

# MEMOIR

ON THE CRANIAL CHARACTERS OF

A P T O R N I S,

WITH

DESCRIPTIONS OF THE SKULL AND BEAK.

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SELDOM has a new idea more rapidly reached its full development than that of the former existence of gigantic terrestrial birds in New Zealand, suggested by the fragment of bone from that island described and figured in the 'Transactions of the Zoological Society' for 1839, vol. iii. p. 29. pl. 3. Three years had scarcely elapsed when other remains, transmitted from New Zealand, led to the determination of one genus of these birds and to the indication of five species, one of the astonishing stature of ten feet, by the characters of bones of the trunk and extremities\*. In 1846† a second genus of large terrestrial bird, together with four additional species, and two at least well-marked varieties, were established, principally by specimens of bones of the extremities: different vertebræ, ribs, and a sternum, were at the same time contributed towards the restoration of the entire skeleton of the extinct gigantic bird, and the cranial portions of the skull of two distinct species were described, and compared with that of the Dodo, so far as its characters could then be deduced from the dried head at Oxford‡.

No trace, however, of the beak of either of the genera indicated by the bones of the extremities had then reached England: but in the 'Athenæum' of September 25th, 1847, Dr. Mantell, F.R.S., announced that his son, Mr. Walter Mantell, of Wellington, New Zealand, "in an exploring tour in search of the remains of the colossal Ostrich-like

\* Op. cit. vol. iii. p. 235. pls. 18-30 (1843).

† Tom. cit. p. 307. pls. 38-50.

‡ The casts of the cranium of the Dodo, which the authorities of the Museum of Natural History of Copenhagen have liberally transmitted, and the exposition of the bones of the dried head at Oxford which the Curator of the Ashmolean Museum has caused to be made, permitted the requisite comparisons to be carried further in the Memoir read before the Zoological Society of London, January 11, 1848.

birds which once inhabited New Zealand, and whose bones occur in the alluvial sand and silt of the rivers,"—"had discovered imbedded with the bones, fragments of their eggs;"—that the bones collected and on their way to England amounted to 700 or 800 in number; and included "portions of several skulls and mandibles."

On the arrival of the collection, I was requested by Dr. Mantell to inspect and describe it.

The bones were in a different state from that of any which I had before seen: instead of the deep brown tint, tenacity and heaviness of those from Wairoa, Waipu, and the beds of the streams that run east of the volcanic chain of Tongariro, which had been transmitted by the Ven. Archdeacon Williams, the Rev. W. Colenso and the Rev. Mr. Cotton, in 1843, they were yellowish-grey or fawn-coloured, light and fragile, with their articular surfaces entire and smooth and all their ridges and processes singularly sharp and perfect; most of the fractures being recent and some evidently the result of accident in the transport: all were, however, more or less absorbent from the loss of their animal matter. They have a different aspect also from those remains obtained by Dr. Mackellar and Mr. Percy Earl from the submerged deposits of the shore at Wake-waite in the Middle Island; these are of whitish-grey colour, and though light and friable retain more elasticity, and more of the animal matter; they do not stick to the tongue.

Some portions of a human skeleton, including a clavicle, part of a radius, and a few phalangeal bones, together with half the lower jaw of a Dog, transmitted with the birds' remains, had been reduced by heat to their constituent white earthy matter. Not any of the bones of the *Dinornis* were in this state, though some had been blanched or partially blanched by exposure. All the remains of the extinct birds were dug out of a bed of volcanic ashes at the mouth of the river 'Wanganui,' North Island, New Zealand. They were moist and friable when first exhumed, but soon hardened on exposure to the air.

