

certainly through diminished mean temperature resulting from increase of extremes: but some minor causes act in the opposite direction, and as yet nothing is known of quantitative effects. For the present, therefore, corroborative evidence may fairly be adduced, as is done by Dr. Croll in the cases of the present Antarctic Ice-cap and the supposed Inter-glacial periods. The discussion of these corroborations is beyond the scope of the present article.

### III.—ON SOME FOSSIL BIRD-REMAINS FROM THE SIWALIK HILLS IN THE BRITISH MUSEUM.

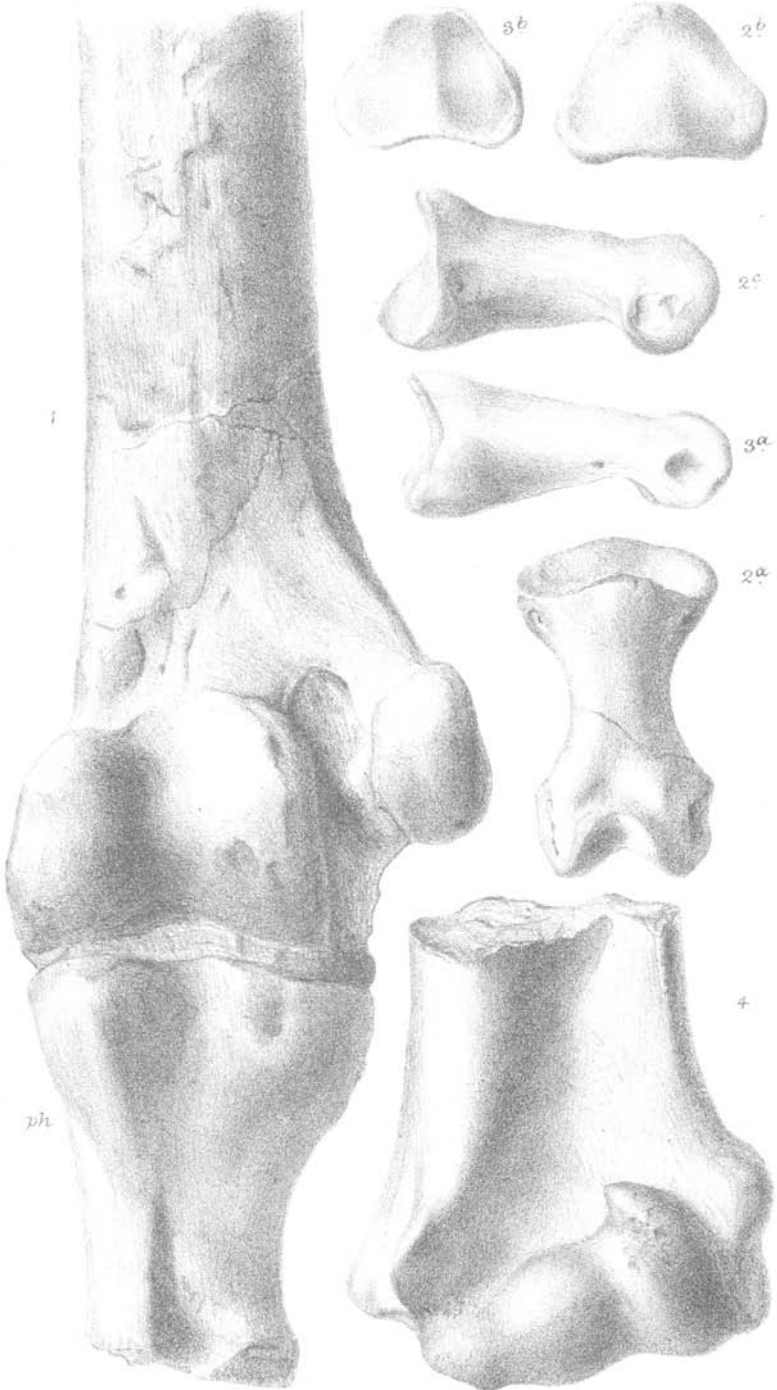
By WILLIAM DAVIES, F.G.S.,  
of the Geological Department.  
(PLATE II.)

