

MEMOIR

ON

BONES OF THE TRUNK AND LIMBS

OF A

GIGANTIC BIRD OF PREY

(*Harpagornis moorei*, Von Haast).

AT p. 108 a speculation is hazarded relative to a condition of extirpation of the now seemingly extinct gigantic wingless birds of New Zealand, which involves the assumption of their continued existence on the islands after the arrival there of mankind. In a subsequent 'section' of the present work (pp. 220, 224) evidence will be submitted of birds, especially young individuals of certain large Moas, having been killed and eaten under circumstances pointing plainly to a Maori race as the cooks and feasters. The advent of such destroyers in islands destitute of herbivorous beasts would first sound the knell of the departure of the huge feathered bipeds incapable of flight.

For how long a period the Dinornithic generations may have roamed unmolested on the plains, hills, and woods of the tract of dry land gradually losing extent, and becoming reduced to the insular conditions and dimensions, such as when it first may have received its Polynesian immigrants, speculation fails to find a basis of estimate. But it might be asked, had the Moas no natural enemies before they became the exciting object of chase to the Maori men?

Having in mind the relation of the existing birds of prey in New Zealand to the other contemporary members of the feathered class, of which the *Apteryx australis* now ranks as one of the giants, it sometimes entered into one's speculations whether the great extinct Apterygians, of which evidence is given in the preceding Memoirs, might have been harried by any raptorial species of analogous or proportional size—whether at least the chicks or young brood of species of *Dinornis* might not have needed the protection of their giant parents against some such enemies.

It was therefore with unusual interest that I received from a valued correspondent, Julius Von Haast, Ph.D., F.R.S., Director of the Canterbury Museum, New Zealand, and of the Geological Survey of that flourishing province, the following announcement of a discovery in the turbary deposits of Glenmark, a locality about forty miles from

Christchurch, Canterbury, of some bones which had been recognized to be those of a huge bird of prey¹, and for which he proposes the generic name of *Harpagornis*.

The bones in question, of which drawings accompanied this announcement, were a left femur, two unguis phalanges, and a rib. Dr. von Haast carries out comparisons of these remains with the answerable bones of existing Raptores, more especially with those of the White-bellied Eagle (*Haliaeetus leucogaster*), the Wedge-tailed or Bold Vulture (*Uroaetus audax*), and the Kahu Harrier (*Circus gouldi*, Buller², *Circus assimilis*, Gray³). The results of these comparisons, notes of which were obligingly transmitted to me along with the drawings, have since appeared in the volume quoted below of the 'Transactions of the New-Zealand Institute.'

In the conclusions arrived at by Von Haast of the nearer affinity of Fuller's great extinct raptorial bird to the small Harrier than to the large Eagle and Vulture now existing in or occasionally frequenting the Islands of New Zealand I concur; but a character will be noted in the course of my descriptions which leads me to place *Harpagornis*, with Falcons and Buzzards, in a subsection of Raptores distinct from that including the Harriers. Of the claims of the great extinct Accipiter to generic as well as specific distinction, confirmatory evidence will be adduced; but a discovery of the skull or beak is still requisite for completing the generic characters and for determining the closer affinities of *Harpagornis* amongst the families of the Accipitres or "Diurnal Raptores" in which the "tibia and tarsus" are not "to all intents equal in length"⁴; but in which the tibia is longer, if not "much longer, than the tarsus"⁵.

Pursuing the search for other evidences of his *Harpagornis moorei*, Von Haast writes, "following down the swampy water-course from which these few remains of *Harpagornis* were previously obtained, a further series of bones was discovered, which, on examination, proved to be another portion of the same skeleton described in that first Memoir. The bones obtained were scattered over the bottom of the turbary deposit along the old water-course, 6 feet to 7 feet below the surface, amongst the remains of decaying swampy vegetation. They were mixed up with pieces of drift timber, and with a considerable number of Moa bones, several of them belonging to the larger species (*Dinornis giganteus*, var. *maximus*, and *D. robustus*)"⁶.

