

6. *Note on a new WEALDEN IGUANODONT and other DINOSAURS.*
By R. LYDEKKER, Esq., B.A., F.G.S. (Read November 23, 1887.)

[PLATE III.]

Introductory.—The primary object of this communication is to bring to the notice of the Society numerous remains of an apparently new Iguanodont Reptile obtained by Mr. C. Dawson, F.G.S., of St. Leonards, from the Wadhurst Clay (one of the beds of the Hastings Sand, or lower division of the Wealden), and recently acquired by the British Museum; and also a maxilla from the Wealden of the Isle of Wight, apparently referable to *Ornithopsis*. Having, however, recently examined the whole of the collection of Dinosaurian remains preserved in the Museum, in the course of the preparation of the first part of the forthcoming 'Catalogue of Fossil Reptilia' of the collection, I have also made certain observations regarding other members of the order, which may be conveniently recorded at the same time.

Iguanodonts.—Commencing with the Iguanodonts, I may first of all observe that I fully concur in the view which M. Dollo informs me he now takes as to the specific identity of *Iguanodon bernissartensis* and *I. Seelyi*; and, although the original description is very meagre and unaccompanied by a figure, I think we ought to adopt the former and earlier name for the species which has been so well described by the Belgian naturalist. The British Museum possesses a considerable series of the remains of this species, many of which were referred by Sir R. Owen to *Cetiosaurus* and *Pelorosaurus*, while others have been described under the name of *Iguanodon Mantelli*.

In addition to the two Wealden species of *Iguanodon* (*I. Mantelli* and *I. bernissartensis*) and the perfectly distinct genus *Hypsilophodon*, Prof. Seeley has described other Iguanodont vertebræ from the same formation in the Isle of Wight, under the name of *Sphenospondylus**; while at the recent meeting of the British Association he has proposed to refer *I. Prestwichi*, Hulke†, of the Kimeridge Clay, to a fourth genus under the name of *Cumnoria*.

With regard to *Sphenospondylus*, I find from specimens in the Museum that several of the anterior dorsal vertebræ were opisthocœlous, while those later in the series retain a trace of the same feature; and from this circumstance I am disposed to regard this form as not improbably entitled to generic distinction from *Iguanodon*, and showing some resemblance to the genus usually known as *Hadrosaurus* (but of which the correct name is *Trachodon*), characterized by all the dorsals being opisthocœlous. The later

* Quart. Journ. Geol. Soc. vol. xxxix. p. 55 (1883).

† *Ibid.* vol. xxxvi. p. 433 (1880).

dorsals approximate, however, to those of an unnamed *Iguanodon* in the Museum from near Hastings; and the absence of teeth like those of *Trachodon* in the Isle of Wight tends, as far as it goes, to indicate that *Sphenospondylus* agreed in dental character with *Iguanodon*. That we should find in England a form more or less intermediate between *Trachodon* and *Iguanodon* is, however, to be expected from the occurrence in this country of a Dinosaur which I provisionally refer to the former. This determination is based on a tooth from the Cambridge Greensand (B. M. No. R. 496), figured by Sir R. Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc.), suppl. ii. pl. 7. figs. 15, 16, under the name of *Iguanodon Mantelli*; but which, as Prof. Seeley has pointed out on page 591 of vol. xxxv. of the Society's Journal, agrees so closely with the teeth of Leidy's *Trachodon Foulki*, from the Upper Cretaceous of New Jersey, that, in the absence of any evidence to the contrary, I propose to refer it provisionally to that genus, with the name of *T. cantabrigiensis* *. This tooth exhibits the peculiar groove on the inferior side of the root made by the point of the tooth immediately below, which is so characteristic of the genus. Finally, since Prof. Seeley has not applied a specific name to the type of *Sphenospondylus*, I propose that it should be known as *S. gracilis*.

Turning to *Iguanodon Prestwichi*—the type of *Cumnoria*—which in the structure of its sacrum differs very widely from the typical forms, there is much to be said for the view expressed by Prof. Seeley as to its right to generic distinction; but, after having been for some time inclined to adopt this view, I think on the whole that it is better to retain it in the original genus, of which it will form the type of a very distinct group. The pelvis is unfortunately very imperfectly known, all that can be definitely predicated being that the preacetabular process of the ilium is considerably elongated. In the structure of the sacrum this form agrees very closely with the North-American Upper Jurassic genus *Camptosaurus*, Marsh †, in which the ilium is remarkable for the great reduction of the preacetabular process, the pubis is of equal length with the ischium, and the latter is stouter and shorter than in *Iguanodon*, the two latter features being also found in *Hypsilophodon*.