THE first part of the "Records of the Geological Survey of India" for 1879 contains some interesting notes by Mr. R. Lydekker, B.A., descriptive of a "few fragmentary bird-remains" recently obtained from the Tertiary deposits of the Siwaliks, and preserved in the Geological Museum at Calcutta. The subjects of most interest alluded to in this memoir are some bones referred to *Dromæus*, by Mr. Lydekker, and his remarks thereon, and upon some bones of kindred birds which form part of the extensive series of vertebrate remains collected in the same range of hills by the late Colonel Sir Proby T. Cautley, then Captain in the Bengal Artillery, and presented by him to the National Collection.<sup>1</sup>

These special fragments preserved in the above-named Museums are of great palæontological interest, for assuming Mr. Lydekker's identification of the bones in the Indian Museum to be correct, the fact is fully established, that in the Upper Miocene or Lower Pliocene period, there lived contemporaneously in India two distinct forms of Struthoid birds, whose geographical habitats are, in the present day, widely separated: namely, the Ostrich in Africa and the Emu in Australia. The evidence as regards the Ostrich rests upon specimens in the National Collection which have never been described, and being but little known, a short description might usefully supplement, and also correct some misapprehensions regarding them contained in Mr. Lydekker's notes.

Commenting upon the rarity of avian remains in the Tertiaries of the Siwaliks, he remarks: "Some of these bones were collected by Dr. Falconer, and were deposited by him in the British Museum." This is an error. They were collected and presented, as stated, by Col. Sir P. T. Cautley. Mr. Lydekker adds, "Figures being given of them

<sup>1</sup> Most of these specimens were drawn on stone for the "Fauna Antiqua Sivalensis" of Falconer and Cautley; being one of a series of eighteen plates which were never printed for publication, and of which only one impression of each—a proof—has been preserved; the drawings having, during Dr. Falconer's lengthened absence in India, been erased from the stones. These impressions are deposited in the Geological Department of the British Museum; and explanations of the figures on each plate, which are respectively lettered A to R, are published in Dr. Falconer's "Palæontological Memoirs" (vol. i. pp. 538—554), edited by the late Charles Murchison, M.D., F.R.S.



G. M. Woodward, del. et lith.

West, Newman & Co. imp.

Fossil Bird Bones.

on Plate R. of the unpublished plates of the 'Fauna Antiqua Sivalensis' on the evidence of these bones, M. A. Milne-Edwards<sup>1</sup> established two species of extinct Siwalik birds, namely, *Struthio asiaticus* and *Argala Falconeri*" (p. 52). Further on he observes: "With regard to *Struthio asiaticus* of M. Milne-Edwards, it appears that this species was formed on the evidence of the phalange, and of the distal extremity of the tibio-tarsus, which are represented in figs. 2 and 15 of the above-quoted plate;" and again, "I am rather at a loss to discover how M. Milne-Edwards determined that his Siwalik ostrich had but two toes, because, as I have said, the only Struthioid bones figured in the 'Fauna Antiqua Sivalensis' are the distal extremity of the tibio-tarsus and a phalange" (p. 53). The species was, however, not founded upon these two bones, as Mr. Lydekker supposes; for in a small collection of vertebrate remains obtained from the same locality, and presented to the British Museum, by the late Major Colvin, there is a distal end of a tarso-metatarsal of a two-toed bird, with the proximal half of the first phalange of the third toe in its natural position (Pl. II. Fig. 1, *ph.*); and this, there can be no doubt, is the specimen which Prof. Alphonse Milne-Edwards refers to as the evidence for his *Struthio asiaticus*. Yet his note relating to it, which we here reproduce, is so short and indefinite, as to justify Mr. Lydekker's conclusion.

Milne-Edwards writes (*op. cit.* tom. ii. p. 587):—

"L'une des espèces les plus remarquables appartenait au groupe des Brévipennes et se rapprochait beaucoup de l'Autruche d'Afrique par la conformation de son pied, qui ne portait que deux doigts; mais elle était de plus petite taille que cette dernière: on pourrait, pour l'en distinguer, la nommer *Struthio asiaticus*."