¹ "During the progress of excavations undertaken in the month of March of this year on the Glenmark property, Mr. F. Fuller, Taxidermist of the Christchurch Museum, found, amongst a quantity of Moa bones, mostly belonging to specimens of *Dinornis casuarinus*, *crassus*, and *didiformis*, five or six feet below the surface of the swamp, and over a space of about thirty feet square, a few small bones in an excellent state of preservation, which he at once correctly referred to a gigantic raptorial bird."—(Letter *penes me*, of July 1873, since published in the 'Transactions and Proceedings of the New-Zealand Institute,' 8vo, vol. iv. p. 192, pls. 10 & 11.)

² 'A History of the Birds of New Zealand,' by Walter Lawry Buller, Sc.D., F.L.S., &c. &c., 4to, part 1, pl. 2, p. 11 (March 1872).

³ 'Ornithology of the Voyage of H.M.S. Erebus and Terror,' p. 2.

⁴ R. Bowdler Sharpe, 'Catalogue of the Accipitres in the British Museum,' 8vo, 1874, p. 46.

⁵ Ibid. ib. pp. 158 (*Buteoninae*), 225 (*Aquilinae*), 350 (*Falconinae*).

⁶ Trans. & Proc. N.Z. Institute, vol. vi. p. 62.

This second 'find' of *Harpagornis*-remains included right and left metatarsus, right and left tibia, right and left fibula, right and left ulna, right and left radius (one fragmentary), right and left scapula, one rib, five phalanges, and four ungual phalanges¹. A portion of a humerus, "without doubt belonging to this species, was obtained about a mile above Glenmark, from the banks of the Glenmark Creek." "We obtained also the lower portion of a metatarsus from a similar older postpliocene bed situated close to Glenmark; so that there is sufficient evidence that this diurnal raptorial bird existed, like the *Dinornis* and *Palapteryx* species, during a long period in New Zealand"². "Finally, were discovered on the left bank of the Glenmark Creek, near the bottom of the swamp, close to a layer of clay, 7 feet to 8 feet below the surface, a pelvis (fragmentary), right and left metatarsus, right and left tibia, right and left femur, right humerus, right and left ulna, left metacarpal, left scapula, one rib, four phalanges, one ungual phalanx"³. These were parts of a skeleton of another *Harpagornis* of smaller dimensions, and, as Von Haast suggests, exemplifying the usual sexual distinction, as to size, in the Raptorial order, the second and smaller series being probably those of a male, the first and larger series those of a female of the huge predatory species.

The wanting parts of the mutilated pelvis from the South Island are fortunately supplied by a perfect specimen of that compound bone of *Harpagornis*, which was included in a series of bones found by Mr. W. A. Low, on the surface-soil under an overhanging rock, in the vicinity of Cowes, in the "Obelisk range of hills," in the province of Otago, South Island, New Zealand⁴. This supplementary series was forwarded by Mr. Low to the Museum at Wellington, where the nature of the pelvis was recognized by Dr. von Haast, to whom it was submitted by the accomplished Director of the Geological Survey of New Zealand, Dr. Hector, F.R.S. Photographs of all the above remains, with admeasurements, have been kindly transmitted to me, from which I have selected the characteristic bones figured of the natural size in Pls. CV., CVI., and CVII. in illustration of the *Harpagornis moorei* of Von Haast.

The raptorial pelvis is characterized by the great proportional extent of its ant-acetabular part (Pl. CV. fig. 1, *a-f*), by the depth, strong definition, and muscular sculpturing of the surface of the ectiliac fossæ (ib. ib. 62), by the breadth of the ilio sacral disk, by the depth and strength of the ischia between the ischiadic (ib. ib. *m*) and obturator (ib. ib. *q*) foramina, and by the close connexion of the pubis (ib. ib. 64) with the ischium (ib. ib. 63) beyond or behind the obturator foramen. The conformity of the pelvis of *Harpagornis* with that of our Blue Harrier⁵ in the foregoing characters

¹ Trans. & Proc. N.Z. Institute, vol. vi. p. 62.

² Ib. ib. p. 63.

³ Ib. ib. p. 63.

⁴ Ib. vol. iv. p. 114. Of this pelvis, Dr. Hector writes:—"It is in wonderful preservation, and is still covered with periosteum, and has the capsular and some other ligaments adherent, while the osseous substance has lost hardly any of the original animal matter which it contained."