In proceeding to determine and classify the specimens, I had the same gratification, as at the first inspection of the series of bones brought home in 1846 by Mr. Percy Earl\*, in recognizing the specific characters, which had been deduced in the first instance from a few specimens or fragments of bone, perfectly repeated in numerous examples of entire femora, tibiæ and metatarsi. Thus after setting apart, of—

	<i>Femora.</i>		<i>Tibiæ.</i>		<i>Fibulæ.</i>		<i>Metatarsi.</i>	
	Right.	Left.	Right.	Left.	Right.	Left.	Right.	Left.
<i>Dinornis casuarinus</i> . . . . .	1	1	1	1	1	1	1	1
——— <i>didiformis</i> . . . . .	9	5	3	2	3	3	1	2
——— <i>curtus</i> . . . . .	0	0	5	3	8	8	2	3
<i>Palapteryx dromioïdes</i> . . . . .	4	7						
——— <i>geranoïdes</i> . . . . .	10	5	8	8	9	4	7	6
there remained of the <i>Palapteryx ingens</i> } var. <i>robustus</i> . . . . . }	1	1	1	0	2	1		

\* See p. 132.

and of *Dinornis giganteus* the right and left fibulæ, the proximal end of a left tibia, and both proximal and distal ends of a right tibia of apparently the same bird. In one of the specimens, which is nearly full-sized, the distal epiphysis of the tibia is ununited.

Upwards of one hundred phalanges of the toes were referable to five or six species of *Dinornis*, *Palapteryx* and *Notornis*.

Of the numerous species of vertebræ (250 in number) seven were referable to *Dinornis giganteus*, four to *Palapteryx ingens*, eighteen to *Dinornis casuarinus*, together with twelve others, forming a continuous series of the neck-bones, corresponding with the vertebræ referred to *Palapteryx ingens* at p. 121, Pl. XXXII. figs. 1, 2 & 3.

There were still more complete series of cervical and dorsal vertebræ referable by their size to *Dinornis didiformis*, *Din. curtus*, *Parapteryx geranoïdes*, and to the species indicated in the Memoir of 1843 as *Dinornis otidiformis*. There were, also, sixteen more or less perfect pelves, referable to at least five species, together with numerous ribs and fragments of ribs.

Amongst the rarer specimens in this collection were some portions of a sternum of a small species of *Dinornis* or *Palapteryx*, and two nearly entire sternums of the Ralline type, and by size referable to the new genus *Notornis*, which, as we have seen, belongs to the same family (*Rallidæ*) as the *Ocydromus* or short-winged Rail of New Zealand.

Eight tarso-metatarsal bones (Pl. L. figs. 5-8), with the articular surface for a very strong hind toe, and of a conformation more nearly resembling those of the *Dodo* than those of the *Dinornis* or *Palapteryx*, but shorter and thicker in proportion than in the *Dodo*, appertained to the same species as the tibiæ and femora described at pp. 85, 137, under the name of '*Dinornis otidiformis*.' The proximal articulation of this remarkable form of tarso-metatarsal exactly fits the distal end of the tibia figured in Pls. XXV. & XXVI. figs. 5 & 6; and also that of a corresponding fractured tibia in Mr. Mantell's collection, which also contains the proximal end of another tibia, a fibula, an entire femur and distal ends of two other femora of the same species.

The large surface for the hind toe; the strong calcaneal process, perforated by a complete bony canal for the tendon at the back part of the proximal end of the tarso-metatarsal; the perforation above the interspace between the condyles for the middle and outer toes; and the more posterior position of the condyle for the inner toe,—all concur to indicate the generic distinction of the bird to which it belonged from either *Dinornis* or *Palapteryx*; and I propose to indicate the new genus by the name of *Aptornis*\*. The present species, *Aptornis otidiformis*, resembles the *Apteryx* in the shortness of the metatarsal as compared with the length of the tibia. Amongst all this collection there is but one bone of a wing—a humerus—which bears the same proportion to the femur referred to *Notornis Mantelli*, which the humerus of the little existing *Ocydromus* does to its femur.

With the bones of the birds were associated fragments of large birds' eggs; some

\* By syncope for '*Apterygiornis*,' from a priv., πτέρυξ wing, ὄρνις bird.

ossified rings of a bird's trachea, about half an inch in diameter (Pl. XCII. fig. 7) ; several bones, including jaws and teeth, of a large Seal of the genus *Arctocephalus* ; and a few bones of a small Dog, besides the calcined bones already alluded to, which include some that have indubitably appertained to a human skeleton. But there is no evidence that the human or canine remains were imbedded, like the bones of the birds and seals, in the deposit of the volcanic sand.