This unique and important fragment is associated in the matrix with a series of twelve cervical vertebræ, and also with the bones of the wing, of probably the same bird; I say probably, because, occasionally in the Siwalik deposits, bones of more than one species of animal are found in juxtaposition, as in this very group, in which an incisor tooth and an atlas vertebra of a small ruminant are in contact with, and cemented by, the matrix inclosing the avian vertebræ and metatarsal.

The result of a careful comparison of the tarso-metatarsal and phalange, with the same bones of an adult and large African Ostrich (356 a), in the British Museum, is, that as regards form and size they are indistinguishable; although M. Alphonse Milne-Edwards supposed the fossil to have been inferior in size to the recent bird, and hence suggested a new specific name; but if we eliminate the conditions of occurrence and locality, the fragment possesses in itself no distinctive character by which it could be separated from the existing African Ostrich. And the annexed measurements, in inches and tenths, of the fossil and recent bones, will show how closely they assimilate in size.

<sup>1</sup> Oiseaux fossiles de la France, tom. i. p. 449, tom. ii. p. 587.

	Fossil. Siwalik.	Recent. African.
Extreme length of fragment of tarso-metatarsal, exclusive of phalange ... ..	5·8	...
Greatest transverse diameter of the trochlea ... ..	2·4	2·4
Transverse diameter of third trochlea ... ..	1·6	1·58
Antero-posterior diameter of ditto ... ..	1·7	1·7
Transverse diameter of outer trochlea ... ..	0·7	0·7
Antero-posterior ditto ... ..	1·05	1·1
Transverse diameter, proximal end of phalange ... ..	1·65	1·7
Vertical ditto ... ..	1·65	1·75

The fossil phalange is a little abraded, which will account for the difference in these measurements.

The avian vertebræ associated with the preceding are twelve in number, ten of which form a consecutive series; of these, the first and the last are represented by little more than their respective approximating articular ends, the others being all more or less perfect as regards the centra; but unfortunately the confluent processes which form the vertebral canal, and also the styliform pleurapophyses, are mutilated in a greater or less degree in all. Each vertebra is closely articulated to that which precedes and follows it by the articulating surface of the centra and of the zygapophyses; and the series is bent back so as almost to describe a circle; this has been accomplished without any apparent detachment of the centra at their articular junctions, but mainly by forcing the zygapophysial facets beyond their natural boundaries, and this is shown by the slight addition that the curve makes to the length, in the aggregate measurement of the series.

Five of these vertebræ are figured, of reduced size, upon the aforementioned unpublished plate R (figs. 1, 1a) of the "Fauna Antiqua Sivalensis;" and represent respectively the 3rd to the 7th of the fossil series, but of which only the posterior and anterior halves of the 3rd and 7th are there delineated. By measurement and by comparison with the bones of the neck of the same skeleton of the African Ostrich (356a, B.M.), I believe the conjoined fossil vertebræ to represent the 5th to the 14th inclusive; and therefore representing the entire middle portion of the neck: the normal number of cervicals in the Ostrich being 18. The antero-posterior dimensions of the respective centra of the fossil series, which with one or two exceptions can be measured very accurately, agree with those having the same numerical position in the neck of the recent bird; and they each increase in length in the same ratio as they recede from the head.

The five vertebræ figured upon the unpublished plate R represent respectively the 7th to the 11th in the natural series, and I select one of these, the 8th, of which a view is there given (fig. 1a) of the inferior surface of the centrum, as a good example for measurement:—

	Fossil.	Recent.
Length of centrum along median line... ..	2·25	2·25
Anterior transverse diameter of vertebra over vertebral canal ... ..	1·2	1·15
Posterior transverse diameter of centrum, inferior surface ... ..	0·7	0·7
Vertical diameter from summit of neural spine ... ..	1·05	1·0