⁵ *Circus cyaneus*, Bp., *Circus hudsonius*, Vieill. See the beautiful figure of this well-known active raptorial

will be obvious in comparing fig. 1 with fig. 7, both of the natural size; but the difference in relative vertical extent of ilium and ischium, and relative size of the foramen (*m*) is to be noted. The parapophyses of the six anterior sacral vertebræ abut against the ilia near the lower border of those bones. Below this abutment the first and second vertebræ develop the cups for the tubercles of the last two pairs of movable ribs; the cups for the heads of these ribs are on the centrum, below the origins of the parapophyses. These processes in the four following sacrals have coalesced with the ilia. Of the interapophysial vacuities (ib. fig. 2, *d*) the first and second are the largest, the other three smaller ones are subequal.

Four interacetabular sacrals, in which the parapophyses are suppressed to give space to the prærenal lobes, are followed by four postacetabular sacrals, in which the parapophyses are resumed. Of these the first pair are slender, the second and third suddenly expanded, the latter (ib. *u*) apparently bifurcate; the fourth pair are short, and inclined backward; on each side of the sacrum these parapophyses coalesce with each other and with the ilia at their outer ends. The last sacral vertebra (ib. *ib. 15*) has not coalesced with the preceding, but appears to have been closely joined therewith, as the ends of its short and thick parapophyses combine with those of the fourteenth sacral to abut against the inflected parts of the ilio-ischial deck-like process (ib. *ib. v*). In the number of sacral vertebræ (fifteen) *Harpagornis* agrees with *Falco* and *Circus*, and differs from *Aquila*; in the species of which I have examined the pelvis there are but fourteen sacral vertebræ. The ischiadic foramen (*m*) extends relatively further beyond the postacetabular facet in *Harpagornis* than in *Aquila*; the foramen is relatively less than in *Circus*.

The prærenal or interacetabular fossæ (Pl. CV. fig. 2, *t*) are relatively narrower in *Harpagornis* than in *Aquila* or *Circus*, and more resemble those in *Buteo*. The pubic portion of the acetabulum does not extend so far outward as in *Aquila*. *Buteo vulgaris* and *Falco communis*, as well as *Circus gouldi* and *Circus cyaneus*, resemble *Harpagornis* in the vertically oval figure of the anterior orifice of the neural canal (ib. fig. 3, *n*); in the smaller species figured (*Circus pygargus*, the Ring-tail or Montagu's Harrier) this outlet is circular (ib. fig. 8), as in most species of *Aquila*. The iliac roofs (ib. fig. 3, *f, f*) of the long acetabular division of the pelvis are steeper in their slope than in *Circus* (ib. fig. 8) and most Eagles; the ilio-neural openings (ib. *ib. o'*) have consequently, as Dr. Haast has remarked, "a greater vertical than lateral extent." The parts of the pelvis in Pl. CV. are indicated by the same symbols as in that of *Aptornis*¹. The gluteal processes (ib. fig. 1, *h*) appear to have been broken off in the fossil; they are

bird in Gould's 'Birds of Great Britain,' folio, part xii. 1867. In no animal does the size become so reduced, in the skeleton, as in the feathered class; with the above plate showing our native 'Harrier' clothed in its plumage, some conception may be formed of the size of the extinct Hawk of New Zealand, magnified according to the proportions of figs. 1, 2, and 6, 7 in Pl. CV.

¹ P. 125; Pls. LXXXIII. & LXXXIV.

more strongly developed in *Circus* and *Buteo* than in *Aquila*. Both first and second sacral vertebræ have well-defined articular surfaces for the head of a rib; and there are indications of a surface for ligamentous attachment of a third free or movable pleurapophysis in the pelvis of *Harpagornis*. The extremity of the long and slender pubis (Pl. CV. fig. 1, 64) has been broken off in the fossil; but doubtless it had similar proportions, when entire, to that element of the pelvis in most existing diurnal Raptorial birds.

Humerus.—This bone appears, as is often the case in fossils, to have lost the terminal angle of the projecting crest (Pl. CVI. figs. 1 & 2, *d*) called ‘pectoral’ or ‘delto-pectoral:’ it is restored in dotted outline after the type of that in *Buteo* and *Circus* (ib. figs. 7, 8). The slight outward bend of the shaft beyond or below this process, which distinguishes the great wing-bone in the Buzzards, Falcons, and Harriers from that in the Eagles, is well shown in the photographs, and is noticed by Dr. Haast in the original bone.