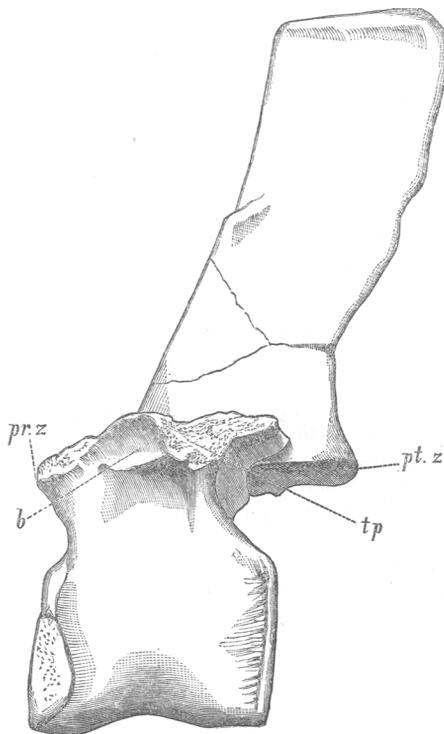
The first of the Iguanodont specimens from the Wadhurst Clay that I propose to notice comprises a part of an associated skeleton including the left ilium, the acetabular region of the pubis of the same side, a number of more or less imperfect dorsal, lumbar, and caudal vertebræ, the proximal half of a tibia, and two metatarsals; besides some imperfect bones which it is difficult or impossible to determine. Of the vertebræ, one of the most perfect from that portion of the dorsal region where there is a rib-facet distinct from the transverse process, is represented in fig. 1. The Iguan-

* The vertebræ from the same formation described on p. 613 of the above cited paper under the name of *Eucercosaurus*, being unlike those of *Trachodon*, are not likely to belong to this form.

† Amer. Journ. Sci. ser. 3, vol. xviii. p. 501, pl. iii. (1879). Here named *Camptonotus*, but subsequently amended.

odont character of this vertebra is self-apparent, and from the comparatively slight degree of compression of the centrum compared with that of some dorsals to be noticed below, and the circumstance that all the other parts of the skeleton belong to the hinder region, I think it probable that it should be regarded as coming from the middle of the dorsal series. In its comparatively low arch, and the high position of the rib-facet, it differs from all the anterior and

Fig. 1.—Left lateral aspect of a middle Dorsal Vertebra of *Iguanodon Dawsoni*, from the Wadhurst Clay. (About $\frac{1}{2}$ nat. size.)



b. Facet for rib.
pr.z. Præzygapophysis.

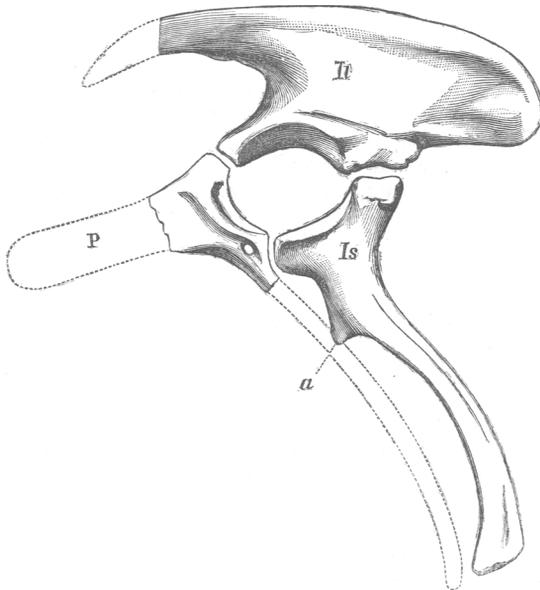
tp. Base of transverse process.
pt.z. Postzygapophysis.

middle dorsals of *I. bernissartensis* with which I have been able to compare it, while its centrum is also less compressed, lower, and more wedge-shaped. In its low arch and the position of the rib-facet it resembles the vertebræ of *Sphenospondylus*, but the centrum is relatively shorter, and other specimens probably belonging to the same form show that the anterior dorsals had higher arches than in *Sphenospondylus*. The dorsals of *I. Prestwichi* described by Mr. Hulke differ from those of *I. bernissartensis* and *I. Mantelli* by the smaller

compression of their centra, which are consequently more wedge-shaped in section. Unfortunately only an anterior dorsal is figured by Mr. Hulke, and in this the neural arch is relatively high; but since there must be a gradual lowering of the height of the arches from the anterior dorsal to the lumbar region, where (as in other species) the arches are very low, there seems to be no reason why the middle dorsals of the Kimeridge form should not have closely resembled the specimen under consideration. The posterior dorsal or lumbar vertebræ associated with this specimen cannot be distinguished from those of the Kimeridge species described and figured in Mr. Hulke's paper. The length of the centrum of the figured specimen is 0.120, the vertical diameter of its anterior face 0.110, the transverse diameter of the same 0.118, and the total height 0.447.

