughter.)

MR. DENNISTOUN WOOD: Being an unscientific man, I hope that I may be excused—though perhaps I ought not to be—for making an unscientific remark. I rise for the purpose of saying that I think the persons who live in what are called new countries, like Australia and New Zealand, are under great obligations to men of the eminence of Professor Owen for directing attention to such a subject as their palæontology. One of the wants which every educated person feels in going to a new country is that there are no antiquities. In England we have cathedrals which recall to us the men of the middle ages; and we may go further back and find remains which call to mind that period when the Romans were lords of England and part of Scotland. But there is nothing of that kind in Australia or in New Zealand, or in most of our Colonies, I remember, after spending a number of years in Australia, how impressed I was with the antiquities, by no means venerable, which I saw at Ceylon, in the shape of fortifications, which had been left there by the Portuguese. But Professor Owen has recalled to the attention of the colonists of Australia and New Zealand that, after all, the countries which they inhabit are not without antiquities. He has gone into “the dark backward or

abysm of time," and has brought before us races whose antiquity is far greater than that of the remains of the Saxon and Roman in the country which we inhabit. And if the people of those Colonies cannot look upon cathedrals or upon mouldering castles, or upon even Roman walls, such as we find in some parts of the United Kingdom, they may be attracted to those remains which are of countless antiquity. And if the attention of the rising generation in Australia and New Zealand is directed to these subjects, it will give them an interest in the land which they inhabit, and will cause patriotic feeling to arise in their minds. (Hear, hear.) This was the idea I wished to bring out. I fear I have done it imperfectly, but I think I have done sufficient to bring a new view of the subject before the meeting. (Hear, hear.) As I said before, I am an unscientific man, but not the less do I feel, and I am sure all Australians and New Zealanders will feel, under the greatest obligations to Professor Owen for the scientific lecture which he has delivered this evening. (Applause.)

The Rev. BRYMER BELCHER: Perhaps I may be excused if I make one or two remarks, one in reference to the Paper by Professor Owen, and to what the Chairman has said, that he himself has known an instance in which a bird that has been existing during the lifetime of individuals has now become extinct. In Professor Owen's Paper he says, with respect to the birds of New Zealand, that there are evidence of different kinds that the extirpation of the extinct birds was the work of man. It seems to me that it is just possible to consider whether the work of extirpation is not going on at the present time; whether there are not other birds which are being killed off the face of the earth as well as those birds of New Zealand, as has been the case with the brown parrot of which the Chairman has told us. We have found it necessary in this country to introduce a "close time" to preserve birds, beasts, and fishes; and I cannot help thinking that if it is found by experience that the work of destruction is being carried on in the Colonies, whether for the sake of those little plumes of feathers with which ladies now adorn themselves, or for any other reason whatever, it would be an object worthy of this Institute to endeavour to get a "close time" for the protection of birds, &c., in our Colonies, as is the case in England. (Hear, hear.)

Mr. DENNISTOUN WOOD (in reference to the Rev. Mr. Belcher's remarks) said: There is an Act in force which extends protection to birds for many months at a time. I can speak for certain as to the Colony of Victoria, and I believe there is a similar law in force in New South Wales.

Professor H. G. SEELEY: I can claim no indulgence on your part in speaking to you upon subjects relating to either Australia, or New Zealand, or the Cape of Good Hope; but I can say one or two words of admiration—more than admiration—of gratitude, to Professor Owen for the treat which no other scientific man could have given us, for the summary of the greater part of his life's work which makes that work intelligible to the whole of the people of England. (Hear, hear.) Myself a pupil of Professor Owen, taught by him to study bones, now nearly a quarter of a century ago, I have found this evening an amount of instruction which has carried me back all through the years in which I have tried to follow his labours; and I have found in this discourse the results so put that I am sure to you they make intelligible the existence of these past creations concerning which he has tried to kindle in us the sense of the chase that has ever been before him as he has brought new discoveries down one by one, and with such a result that, when speaking of the Cape of Good Hope, he recalled before us reptilian forms so vast in size, so great in numbers, and so varied in organisation, that we look round over the world in vain to see anything comparable to them either in importance or interest. When dealing with the birds of New Zealand we gain a knowledge of the wonders of a creation contrasting in almost every respect with the existing bird fauna of that part of the world; and in Australia, evidence that the laws of life, although they may have been the same in past times, have operated to produce a diversity of animals as ages succeeded each other. This Professor Owen has made intelligible to us, and more than intelligible, for he has left paths on which we ourselves may follow in aftertimes, I hope long and distant times, the labours which he has begun; and, as new materials accumulate, build up a perfect knowledge of the grand accumulations of life which existed in British Colonies, which at present instruct us, and which in time to come shall instruct our children. (Hear, hear.)

The CHAIRMAN: Before Professor Owen replies, I will ask him whether there is any authentic information of the existence of the great raptorial bird as to New Zealand? I think I understood very recently from Dr. Hector that some such remains have been found in New Zealand.

