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# DICTIONARY OF BIRDS

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was promptly (14th Feb. 1843) substituted for it and has ever since held ground (*Proc. Zool. Soc.* 1843, pp. 1, 2, 8-10, 19). In due time these specimens with others, subsequently received from the same quarter (*tom. cit.* pp. 144-146), and referred to five, or rather six, distinct species of the genus<sup>1</sup> were fully described and figured (*Trans. Zool. Soc.* iii. pp. 235-275, pls. 18-30), forming the first of that incomparable series of memoirs continued over nearly forty years which will always be associated with the author's name,<sup>2</sup> but cannot be here further particularized, though mention must be made of the assistance rendered by Mr. Percy Earl and by Mr. Walter Mantell.

The Moas inhabited both the North and South Islands of New Zealand, where they were represented by a considerable number of species, of which the smallest was scarcely larger than a Turkey, while the largest had a tibia of more than a yard in length. We are inclined to estimate the number of species at about 20; Capt. Hutton (*N. Zeal. Journ.* i. pp. 247-249; *Trans. N. Zeal. Inst.* xxiv. pp. 93-172) admits, indeed, 26 species, but some of these we should prefer regarding merely as varieties or sexes. Certain species were peculiar to the North, and others to the South Island, while some were common to both. A femur described under the name of *D. queenslandiæ*<sup>3</sup> appears to belong to a Moa, and if its reputed place of origin be correct, shews that the Family extended to Australia;—a fact in distribution which, if true, is of extreme importance.

When New Zealand was first systematically explored by Europeans, Moa-bones were found lying on the surface of the ground in many districts in great profusion, being especially abundant near the old cooking-places of the natives, and often shewing traces of the action of fire. They also occur in the most superficial and recent deposits, such as blown sands, as well as in caves and swamps. Many of the latter, such as that of Glenmark, near Canterbury, when drained have been found to be full of Moa-bones, frequently in all conceivable positions. In one particular district of the South Island, where climatic conditions appear to be peculiarly favourable, skeletons have been found with the bones connected by dried muscles, ligaments, and integument with the cuticle and feathers. Fragments of egg-shells, as well as pebbles swallowed by the birds and contained in their stomachs at their death, together with impressions of footprints, have likewise been discovered. The discovery of

<sup>1</sup> Namely *D. giganteus*, *ingens*, *struthioides*, *dromæoides*, *didiformis* and *otidiformis*. The original specific name *novæ-zealandiæ* was tacitly dropped.

<sup>2</sup> This series was issued in 1879 in a separate form under the title of *The Extinct Birds of New Zealand*.

<sup>3</sup> De Vis, *Proc. R. Soc. Queensl.* i. p. 27, pls. iii. iv. (1884). Etheridge, *Rec. Geol. Surv. N. S. W.* i. p. 128 (1889).

remains of a Moa (*Anomalopteryx antiqua*) in clay on Timaru Downs seems, however, to carry back the group to the Pliocene, or possibly the upper part of the Miocene period; but the age of the beds has been called in question by Mr. H. O. Forbes. That Moas lived down to a comparatively recent epoch is abundantly evident, and it is practically certain that they formed a considerable portion of the food of the human race by whom New Zealand was first peopled, and by whom they were in great part or wholly extirpated. Capt. Hutton considers that in the North Island Moas were exterminated not less than 400 or 500 years ago, while in the South Island they might have lingered a century later. The larger species (*Dinornis*) were always comparatively rare, but many of the smaller forms were very numerous. How so many became entombed in the swamps is a question not yet solved; although it is suggested that *débâcles* during a glacial period may have been the chief agents.

As a rule, Moas were destitute of wings, although Capt. Hutton states that a rudimentary pair existed in *Anomalopteryx* (*Palapteryx*) *dromavoides*. The nearest allies of the Moas being apparently the KIWIS, it seems a fair inference that the females were larger than the males; and this is confirmed by bones differing only slightly, but constantly, in size.<sup>1</sup> The feathers differ from those of the KIWIS in having an aftershaft.

Moas are distinguished from all existing *Ratitæ* in having a bony bridge on the anterior surface of the lower end of the tibia above the condyles (fig. 1). The tarso-metatarsus (fig. 2) has three distal trochleæ, and in most cases (according to Capt. Hutton probably all) carried a hallux. The beak (unlike that of the KIWIS) is short and stout; the form of the lower jaw being either U-like or V-like. The general form of the pelvis is very like that of the KIWIS; but the sternum (fig. 3) differs by the absence of the superior notch, the more divergent lateral processes, and the abortion or disappearance of the grooves for the coracoids.

The most remarkable features which the birds present are the gigantic dimensions attained by some of them, and the great number of species occurring in such a limited area as New Zealand. The absence of Mammals in those islands has doubtless been the chief cause which has led to this great development, both as regards species and individuals, of Moas (as well as of other flightless birds); and it has generally been considered that this development has taken place entirely within the limits of these islands;<sup>2</sup> while Capt. Hutton suggests that the genera may have been differentiated on separate islets by subsidence during the Pliocene period. As regards their introduction into New Zealand, Mr. Wallace (*Island Life*, pp. 446, 447) is of opinion that Cassowaries, Emeus, *Dromornis*, KIWIS

<sup>1</sup> Capt. Hutton does not admit this sexual difference in size.