Of the associated bones, the left ilium (No. R. 802) is represented in fig. 2 (*Il.*), in association with an ischium to be immediately mentioned. The length of this ilium, which wants the extremity

Fig. 2.—*The left side of the Pelvis of Iguanodon Dawsoni, from the Wadhurst Clay of Hastings. (About $\frac{1}{16}$ nat. size.)*



Il. Ilium. *Is.* Ischium. *P.* Pubis. *a.* Obturator process.

of the preacetabular process, is 0.830, and its greatest depth posteriorly 0.260; the preacetabular process, when entire, was long, the superior border is convex, and the postacetabular portion is long,
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deep, and has its termination blunt, rounded superiorly, and angulated inferiorly. The difference in the form of the hinder half of this bone from the pointed extremity of the same part in both *I. Mantelli* and *I. bernissartensis* is very marked and, coupled with the greater vertical depth of the bone, would, apart from other evidence, indicate the specific distinctness of its owner. The ilium indicates a species intermediate in point of size between the two above-mentioned forms, and in contour comes nearer to that of *Hypsilophodon*, but is very widely different from the corresponding element in *Camptosaurus*. The pubis associated with the ilium is too imperfect to afford much information, but the portion immediately in advance of the acetabulum is deeper than in *I. bernissartensis*. The apparently associated metatarsals are of the short and massive type of typical species of *Iguanodon*; a second left metatarsal (No. R. 999) being undistinguishable from the corresponding bone in small examples of *I. bernissartensis*.

I have now to mention a sacrum and the associated ischia (No. R. 811) also obtained from the Wadhurst Clay, although belonging to a different individual from the preceding specimens, which I regard as the types. Other specimens (No. R. 604) from the same locality and bed, comprising part of a left pubis and a considerable number of imperfect vertebræ, may be regarded, according to Mr. Dawson's information, as well as from their mineral condition, as almost certainly belonging to the same individual. An anterior dorsal agrees very closely with the figured anterior dorsal of *I. Prestwichi*, although its arch is slightly lower, and thereby differs widely from *Sphenospondylus*. Turning to the sacrum and ischia, and seeing that the latter, although clearly Iguanodont, differ from the corresponding bones of both *I. Mantelli* and *I. bernissartensis*, and agree approximately in relative size with the ilium of the present form (as is shown in fig. 2, where the left ischium is figured), the presumption is so great as to amount almost to a certainty that they belong to the same species as the latter, and they will accordingly be so regarded. These ischia measure 0·870 (36·5 inches) in length, and closely resemble in general contour the corresponding elements of *Camptosaurus*, and less closely those of *Hypsilophodon*. They differ from the ischia of typical species of *Iguanodon* by being relatively shorter and stouter, by the absence of twisting in the axis of the shaft, by the more hammer-like head, and the longer interval between the pubic process of the latter and the obturator process. Their resemblance to the ischia of *Camptosaurus* and *Hypsilophodon* suggests that in the present form the pubis may have been equal in length to the ischium. The sacrum included five ankylosed vertebræ, which are of the inferiorly flattened type of those of *Camptosaurus* and *I. Prestwichi*.

The foregoing notes indicate that we have here to do with a Wealden Iguanodont which is certainly distinct from both *I. Mantelli* and *I. bernissartensis*, and which I cannot identify with *Sphenospondylus gracilis*. It was probably more nearly allied to the Kimeridgian *I. Prestwichi*, although, in the absence of any definite

knowledge of the pelvis of the latter, the closeness of its relationship cannot be determined. Its higher geological horizon renders it, however, pretty certain that it cannot be specifically the same as the latter. In the structure of the pelvis this Iguanodont approximates to *Camptosaurus* and *Hypsilophodon*, and it also agrees with the former in its sacral characters; its hind foot was, however, essentially that of *Iguanodon*, and the presumption therefore is that the manus was also of similar structure. In the opinion of many authorities I have little doubt that these differences would be regarded as of generic value, and the question would then arise whether this form should constitute a new genus, or whether it should be classed with *I. Prestwichi* as a species of *Cumnoria*, or possibly with *S. gracilis* as a *Sphenospondylus*. I am, however, inclined to the opinion that it is preferable, at least for the present, to employ the generic term *Iguanodon* in a sense which will embrace all the variations between the typical and the present form, and I accordingly propose to include the latter in that genus, under the name of *Iguanodon Dawsoni*.