I also annex measurements of the 13th vertebra of the normal cervical series :—

	Fossil.	Recent.
Length of centrum along median line ... ..	2·62 ...	2·68
Anterior transverse diameter over vertebral canal ... ..	1·85 ...	1·47
Posterior transverse diameter of centrum ... ..	0·67 ...	0·6
Vertical diameter from summit of neural spine ... ..	1·4 ...	1·15
The aggregate lengths of eight consecutive fossil vertebrae measured along the outer curve ... ..	19·5 ...	
The corresponding eight recent vertebrae placed in the same curved position measured... ..		20·0
The same vertebrae placed in a straight line ... ..		19·0

The above measurements corroborate the evidence adduced from the leg-bones that the Siwalik Ostrich stood as high as its African congener; but the greater vertical depth and anterior transverse diameter of the cervical vertebrae indicate a bird of robuster proportions as regards the neck.<sup>1</sup>

The wing-bones, consisting of portions of the carpal ends of the ulna and radius, metacarpus and phalange, are all, with the exception of the metacarpus, fragmentary and mutilated, and only recognized by their relative positions in regard to the metacarpus. This part of the wing is sufficiently complete for identification, the most perfect element being the middle, or third, metacarpal of the pentadactyle hand, and it shows the short second metacarpal anchylosed to it; the outer, or fourth, metacarpal has the curve, characteristic of this bone in the Ostrich; it is also much stouter, relatively to the third metacarpal, than are the same bones to each other in the recent bird.

The length of the third metacarpal in the fossil is 3·6 inches, and in the recent skeleton 3·7, the proximal end of the fossil being imperfect.

The next most important fragment is the distal extremity of the tibio-tarsus afore-mentioned. It forms part of the Cautley collection, and is represented on the already quoted unpublished pl. R. (figs. 2, 2a, b, c, d); and, although unrecorded, we may assume that its affinity was known or suspected by Dr. Falconer, from his placing in conjunction with the figures of the fossil a figure of the corresponding portion of the tibia of a recent Ostrich (fig. 6). Unfortunately the fossil is imperfectly preserved, the sharp edges of the condyles being much abraded, and this defect not being clearly shown in the engraving, gives a somewhat erroneous impression as regards its original form. Nevertheless, it has the form and possesses all the characters of that portion of the shin-bone of the recent skeleton (356a, Brit. Mus. Coll.) with which it has been

<sup>1</sup> These vertebrae were originally assigned by the finder to the "Swan": this name being written on one of the series; and in a small pamphlet, descriptive of Siwalik fossils, entitled, "Memoirs by Major W. E. Baker, Bengal Engineers, on the Fossil Remains, presented by himself and Colonel Colvin, C. B., to the Museum of Natural History at Ludlow" (Ludlow, 1850), it is stated that "the remains of birds have been found in the Siwalik strata, but they are of rare occurrence, and consist of bones of gallæ or waders, and of a large kind of swan." This, there can be no doubt, refers to the specimen above described.

compared. The commencement of the condylar ridges, the shape of the condyle, the anterior depression, with the condylar tuberosity which it contains, are alike in each, and the annexed measurements of the more perfect parts of the fossil, and of the corresponding portion of the recent bone, exhibit the same relative proportions, and prove it to have belonged to a bird as large, if not actually to the same individual, as the preceding fragments.

	Fossil.	Recent.
Length of fragment ... ..	7.0	...
Medial antero-posterior diameter of condyle ... ..	1.95	2.0
Anterior transverse diameter at the lateral condylar depressions ...	2.6	2.75
Antero-posterior diameter of shaft above the condylar tuberosity ...	1.2	1.12
Transverse diameter at ditto ... ..	1.8	2.0
Circumference of shaft at $4\frac{1}{2}$ inches from the distal extremity ...	4.6	4.6

At the fractured end of the fossil is seen the medullary cavity, its diameter being 0.8 of an inch, the bone having a thickness of 0.3.