The articular head (ib. *a*) is transversely broader, in proportion to the fore-and-aft diameter, in both the extinct *Harpagornis* and in existing Falcons than in Eagles. The pneumatic ridge or crest (ib. *c. p*), extending from the ulnar tuberosity to below the pneumatic orifice, is relatively shorter in *Harpagornis moorei* than in *Aquila chrysaetos*; the breadth of the entire proximal end is relatively greater in the Falcons than in the Eagles. The radial tuberosity (ib. *b*) is more strongly marked in *Harpagornis moorei*. In this huge species the graceful sigmoid bend of the entire humerus is better marked than in the smaller existing Falconines and than in any Eagle; it suggests a greater force in the movements of the wing. The longitudinal line (ib. fig. 2, *e*) along the palmar aspect of the shaft of the humerus is better marked in *Harpagornis moorei* than in the humerus of any existing Raptorial species, though not so developed as to be termed a ridge. In this character the Falcons make the nearest approach (as in Pl. CVI. fig. 8, *c*) to their great extinct confamiliar. In both the line rises to the character of a ridge as it descends to terminate in the palmar prominence (*g'*) of the ulnar epicondyle. The radial epicondylar process (*f*) is characteristically developed in both the recent (fig. 8) and extinct (figs. 1 & 2) Falconines. The condyles themselves (ib. *h, i'*) show the usual well-marked modification of that part of the humerus in birds of flight. The radial (*h*) and ulnar (*i*) convexities are strongly marked in *Harpagornis moorei*. The least circumference of the shaft of the present humerus is 2 inches 2 lines; it formed part of the series of the smaller (male?) *Harpagornis* (*H. assimilis*, Von Haast), and is estimated to have been one inch shorter than the humerus in the female (?*H. moorei*, Von Haast), of which the shaft only was found.

The radius (Pl. CVI. fig. 4) is thicker in proportion to its length, and also in proportion to the ulna, in *Harpagornis*, than in existing Raptores. The ridges and processes indicative of the power of the muscles of flight are strongly marked, especially the tubercle near the proximal end for the insertion of the main tendon of the biceps. The shaft is more bent toward the distal end, as Von Haast has observed, than in existing birds of prey.

The ulna (Pl. CVI. fig. 3) is distinguished from that of the largest Eagles more by its thickness and the expansion of its articular ends than by its superiority in length. The proximal surfaces for both condyles of the humerus bear proportion to their characteristic development in that bone; the 'coronoid' angle (*d*) is well marked. The distal articular convexity (*k*) indicates the extent of the evolutions of the manual part of the wing, with its great 'primary remiges,' in the actions of flight. My photographs showed no indication of the pits and prominences for the 'secondary' and 'tertiary' remiges; and Von Haast expressly states that in the ulna first obtained from the Glenmark alluvium "the quill-knobs are obliterated:" but this may be due to posthumous decay or abrasion; for in the second and smaller examples of ulna obtained from the left bank of the Glenmark creek, "two rows of quill-knobs, and principally the one on the ulnar side, are well seen, as well as the intermuscular ridge on the palmar side and the flat processes for the attachments of muscles"¹.

One metacarpus only, the left, of *Harpagornis* seems hitherto to have been found; it was associated with the series belonging to a smaller individual, and indicative either of a sexual (male) or a smaller variety, or of a smaller but nearly allied species of *Harpagornis*. Von Haast remarks, however, of this compound wing-bone, that "it is not only a little longer than that of *Aquila*" (*audax*?), "but also much stouter in its proportions. This is most conspicuous in the medius metacarpal and the proximal end. The process for the attachment of the index phalanx is broad and heart-shaped; and the two principal intermuscular ridges upon the medius metacarpal enclose a broad and well-defined channel"².