From this extremely rich and interesting addition to the materials for working out the zoological history, past and present, of the distant isles of New Zealand, I select for the subject of the present Memoir the bones of the head and beak of a bird which I am induced, provisionally, to refer to the same genus and species as the limb-bone of *Aptornis otidiformis*.

The largest and most complete specimen (Pl. XLIII. figs. 1, 2, 3) has a broad, depressed, subelongate beak, regularly but moderately curved downwards, resembling a cooper's ' adze ' (*doloire*, Fr.), with evidence in the skull of unusual muscular forces for working such beak. A second skull (Pl. XLVII.), of nearly equal size, with a beak more resembling that of the Emeu, and with characters of the skull which deviate less than those in *Dinornis* from the cranial organization of the *Apteryx*, I refer to the genus *Palapteryx*, indicated in the preceding Memoir by certain characters in the bones of the legs approaching those of *Apteryx*. There is a portion of the lower jaw (Pl. XLIV. figs. 1, 2) which from its size may have belonged to the *Palapteryx ingens*, if not to the *Dinornis giganteus*.

The cranial portion of the skull of *Aptornis otidiformis* is intermediate in size between that figured in Pl. XVI. figs. 1-4, and that in Pl. XXXI. figs. 4, 5 & 6, of a preceding Memoir, p. 116 ; and if the reference of the larger of those crania to *Dinornis struthoides*, and of the smaller one to *Dinornis dromioides* be correct, the present skull indicates that the genus and species of bird to which it is here referred differed from both *Dinornis* and *Palapteryx* in the greater relative size of the head to the body and legs of the extinct bird.

The cranium of *Aptornis* in its general broad and depressed form, in the pedunculate condyle, in the vertical plane of the foramen magnum (fig. 4, *o*), in the direction from below upwards and forwards of the broad and low occipital surface (fig. 1, 3), in the slight convexity of the parietal region (fig. 2, 7), and in the wide and deep temporal fossæ (fig. 1, *t*, 8", 12), approaches the characters exhibited by the previously described specimens of the cranium of *Dinornis* (pp. 116-120, Pls. XVI. & XXXI.). But some of these cranial peculiarities of the great extinct wingless birds are exaggerated in the present genus, especially the downward development and abrupt descent of the basioccipital and basisphenoid (fig. 4, 5) and the forward inclination of the occipital surface, which makes the occipital condyle (figs. 4 & 6, 1) the centre of the hinder surface of the skull, and places the occipital foramen (*o*) in the upper half—characters hitherto unknown in the air-breathing Vertebrata, amongst which the *Crocodylia*, perhaps,

present the nearest approximation to the peculiar structure exhibited in fig. 4. The extent of the paroccipital, to which the great breadth of the occipital region is due, is characteristic of the *Aptornis*.

The nasal process of the premaxillary, partly overlapped by the nasals, quickly expands, and in its turn begins to overlap the anterior ends of those bones. The upper surface of the premaxillary, at first flat or slightly concave, soon becomes convex, and gradually broader to the fore part of the external nostrils, where it bends down on each side to form their anterior boundary, and joins what may be termed the body of the premaxillary (22, fig. 1). From this part forwards the convexity begins to subside; and the bone very gradually contracts as it extends forwards to terminate in a broad truncated or slightly rounded border.

The palatal plate of the premaxillary extends one inch nine lines entire from the fractured end to the anterior border of the palatal nostril. A well-defined rough alveolar border (*ss*, fig. 3) extends backwards on each side from the premaxillary upon the coalesced maxillaries (*s'*, 21), and terminates by a slightly expanded portion below the anterior boundary of the external nostril (indicated by the dotted line at *n*, fig. 1).