As the fragments of fossil bones above described certainly belong to the genus *Struthio*, they establish the fact, so far as our present knowledge extends, that the Ostrich had its early home in Asia, its fossil remains not having hitherto been found elsewhere; also, that as regards size, the ancient bird was not inferior to its modern African congener, and in respect to the form of the bones of the limbs is indistinguishable from it. This intimate resemblance tends to the inference, if not to the assurance, that the African Ostrich is a direct descendant, perhaps slightly modified, as regards the cervical vertebræ, of the older Asiatic bird, which, at some remote period, impelled by circumstances, migrated from its original home to its present habitat. And, whatever the physical changes that necessitated the migration, it was not accomplished alone; for the Giraffe, now confined exclusively to the African continent, had also an Asiatic origin, and has left its remains, associated with those of the Ostrich, in the same Indian deposits. Referring to the fossil Giraffe, Dr. Falconer observes that the "teeth come so near those of the existing African species in size and form as to be indistinguishable."<sup>1</sup> And with regard to the existing African mammalia, Mr. Wallace, commenting upon the former junction of Africa with Asia, says that "all over Africa, but more especially in the east, we have abundance of large ungulates and felines, antelopes, giraffes, buffaloes, elephants, and rhinoceroses, with lions, leopards, and hyænas, all of types now or recently found in India."<sup>2</sup> He elsewhere observes that the migration was "apparently effected by the way of Syria and the shores of the Red Sea," and that, "by this route the old south Palæarctic fauna, indicated by the fossils of Pikermi (Greece), and the Siwalik Hills, poured into Africa" (p. 288).

The phalange referred to by Mr. Lydekker, and which is represented on the unpublished plate R (figs. 15, 15a, b, c, d), is an entire second phalanx of the middle toe of a tridactyle Struthious bird, distinct from either the Emeu or Cassowary; though approaching nearer to the latter than to the former, it possesses distinctive

<sup>1</sup> Palæontological Memoirs, vol. i. p. 26.

<sup>2</sup> Geographical Distribution of Animals, vol. i. p. 286.

characters, which cannot be referred to sexual or individual variations of either of the above-named birds. A glance at the representations of the fossil (Pl. II. Fig. 2 *a, b, c*) and corresponding phalanx (Pl. II. Fig. 3 *a, b*) of the Cassowary (585*b*, Brit. Mus. Coll.) shows the essential points of difference. The fossil is much stouter in proportion, the length being nearly the same in each, nor does it taper so rapidly forward; the proximal end is vertically deeper and more regularly triangular in outline, the inferior marginal border is convex, whilst in the Cassowary it is slightly concave; the lower half of the articular surface is also broadly convex, with shallow condylar depressions on either side, but exhibits no trace of an intercondylar ridge,<sup>1</sup> whereas in the Cassowary a narrow vertical median ridge is well defined between two broad and comparatively deep depressions which receive the distal condyles of the first phalange. In the fossil the anterior or anconal surface of the phalange rises rather abruptly near the proximal end, the middle portion of the bone being slightly depressed; the anconal surface of the phalange of the Cassowary forms a nearly straight line. The distal articular groove is deeper and relatively broader, the condyles rising higher and being less rounded; the pre-condylar depression is also deeper and broader in the fossil than in the recent bone.

These differences impart to the fossil a distinctive osteological character, and a special palæontological interest, inasmuch that it is evidence—so far as a digital bone of the pes can be accepted as evidence—of a third species of Struthioid bird, genus undetermined, having been contemporaneous with the Ostrich and Emeu in the ancient plains of India.

The following measurements will show the relative proportions of the fossil and recent bone:—

	Fossil.	Cassowary.
Length of phalanx ... ..	1·68	1·55
Transverse diameter, proximal end ... ..	1·05	0·98
Vertical diameter ... ..	0·8	0·68
Transverse diameter, distal end ... ..	0·85	0·74
Vertical diameter, between condyles ... ..	0·48	0·36
Smallest circumference of shaft ... ..	1·8	1·57

#### *Argala Falconeri*, A. M.-Edw.

Professor Alphonse Milne-Edwards has described some fragmentary remains of a gigantic Crane preserved in the Cautley Collection in the British Museum, under the above designation.<sup>2</sup> They comprise two distal extremities of tibio-tarsi, and a proximal and distal end of the tarso-metatarsus. The descriptions, with measurements of each, are brief, and unaccompanied by figures. They are, however, represented by several views of each bone of the size of nature upon the unpublished plate R. (figs. 3, 5, 9 and 11) of the "Fauna Antiqua Sivalensis."