In this sense the genus *Iguanodon* may be divided into a Eu-iguanodont group comprising *I. Mantelli* and *I. bernissartensis*, and characterized by the pointed posterior extremity of the ilium, the short pubis, the twisted ischium, and the compressed sacrals, as well as by certain features of the anterior dorsal vertebræ; and into a Proiguanodont group, including *I. Prestwichi* and *I. Dawsoni*, and characterized by the blunt extremity of the ilium, the probably long pubis, the absence of twist in the ischium, and the hæmally flattened sacrum. The Proiguanodont group will be the one connecting the typical forms of the genus with *Hypsilophodon* and *Camptosaurus*.

I may here call attention to certain specimens some of which may probably belong to the Wadhurst-Clay *Iguanodon*. The first is a fine left scapula (No. R. 966) obtained by Mr. Dawson from the Wadhurst Clay, which agrees in relative size with the type ilium. This bone is remarkable for having a conical puncture on the posterior side on the middle of the dorsal surface, which appears to have been not improbably caused by a wound from the strong spike terminating the pollex of another, and probably male, individual. It may also be observed that on the anterior border of the proximal expansion there occurs a facet, which I at first thought might indicate the articulation of a clavicle; but Prof. Seeley, to whom I pointed it out, suggests that it may merely indicate a cartilaginous epiphysis*.

Among the Fox Collection from the Isle of Wight, I find the centrum of a posterior dorsal or lumbar vertebra (No. R. 136) from the Upper Wealden, which, from its precise resemblance to the hinder trunk vertebræ of *I. Dawsoni*, I refer provisionally to that species. If this should prove the existence of that form in the

* It may be observed that in the 'Geol. Mag.' 1887, p. 85, Prof. Seeley states that the absence of such a facet is one of his reasons for rejecting Mr. Hulke's interpretation of the sternal ossifications.

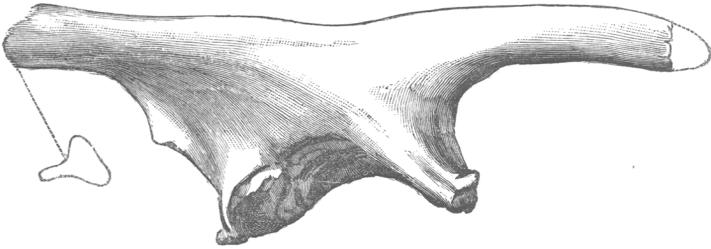
Upper Wealden, I would suggest, without venturing to enter on the vexed question of their homology, that the bones of the sternal region of an Iguanodont figured by Mr. Hulke in vol. xli. pl. xiv. fig. 1, of the Society's 'Journal,' may belong to the same form, since the difference in their contour from the corresponding bones of both *I. Mantelli* and *I. bernissartensis* appears to me to support the view expressed by M. Dollo, that they are not referable to either of those species.

Before leaving the Iguanodonts, I may draw attention to two scapulæ and a coracoid from the Upper Wealden which differ somewhat from the corresponding bones of the skeleton of *I. bernissartensis* figured by M. Dollo, although I do not know to what other form to refer them. The coracoid is in the Cambridge Museum, and is figured by Prof. Seeley in the 'Quart. Journ. Geol. Soc.' vol. xxxviii. pp. 367, 371, where it is provisionally referred to *Ornithopsis*. It is, however, essentially Iguanodont, but differs from M. Dollo's coracoid of *I. bernissartensis* by its greater breadth, and the presence of a complete foramen in place of a notch. The scapulæ are likewise from the Isle of Wight, and belong to the Mantell Collection of the British Museum (Nos. R. 1012 and 32913). The less imperfect of these bones differs from that in M. Dollo's figure by its greater curvature, and also by diminishing gradually in width above the proximal expansion, instead of expanding towards the summit. It is totally unlike any Sauropodous scapula, and is decidedly Iguanodont; while it is not improbable that it may have belonged to the same individual as some of the vertebræ of *I. bernissartensis* in the same collection. I do not think that these bones can indicate the distinctness of *I. Seelyi* from *I. bernissartensis*, especially since the Museum has a coracoid like M. Dollo's specimen, associated with an ilium which cannot be distinguished from Mr. Hulke's type of the former. These scapulæ, besides being of too large dimensions for *I. Dawsoni*, differ widely from the specimen of that bone which I provisionally refer to that species.