Mr. H. DE MOSENTHAL: I would feel much obliged to Professor Owen if he would kindly tell us whether he has determined the specimen he kindly showed me at the British Museum some months ago, and which Mr. Bain had sent him from South Africa, the peculiarity of the reptile being a row of teeth on the palate, and

whether he has found out what use the animal made of this second row of teeth.

Professor OWEN: I desire to express my acknowledgments to Sir Henry Barkly for calling to my attention the evidences of the Dingo, the half-wild dog, which probably accompanied the natives as the aborigines' servant and friend. I have received remains of the Dingo from some of the caves, but not yet of others which I am told have been found at considerable depths in the drift. As, however, it is not an extinct species in Australia, it was without the scope of my present discourse. I have thought of its remains as a stimulant to further researches for evidences of the masters of the dogs, and so to get proof of the antiquity of the aborigines themselves. With the remains of the extinct birds of New Zealand, I have received evidences of the dog of the Maories, and abundant proof in ancient cooking-pits of their contemporaneity with species of *Dinornis*. But I have found nothing to affect the inference that the Maories brought with them in their canoes, when they first came to New Zealand, their dogs as well as their wives and children. Still the mode and period of the introduction of the Dingo in Australia may be regarded as "open questions." With regard to the specimens recently received through the kindness of contributors from the Cape of Good Hope, I have lately received more than I can hope at my period of life and power to work out—(no, no);—and I have not yet taken in hand the specimen to which my attention has been called. My last Paper, read at the Geological Society, was on a new extinct reptile at the Cape; and I have recently contributed another on the same subject. A chief motive to persevere, during the years past, in completing descriptions and figures of the more instructive fossils from our Colonies, and to get the figures executed in lithography of the natural size, has been to provide the principal cities of our Colonies with facilities for the rising generations of naturalists and geologists, to compare and determine the fossils which they may, and doubtless will, discover. Their contributions to the advance of our science will then equal the important ones that have been made by the pupils of Agassiz in the United States of America. In New Zealand there are already naturalists and geologists contributing most acceptable materials toward the advancement of their respective sciences. My work in reference to that Colony is done. The illustrations of the great work of my master, Cuvier, were, at its date, in line-engraving, and most of the subjects much reduced in size. With experience of the difficulty of satisfactory comparisons therewith of later acquired fossils, I determined to avail myself

of lithography, to make easier the task of my successors. I am obliged to our President for recalling attention to Dr. Von Haast's remarkable discovery of the gigantic bird of prey, which he called *Harpagornis*. I had duly noted it in my discourse; but, in the reading, accidentally turned over the page. The learned and indefatigable Curator of the Museum at Christchurch, Canterbury, has shown that, though his *Harpagornis* surpassed the eagle or the condor in bulk, it was nearest akin to the raptorial bird we call a "hen-harrier," which is chiefly noted in our own country for preying upon the chickens of the poultry yard; and its huge ally in New Zealand most probably harried and devoured the young of the gigantic species of *Dinornis*. When these became extinct by the slaughter of the parent bird and assiduous collection of the eggs by natives for food, then, also, the feathered enemy of the wingless birds died out. But of the huge bird of flight the Maories might long retain some recollection, and so the person who brought me "the bone" in 1838, was told by the native from whom he received it, that it was the bone of a gigantic eagle. (Loud cheers.)

The CHAIRMAN: I think it is the duty of us all to give our hearty and grateful acknowledgments to Professor Owen for the most admirable and instructive Paper which he has read this evening. (Applause.) I fully concur in the remarks made by Mr. Dennistoun Wood as to the advantages that would follow from discussions of this kind, and the stimulus they will give to inquirers in Australia and other Colonies in which palæontological researches and natural history may be carried out. A report of a meeting like this will circulate throughout the whole of the Colonies of Australia, and I have no doubt will act as an incentive to hundreds of individuals to direct their attention towards the points of investigation which are indicated as deserving of their consideration. There is no name so well known throughout the whole of the Australian Colonies as that of Professor Owen. (Cheers.) I am sure there is hardly a village or township or homestead in Australia where, if anything curious happens to turn up, that the suggestion is not at once made that [it be immediately sent on to Professor Owen. (Hear, hear.) There the eminent services of Professor Owen are fully, if not quite understood, at any rate, appreciated; and I for one do anticipate great advantages to the cause of scientific inquiry throughout Australia by the delivery of such an instructive and interesting Paper. (Cheers.) I invite you all to concur in the expression of our grateful thanks to Professor Owen. (Loud and long-continued applause.)

Professor OWEN, in returning thanks, said: I feel much indebted

to the Council of the Royal Colonial Institute for affording me this opportunity of giving the condensed view of the subject submitted to them; and, with them, I feel indebted to the President and Council of the Society of Arts for granting the use of this room for this meeting; and my acknowledgments are more especially due to the distinguished auditory filling it, for the kind reception which has been given to my discourse. (Cheers.)

A vote of thanks to the Chairman closed the meeting.

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