There are, besides the above, two other fragments in the same

<sup>1</sup> The figure on the unpublished plate is not a faithful representation of the proximal articular surface.

<sup>2</sup> *Op. cit.* tom. ii. p. 449.

collection, also figured upon the same plate, which appertain without doubt to the same species of Crane, but are unnoticed by Prof. Milne-Edwards.

The first fragment consists of little more than the proximal third of the first phalange of the wing, and is faithfully represented of the natural size on pl. R. (figs. 8, *Sa, b, c*). The articular surface, although not quite perfect, coincides in form with that portion of the phalange of a recent bird, and with regard to size the antero-posterior diameter is 0.5, that of the recent bone being 0.42; the articular surface of the fossil is imperfect in the transverse direction. The lateral lamelliform expansion rises more abruptly than in the recent bone, but this is the only difference that I can detect.

A second fragment, which is also figured upon the above-quoted plate (figs. 4, *4a, b*), is the distal extremity of a left femur; it is somewhat mutilated, and is broken below the commencement of the condylar ridges, and therefore represents little more than the articular end. Compared with the femur of a skeleton of *Argala indica* (397a) in the British Museum, I again fail to detect any specific character—size always excepted—by which the fossil can be distinguished from the recent bone, unless it be that the anterior condylar groove in the fossil appears to be relatively a little deeper and narrower, a point of very slight importance. As regards size, the transverse diameter of the articular surfaces of the condyles in the fossil and recent bones, which measure respectively 1.77 and 1.48, will indicate the degree in which they differ.

Another important fragment, which originally belonged to the late Dr. Falconer, and has only recently been acquired for the National Collection by the liberality of his brother, Charles Falconer, Esq., F.G.S. (since deceased), is the distal extremity of a left humerus (Pl. II. Fig. 4). It is in good condition, the condyles being perfect, and the anconal surface of the bone beautifully preserved; a portion of the palmar surface is destroyed. And, as in the previously described fragments, it is also indistinguishable from the corresponding portion of the humerus of the great Indian Crane; so that, with the exception of size, of which I append comparative measurements, it possesses no distinctive characters for special description.

	Fossil.	Recent.
Length of fragment	2.5	...
Transverse diameter at condylar tuberosities	2.3	2.1
Ditto, of condyles	1.75	1.5
Antero-posterior diameter of base of shaft, radial side	0.9	0.7

All the above-mentioned fragments of bones, representing various portions of the skeleton, and probably of as many individuals, being in accord as regards their relative proportions, tend to the conclusion that the remote ancestors of the existing Adjutant Crane surpassed it in size; yet there is in the National Collection a lower extremity of a tibio-tarsus, no larger than is that of the recent skeleton with which the other fragments have been compared. Mr. Lydekker himself states, that, of three bones of *Argala Falconeri*, in the Indian Museum, two are of "exactly the same size," and the "third is slightly smaller" than in the living Adjutant. This inequality in size may



foreshadow another palæontological species, to be perhaps hereafter determined, when other and more perfect portions of skeletons shall have been obtained; at present we can only refer it either to sexual disparity, or to great variation in individual growth. The intimate resemblance of the fossil and recent bird-bones is a character common to other classes of Siwalik vertebrate fossils, of which representatives are still living in India, and has been a subject of comment by various writers. Dr. Falconer, remarking upon the abundance and variety of form of the reptilian remains, says, "*Leptorhynchus gangeticus* and *Emys tectum* are indistinguishable from existing species," and, "in several instances the fossil forms make the closest approach to species now living in India. This is also the case with several of the Carnivora."<sup>1</sup>

The only reference to birds by the above eminent authority upon Siwalik fossils in the work above quoted is the following short paragraph:—"Among the Siwalik fossils there are also the remains of several species of *Birds*, including *Grallæ*, greatly surpassing in size the gigantic crane of Bengal (*Ciconia Argala*)"—*op. cit.* p. 23.