#### *Skull of Palapteryx geranoïdes* (?)

The second almost entire cranium (Pl. XLV.) agrees in all the characteristics by which that of *Dinornis* differs from the cranium assumed to belong to *Aptornis* (Pl. XLIII.), viz. in the minor descent of the basioccipital (1, 1'', fig. 4), the square platform of the basisphenoid (5, fig. 3), the higher position of the precondyloid holes (*p*, fig. 4) and their separation from the carotid holes (*c*), the minor development of the paroccipitals (*t*), the major development of the mastoids (*s*) and olfactory chambers (18, fig. 3), and especially in the large and single oblong depression (*y*, fig. 3) beneath the mastoid for the single superior condyle of the tympanic. But it shows the palapterygian slenderness of beak.

### DESCRIPTION OF THE PLATES.

#### PLATE XLIII. APTORNIS.

Fig. 1. Side view of the cranium and upper mandible of *Aptornis otidiformis*.

2. Upper view of ditto.

3. Under view of ditto.

4. Back view of ditto.

5. Front view of the cranium, showing the surface from which the beak had been broken off.

6. An oblique view of the hinder part of the cranium, showing the two ridges

of the downwardly developed basioccipital (1'') and basisphenoid (5'), and the anchylosed stylohyal (38).

Fig. 7. Inner surface of part of the cranium with the pedunculate condyle (1).

8. Under view of the cranium of the Bustard (*Otis tarda*).

9. Oblique view of the hinder part of the same cranium.

## PLATE XLIV.

- Fig. 1. Back part of ramus of lower jaw of a large *Dinornis* or *Palapteryx*.  
 2. Upper view of ditto.  
 3. Back view of expanded end of ditto.  
 4. Upper view of lower jaw of an Ostrich (*Struthio Camelus*).  
 5. Side view of ditto.  
 6. Back view of expanded end of ditto.  
 7. Under surface of calvarium, showing the cerebral and olfactory cavities of *Palapteryx geranoïdes*.  
 8, 9 & 10. Views of the os tympanicum of the *Dinornis casuarinus* (p. 126).

- Fig. 11. Side view of the upper mandible of a species of *Nestor*.  
 12. Upper view of ditto.  
 n, the nostril.  
 22, the groove behind the upper end of the premaxillary part of the mandible.  
 13. Under view of ditto.  
 14, 15 & 16. Corresponding views of the upper mandible of a living species of *Nestor* (*N. hypopolius*).

## PLATE XLV. PALAPTERYX.

- Fig. 1. Side view of the skull, with lost parts restored in outline, of the *Palapteryx geranoïdes*.  
 2. Upper view of ditto.  
 3. Under view of ditto.  
 4. Back view of ditto.  
 5. Back view of the extremity of the upper beak.

- Fig. 6. Under view of the portion of lower jaw.  
 7. Upper view of ditto.  
 8. Outline of head of *Aptornis* as conjecturally restored in 1843 (see pl. 30).  
 9. Outline of cranium of *Dinornis* reduced to the same proportions.

## PLATE XLVI. PALAPTERYX.

- Fig. 1. Side view of the cranium of a *Palapteryx*.  
 2. Back view of ditto.  
 3. Under view of ditto.  
 4. Side view of the cranium of a different and larger species of *Palapteryx*.

- Fig. 5. Under view of the cranium of a different and larger species of *Palapteryx*.  
 6. Upper view of a mutilated cranium of apparently the same species, indicating the form and proportions of the cerebrum and cerebellum.

## PLATE XLVII. NOTORNIS MANTELLI.

- Fig. 1. Side view of the skull of *Porphyrio Sultana*.  
 2. Upper view of ditto.  
 3. Under view of ditto.  
 4. Back view of ditto.  
 5. Under view of lower jaw.  
 6. Upper view of lower jaw.  
 7. Side view of skull, with lost parts

- restored in outline, of *Notornis Mantelli*.  
 Fig. 8. Upper view of ditto.  
 9. Under view of ditto.  
 10. Back view of ditto.  
 11. Interior of cranium of ditto.  
 12. Under view of lower jaw.  
 13. Upper view of ditto.

The homologous bones and parts are indicated by the same numbers or letters in each figure, and are explained and referred to in the text.