Femur.—With the usual characteristics of this bone in the Raptorial order, the femur of *Harpagornis* is remarkable for its greater relative thickness and the greater expanse of its extremities, especially of the distal one. The pneumatic foramen (Pl. CVII. fig. 2, *g*) is large, single, and situated, as usual in the Order, on the fore part of the bone between the prætrochanterian ridge (ib. ib. *f*, *k*) and the supporting base (*d*) of the head (*a*) of the femur; no constriction, like a 'neck,' is present; and the head, from which the articular cartilage was extended along the upper surface of the supporting base to the great trochanter, is as characteristically sessile as in other Raptores. The contrast which the present New-Zealand fossil presents with the femora of the great extinct wingless birds of that island, in the configuration of the proximal end of the femur, may be appreciated by comparing the figures of the femur of *Harpagornis moorei* in Pl. CVI. with those of the femur of *Dinornis gravis* (Pls. XLI. & XLI. A). The ectotrochanterian ridge (*k*) is less convex in contour than in the Golden Eagle (*Aquila chrysaetos*); the hypotrochanterian roughness for the insertion of the intrapelvic muscle, which I have called 'oburator internus' in the *Apteryx* (*ante*, p. 56), has more the form of a ridge in *Harpagornis* than of a tubercle.

¹ Trans. and Proc. of the New-Zealand Institute, vol. vi. p. 70.

² *Tom. cit.* p. 71.

The prætrochanterian ridge (Pl. CVII. fig. 2, *h*) is linear, and may be traced down the middle of the fore part of the shaft; its continuation into the antentocondylar ridge (*n*) is interrupted. This ridge, as well as the antectocondylar ridge (ib. ib. *m*), is well marked, and relatively sharper than in *Aquila*. The rotular channel is broad and deep. The popliteal space (ib. fig. 1, *z*) is shallow. The distal end of the femur is relatively broader transversely than in *Aquila*. The intercondylar ridge (ib. fig. 4, *t'*) is well marked. The backward production of the inner condyle dividing the tibial facet (ib. ib. *x*) from the fibular facet (*y'*), is relatively more produced and sharper. Every character of the femur indicative of muscular force and strength of joint is better marked than in the smaller existing Raptorial birds, although inferior, especially as regards the posterior ridges of the shaft, or 'lineæ asperæ,' to that bone in the huge objects of prey of the *Harpagornis* (Pls. XX.—XXIII.). The least circumference of the femoral shaft in the larger (female?) *Harpagornis* is 2 inches 6 lines, in the smaller (male?) specimen 2 inches 3 lines. The admeasurement in the Table, as in the subject in Pl. CVII., is from the larger specimen of the extinct bird of prey.

Tibia.—This bone in *Harpagornis* corresponds with the femur in its strength, *i. e.* in the proportions of breadth to length of shaft.

The procnemial ridge (Pl. CVII. figs. 5 & 6, *g*) is more produced at its upper part than in the Eagles, but sooner subsides into the lower less prominent ridge (ib. fig. 6, *g'*), which is continued down the fore part of the shaft, inclining toward the innermost of the distal condyles. The depression on each side of the procnemial ridge is well marked; the inner (tibial) one (ib. fig. 6, *l*) is bounded by the low, thick, obtuse 'entocnemial' ridge (ib. ib. *o*), extending from the overhanging inner (tibial) border of the proximal articular facet of that side of the head, obliquely downward and forward to join or be lost in the procnemial ridge. The outer depression (ib. fig. 5, *k*) has the form of a wide vertical channel, and is bounded externally (fibulad) by the ectocnemial process (ib. ib. *h*). The fibular ridge (ib. fig. 5, *m*, *m'*) is well marked; it is relatively more prominent, but is of minor longitudinal extent, than in the Eagles. The ectarticular convexity is smoothly rounded; the rugous facet anterior to it for the 'crucial' ligament, and that attached to the head of the fibula, are well marked. The two distal condyles (ib. fig. 5, *t*, *s*) show a breadth which exceeds by two fifths that of the same part of the leg-bone in the Condor or Lammergeyer. In their proportions, shape, and degree of anterior convexity these condyles exhibit the Falconine characters of this end of the tibia. The præcondylar groove (ib. ib. *p*) is crossed by the osseous bridge (*q'*), as in the 'Diurnal' division of Raptores. The strength of the 'tibialis anticus' muscle (p. 61, Pls. XI., XIV. 8, *Apteryx*) is significantly indicated by the size of the bony canal which was traversed by its tendon.

In the metatarsus (Pl. CVII. figs. 5, 6) of *Harpagornis* the indications of the power of the raptorial foot reach their maximum. This will be evident to any one comparing the above figures with those of the metatarsus of the Golden Eagle (*Aquila chrysaetos*).