<sup>2</sup> If *D. queenslandiæ* be truly Australian, this view will need modification.

and Moas were derived from an Asiatic stock of Ratite birds ; but Capt. Hutton objects to this view, and suggests that the Moas are descended from volant birds, allied to the TINAMOUS, which inhabited New Zealand during the Eocene. The Moas are thus regarded as the ancestral stock of all the Australasian *Ratitæ*, while those of Asia and America are supposed to have had a totally independent origin. There are, however, many objections to this view ; one of the most obvious being the absence of any evidence of the presumed Tinamou-like Eocene birds.<sup>1</sup>

Although, as already mentioned, there is some uncertainty as to the actual number of species of Moas, yet there is no doubt that the

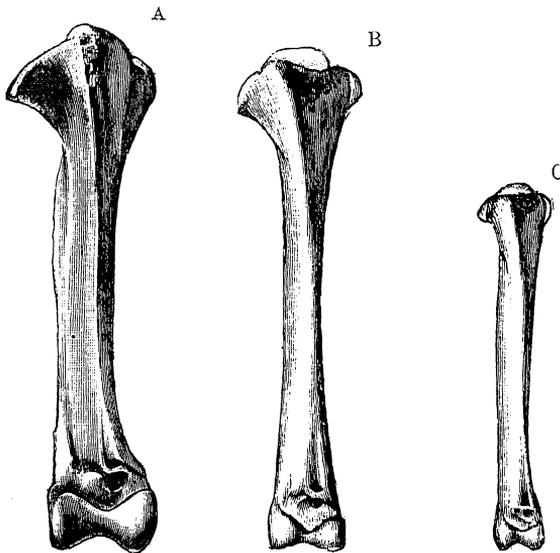


Fig. 1. RIGHT TIBIA of *Euryapteryx gravis* (A), 1/6, of *Dinornis gracilis* (B), 1/8, and *Megalapteryx teniipes* (C), 1/8. Anterior view.

(From Lydekker's 'Catalogue of Fossil Birds in the British Museum.')

number was large. The Family may be divided into at least 5 genera, of which the first and last are very widely separated, although connected to a certain extent by the intermediate forms.<sup>2</sup>

The typical genus *Dinornis*, Owen, includes the tallest of the Moas, and is characterized by the length and slenderness of the

<sup>1</sup> It is not easy to reconcile Capt. Hutton's views as to the impossibility of an immigration of flightless birds having taken place into New Zealand, while he admits that emigrations must have happened.

<sup>2</sup> Capt. Hutton adopts 7 genera (one of which he subdivides into two sub-genera), exclusive of one of those noticed below.

tibia (fig. 1, B) and tarso-metatarsus (fig. 2, B), and also by the broad and flattened beak, the apparent absence of the hallux, and the width and convexity of the sternum. The typical *D. novae-zealandiae* (including *D. giganteus* and *D. ingens*<sup>1</sup>) is mainly confined to the North Island, and is one of the largest species, the length of the tibia of the presumed female being 35 inches. In the South Island this Moa was represented by the closely-allied *D. macrimus* (*D. robustus*, in part), which is the largest of all the species, having a tibia measuring 39 inches, and probably reaching a height of 12 feet. *D. gravis* (fig. 1, B) and *D. struthioides* (fig. 2, B) were considerably smaller forms, occurring in both islands, and referred by Hutton to a distinct subgenus (*Tylopteryx*).

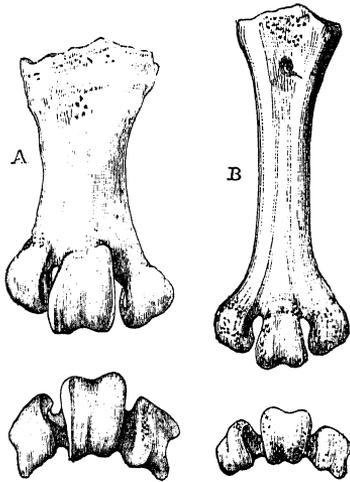


Fig. 2. RIGHT TARSO-METATARSUS OF *Pachyornis elephantopus* (A), and *Dinornis struthioides* (B), 1/6. Anterior aspect. (From the same work.)

smaller and imperfectly-known forms from the South Island, characterized by the extreme slenderness and length of the femur and tibia (fig. 1, C), and the shorter tarso-metatarsus.

*Anomalopteryx*, Reichenbach (= *Meionornis*, Haast) is typically represented by the small *D. didiformis*, Owen, and, in our opinion, may be conveniently taken to include all the smaller species of the group, although Capt. Hutton prefers to separate Owen's *D. dromaeoides* as *Palaopteryx*, *D. curtus* as *Cela*, and *D. dubius* as *Mesopteryx*. On the other hand, Owen's *D. casuarinus*, which Von Haast included in *Meionornis*, is placed by Capt. Hutton with *Emeus crassus*. Whether included under one or more generic headings, all these forms are characterized by having the tibia and tarso-metatarsus considerably shorter and stouter than in *Dinornis*, while the beak is narrow and more or less pointed, the hallux present (as in the following genera), and the sternum (fig. 3, A) very long and narrow. There is great difficulty in correctly identifying the various members of this group with the species named by Owen on the evidence of detached bones. *A. casuarina*, with a tibia measuring 19 inches in length, is the largest form, and *A. (Cela)*

<sup>1</sup> If these forms be regarded as distinct, the name *novae-zealandiae* should be adopted for the latter.