With regard to the proximal end of a small tarso-metatarsal, which M. A. Milne-Edwards considered, though with doubt, and after hasty examination, to have belonged to a bird allied to the existing Tropic Bird (*Phæton phœnicurus*, Gmel.), but about one-third larger, Mr. Lydekker observes: "It seems incredible that a bird of that essentially oceanic genus could have lived in the land-locked Siwalik country. The difficulty may perhaps be got over by calling in question the authenticity of the locality of the bone, of which there seems no certain history." This ready, though not scientific method of disposing of a palæontological difficulty, will, happily, in this instance not apply: the history and locality of the bone in question being well authenticated, as it forms part of the Cautley collection, and is moreover figured upon the oft-quoted unpublished plate R (figs. 13, 13a, b), upon which plate all the fossils figured are unquestionably from the Siwaliks. The following quotation will also show that Milne-Edwards carefully avoided committing himself to any positive assertion as to the genus or the affinity of the fossil. He says: "Mais je ne propose cette détermination qu'avec une grande réserve, car je n'ai étudié ce fossile que très-rapidement, et il serait nécessaire de la soumettre à un examen comparatif approfondi."<sup>2</sup>

The fragment does not agree with Milne-Edwards's figure of the tarso-metatarsal of *Phæton phœnicurus* (*op. cit.* pl. 32, figs. 6-10), nor yet with the recent bone of *P. æthurus*, preserved in the Museum of the College of Surgeons. Unfortunately, neither in the latter Museum nor in the National Collection is there a skeleton of the first-named species. On comparing the fossil with the proximal portion of the tarso-metatarsal of the Cormorant, *Graculus (Phalacrocorax) carbo*, I find that the form of the tibial condylar cavities, the intercondylar tuberosity, and the depth of the upper portion of the anterior channel dividing the outer and inner metatarsals, also

<sup>1</sup> Palæontological Memoirs, vol. i. pp. 23 and 26.

<sup>2</sup> *Op. cit.* tom. i. p. 250.

the oblique canal on the latter for the reception of the extensor tendon of the great toe; together with the calcaneal tendinal grooves, and what remains of the calcaneal process; approach so nearly in their general characters, that they indicate a bird, which, if not actually belonging to the genus *Graculus*, must be referred to a genus very nearly related to it. It differs from the common Cormorant, in having the anterior margin of the outer metatarsal less sharply ridged, and in the inner not being so depressed immediately below the articular cavity, but descending by an easy incline to the tendinal groove of the first digit; it is also deeply depressed on either side of the calcaneal process.

Among the remains of birds from New Zealand, collected by Mr. (now the Honourable) Walter Mantell, and acquired by the British Museum, is an entire tarso-metatarsal of a species of Cormorant, so alike to the Siwalik fossil, that at first sight they might be considered as specifically the same. This bone has, however, not been identified, for, as with *Phæton*, no skeleton of *Graculus*, besides that of the common Cormorant, has been available to me for comparison; and, judging from the condition of the bone, the species can scarcely be considered extinct, but may be represented by one of the species of Cormorants still living in New Zealand, or alike common to those Islands and Australia.

*Pelicanus Cautleyi*, Dav.

The collection also contains two other avian fragments of interest, in so far that they prove that species of the Pelican were contemporaneous with the preceding; and that then, as now, the genus had a wide geographical range, remains of two or three species having been found in European Miocene deposits.

The specimens consist of the distal ends of ulnæ, and respectively represent two species of the above Totipalmate bird. The larger and most perfect is figured of the natural size upon the oft-quoted plate R (figs. 7, 7a, b).<sup>1</sup> It belonged to a bird somewhat smaller than the existing *Pelicanus mitratus* from India, represented by a skeleton in the National Collection; but the form of the trochlear articulations are essentially the same, as is also the external tendinal pit, with its short bony projection. It differs in the greater depth and elongation of the palmar trochæal depression, and in none of the Pelicans that I have examined is this depression so pronounced, and may be deemed a specific character. The shaft is also more compressed laterally, and is more ovate in section. The generic identity being established, I dedicate the species to its discoverer.