From that type the present fossil differs in its greater breadth and thickness in proportion to its length, and especially in the greater strength and outward extension of the condyle for the innermost of the anteriorly directed toes (Pl. CVI. figs. 5, 6, *ii*); the shaft of this composite bone is rather more twisted on its axis, with a greater inclination of the stem of the condyle (*ii*) backward. The 'entocondylar cavity' (ib. fig. 5, *a*) is somewhat deeper and larger than the ectocondylar one (*b*); the intercondylar tubercle (*c*) is large, but little elevated. The ectocalcaneal process (ib. fig. 6, *s*) is a strong and prominent subquadrate plate of bone. The entocalcaneal process (ib. *r*) is, as usual in Raptores, of smaller size. The intervening calcaneal groove or channel (ib. *u*) is of great depth and width. Into the wide and deep antinterosseal depression (ib. fig. 5, *i*) open the entinterosseous and ectinterosseous canals. The small hinder orifice of the latter remnant of the primitive interspace between the ecto- and mesometatarsal elements is shown in fig. 6, at *m*. The ectinterosseous groove is continued down a short way below this orifice. A strong tuberosity (fig. 5, *n*) marks the insertion of the tendon of the 'tibialis anticus.' The entogastrocnemial ridge (*g*) is continued from the entocalcaneal process nearly halfway down the shaft of the metatarsus. The ectogastrocnemial ridge (*x*) and the postinterosseous ridge (*y*) are well developed. The intermuscular ridges on the fore part of the shaft (fig. 5) are equally well marked; the entometatarsal ridge is shown at *q*, the ectometatarsal ridge at *k*. A long groove (*o*) for the 'adductor digiti externi' deepens as it leads to the foramen (*p*), through which the tendon of that small muscle glided to the interspace between the meso- and ectotrochleæ. A strong osseous bridge (ib. fig. 6, *q*) divides the upper and hinder orifice (*p'*) from the intertrochlear outlet of the tendinal canal. The depth and extent of the surface for the ligamentous attachment of the innermost and backwardly directed metatarsal (*i*) bespeak the strength of the toe opposing the forwardly directed digits (*ii* & *iii*) in the grasping actions. The ectotrochlea (*iv*) is, transversely, rather narrower than usual relatively to the other trochleæ; but it is of equal antero-posterior extent. The least circumference of the shaft of the metatarsal of *Harpagornis moorei* is 2 inches; the breadth of the two extremities and the length of the bone are shown in Pl. CVI.

Among the more characteristic evidences of the present extinct gigantic Raptorial are certain claw-bones (ungual phalanges). Assuming this unguis phalanx (Pl. CVII. fig. 7) to correspond with the one which is commonly the largest in diurnal Raptores, viz. that which supports the back toe (digit *i*), a second somewhat smaller claw-bone, discovered at the same time and place, and differing only in a slight inferiority of size, may well be a claw-bone of the toe *iii*. Subsequently a third unguis phalanx was discovered in another part of the Glenmark swamp, of rather less length than the second, but of equal size of basal articulation, and with it the penultimate phalanx of the same toe. On the assumption that the largest claw-bone (Pl. CVII. fig. 7) was that of the 'hallux,' or hind toe (*i*), it may be compared with the homologous bone in the Great Wedge-tailed Eagle of Australia (*Aquila cuneicaudata* of Brehm) or the Bold

Vulture (*Vultur (Uroaetus) audax* of Latham (ib. fig. 8), and with that in the larger Harrier Hawk of New Zealand (*Circus gouldi*) (ib. fig. 13). In all diurnal Raptores such unguis phalanx is characterized not only by its size, but by its curvature, its gradual tapering to a sharp point, by the depth of the pair of trochlear cavities at the base fitting closely or interlocking with the distal condyles of the penultimate phalanx, and above all by the size and prominence of the lever for the insertion of the flexor tendon of the claw phalanx, which recalls the corresponding development in the retractile claw-bones of the Tiger. The process in question (*b*), in its direction and extent, resembles that in the Falcons and Harriers (fig. 13, *b*) more than that in the Bold Vulture or in the Eagles.