*Pelicanus ? Sivalensis*, Dav.

This fragment is not so perfectly preserved, and differs from the preceding in several points, notably, the shaft is not so compressed,

<sup>1</sup> Frequent reference has been made to this unpublished plate of bird-remains, by reason of its importance in denoting the special objects selected by Dr. Falconer for illustration and description in the "Fauna Antiqua Sivalensis," and by its occurring among the descriptions of the series of unpublished plates in Falconer's "Palæontological Memoirs," vol. i. p. 554. It is also of importance to notice the fact that these plates have all been photographed at the expense of the Geological Survey of India, and copies may be obtained of the Autotype Company, London.

and is sub-cylindric in section, the palmar trocheal depression is shallow, and not so elongate, the diameter of the cuneiform and magnum facets are narrower relatively to the length of the ulnar trochlea; and the carpal trochlear projection dividing the articulating surfaces of the scapho-lunare and magnum is more oblique. These differences I believe to be of specific, and not of generic value; nevertheless I refer it to *Pelicanus* with a note of interrogation. Appended are measurements of the fossils and of the distal end of the ulna of *Pelicanus mitratus* :—

	P. Sivalensis.	P. Cautleyi.	P. mitratus.
Length of fragment	... 1.5	... 1.5	...
Transverse diameter, including radial tuberosity	... 0.52	... 0.7	... 0.85
Antero-posterior diameter of ulnar trochlea	... 0.6	... 0.75	... 0.95
Transverse diameter of shaft at distal end	... 0.4	... 0.45	... 0.58
Antero-posterior diameter at ditto	... 0.5	... 0.6	... 0.65

There are a few other portions of avian bones still unnoticed, but I cannot determine their affinities satisfactorily. Although the remains of birds are few, when compared with the abundance of those of other classes of vertebrata found in these deposits, yet the following list of the species already determined, or noticed, will show that the class was well represented among the fauna whose bones have been preserved in the Siwalik rocks :—

<i>Struthio asiaticus</i> , A. M.-Edw.		<i>Megaloscelornis Sivalensis</i> , Lyd.
<i>Dromæus Sivalensis</i> , Lyd.		<i>Pelicanus Cautleyi</i> , Dav.
Sp. indet., Brit. Mus. Coll.		————— ? <i>Sivalensis</i> , Dav.
<i>Argala Falconeri</i> , A. M.-Edw.		Species allied to <i>Graculus</i> .

EXPLANATION OF PLATE II.

- FIG. 1. Posterior view of the distal end of the tarso-metatarsal and phalange of *Struthio asiaticus*, A. Milne-Edw. *ph.* Phalange.  
 ,, 2a. Upper view of second phalange of the middle toe of a new form of Struthioid bird.  
 ,, 2b. View of the proximal articular surface of the same.  
 ,, 2c. Side view of the same.  
 ,, 3a. Side view of the second phalange of the middle toe of *Casuarinus emeu*.  
 ,, 3b. View of the proximal articular surface of the same.  
 ,, 4. Palmar view of the distal extremity of the left humerus of *Argala Falconeri*, A. Milne-Edw.

All the figures are drawn of the natural size.

IV.—THE SUPPOSED OLD RED SANDSTONE OF THE CURLEW AND FINTONA DISTRICTS, CONNAUGHT AND ULSTER, IRELAND.

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SINCE my former paper on the rocks of the Curlew and Fintona districts was published,<sup>1</sup> I have had an opportunity of more carefully examining these districts. Both are eminently favourable for the theoretical geologist, as in them the rocks are much obscured by drift; however, for a careful and painstaking explorer, there are sufficient sections exposed, to show the geological age of the rocks. The accompanying diagram represents the rocks as they occur in the Curlew Mountains district.

<sup>1</sup> GEOL. MAG. February, 1879, p. 65.