In reference to the evidences which may be adduced from the above-described remains of the more especial or nearer affinities of *Harpagornis* in the diurnal division of the Raptorial order, I esteem as the most important that of the relative length of the metatarsus to the tibia. In the Eagles (*Aquilinæ*, Bd. Sh.), Buzzards (*Buteoninæ*, Bd. Sh.), and Falcons (*Falconinæ*, Bd. Sh.) the superiority of length in the tibia as compared with the metatarsus is greater than in the Harriers and Goshawks (*Accipitrinæ*, Bd. Sh.). In the Wedge-tailed or Bold Eagle (*Uroaetus audax*) the tibia is one third longer than the metatarsus. In the Golden Eagle (*Aquila chrysaetos*) the tibia is rather more than two fifths longer than the metatarsus. In our Ring-tail Harrier (*Circus pygargus*) the tibia (Pl. CVII. figs. 11, 12) is rather less than one fourth longer than the metatarsus. In *Harpagornis moorei* the tibia (ib. figs. 5, 6) is rather more than one third longer than the metatarsus (Pl. CVI. figs. 5, 6). By this character the great extinct Raptorial of New Zealand deviates from the Harriers (*Circus*) and Goshawks (*Astur*), and approximates the Eagles and Falcons, and more especially the latter, and also the Buzzards, in some minor modifications which have been pointed out in the descriptions of the bones. The determination of the closer affinity of *Harpagornis* to the shorter-tarsaled groups of Accipitres, or Diurnal Birds of Prey, must, however, await the acquisition of evidence of the skull and beak and of the sternum.

I cannot quit this especially interesting subject, connected with the history of the extinct birds of New Zealand, without a quotation from the paper initiating the quest of their osseous remains. In the "Notice of a Fragment of the Femur of a Gigantic Bird of New Zealand," published in the 'Transactions' of the Zoological Society, I cite the testimony of the person who brought the specimen for sale to the Royal College of Surgeons, and permitted me to describe and figure it, viz. that the natives of the North Island of New Zealand, from whom he stated that he had obtained the bone, "had a tradition that it belonged to a bird of the Eagle kind, but which has become extinct, and to which they gave the name of Movie"¹.

¹ Vol. iii. (1839) p. 29, pl. 3. The specimen in question was submitted for sale, in the first place, to the British Museum; and the vendor was recommended by Dr. Gray to offer it to the Royal College of Surgeons. The price asked (ten guineas) was deemed too high for the fragment by the then "Museum Committee of the

Harpagornis exceeds the Golden Eagle and our native Harrier Hawk more in the length and strength of its legs than of its wings. The anatomical characters of femur, tibia, and especially of metatarsus and unguis phalanges, bespeak a strength and vigour of grasp well-matched, as it would seem, to the bulk of the terrestrial birds on which it preyed. And in regard to these, which the first indication of a leg-bone suggested to be less fleet in movement than the Emu or Ostrich, a corresponding power of wing would be less essential to the predatory Buzzard or Falcon of the Moas than his faculty of holding and mastering them when caught.

Nevertheless it would be rash to infer an inferiority of power of flight, size for size, in the *Harpagornis* over the Eagle, from the minor inequality of length of humerus as compared with that of femur. The proportions, especially of length, of the chief wing-bones in the Humming-Birds, for example, fall short of those in many birds of much inferior powers of flight. The wing, for excellency in its main function, requires also length and strength of primaries, with proportions of those quill-feathers resulting in the elongate and pointed form of wing, such as characterizes Swifts and Humming-Birds.

DESCRIPTION OF THE PLATES.

PLATE CV.

Figs. 1-4. Pelvis of *Harpagornis moorei*. Figs. 5-7. Pelvis of *Circus pygargus*.

PLATE CVI.

Figs. 1-6. Humerus of *Harpagornis moorei*.

Figs. 7-12. Humerus of *Circus pygargus*.

PLATE CVII.

Figs. 1-4. Femur of *Harpagornis moorei*. Figs. 5, 6. Tibia of *Harpagornis moorei*.

Fig. 7. Side view of unguis phalanx of back toe (*i*) of *Harpagornis moorei*.

Fig. 8. Side view of unguis phalanx of *Aquila cuneicaudata*.

Figs. 9, 10. Femur of *Circus pygargus*.

Figs. 11, 12. Tibia of *Circus pygargus*.

Fig. 13. Phalanx of back toe of *Circus gouldi*.

College;" and it was purchased, after the publication of my Memoir, by B. Bright, Esq., of Bristol. It has since been presented, with the rest of the "Bright Collection," to the Trustees of the British Museum by Benj. Bright, Esq., the grandson of the founder.