Scelidosauridae.—The specimen to which I desire to particularly direct attention under this heading is a right ilium (No. 2150), from the Wealden of Cuckfield, which has long been labelled *Iguanodon Mantelli*, but which has nothing whatever to do with that genus. This specimen is figured (reversed) in the accompanying woodcut; it is clearly of an Ornithopodous type, and has long pre- and postacetabular processes, of which the former is laterally compressed, and the latter, by the giving off of an inner horizontal plate, has a triangular cross-section. In general contour this ilium comes nearer to that of *Scelidosaurus* than any other with which I am acquainted, and I am therefore inclined provisionally to refer it to the Wealden genus *Hylæosaurus*, of which the pelvis has been hitherto unknown, and with the other bones of which the present specimen would agree well in relative size. This ilium presents, however, a considerable resemblance to the one from the Wealden, figured by Mr. Hulke in vol. xxxv. pl. xxi. of the Society's 'Journal,' under the name of *Vectisaurus*; and this induces me to regard the

latter as probably referable to the Scelidosauridæ rather than to the Iguanodontidæ, in which its founder was inclined to place it. If this be so, the question will arise whether *Vectisaurus* may not be identical with *Regnosaurus*, Mantell (Phil. Trans. 1848, p. 198), founded upon a Scelidosaurian lower jaw from the Wealden of Cuckfield, which Sir R. Owen subsequently referred to *Hylæosaurus*.

Fig. 3.—Outer aspect of a right Ilium (reversed) provisionally referred to *Hylæosaurus*.



A section of the postacetabular process is shown.

That *Regnosaurus* is not, however, identical with *Hylæosaurus* is almost certain if the detached teeth referred to the latter by Sir R. Owen are correctly determined—and I do not know to what other form they can belong—and the dimensions of the type mandible of the former are such as to accord well with the vertebræ and ilium of *Vectisaurus*.

Before leaving *Hylæosaurus*, I may mention that the imperfect metatarsals provisionally referred by Sir R. Owen to that genus, but which Mr. Hulke pointed out could not well belong to it, are referable to *Megalosaurus*; since I find that a similar specimen from Hastings, acquired by the Museum from Mr. Dawson, not only agrees in contour with the corresponding bone of the Stonesfield *Megalosaurus*, figured by Phillips, but was found in association with a dorsal vertebra and a tibia undoubtedly belonging to that genus.

Sauropoda.—Turning to the Sauropoda, I may observe that although I agree with Prof. Seeley in regarding this suborder as closely allied to the Theropoda, yet I am not prepared to accept the proposal made by him at the recent meeting of the British Association to unite these two groups. Apart from the difference in the pelvis, the wide divergence in the type of cranial structure exhibited by *Ceratosaurus* and *Diplodocus* appears to me to be decidedly of subordinal value, even if we should eventually find forms connecting the two. While, indeed, the former agrees in the position of the anterior nares with the Ornithopoda, the latter approximates in this respect as closely to the Parasuchian Crocodilia; and there seems to me to be almost as much ground for uniting the

latter suborder of the Crocodilia with the Sauropoda as for taking the course proposed by Prof. Seeley.

What, however, I have especially to say in regard to the Sauropoda, is to endeavour to point out the relationships of the two best-known English genera, to notice a maxilla which I refer to one of them, and also to show how extremely unsatisfactory is our knowledge in respect of other specimens to which generic names have been applied. First, in regard to *Ornithopsis*, it appears to me to be incumbent to take as the type of the genus, and therefore also of the type species *O. Hulkei*, the vertebra from the Isle of Wight (B.M. No. 28632), which probably belongs to the anterior dorsal region; although I am aware that Mr. Hulke has proposed to take in this sense the smaller Sussex specimen, described by Prof. Seeley as generically identical with the former, but which appears to me as probably belonging to a different genus.

The dorsal and cervical vertebræ of this genus, thus regarded, closely resemble those of the American *Brontosaurus*, while the resemblance between the ischium and pubis, figured by Mr. Hulke in vol. xxxviii. pl. xiv., and the corresponding bones of the last-named genus is (as Mr. Hulke has already indicated) so close as to leave no doubt as to the near alliance of the English and American forms. This being so, and seeing that *Brontosaurus* has amphicœlous caudal vertebræ with closed chevrons, it becomes necessary that I should retract the opinion expressed in a paper published in the last volume of the Society's 'Journal'* that the caudal vertebræ on which *Titanosaurus* was founded might perhaps be referable to *Ornithopsis*; to the former genus I shall have to allude again, later on, but its apparent distinctness from the latter removes all grounds for referring that genus to a family distinct from the Atlantosauriæ of Prof. Marsh.

Here I may notice a very interesting specimen which may, I think, be probably referred to *O. Hulkei*. Some years ago the late Dr. Wright figured in the 'Annals and Magazine of Natural History' † a reptilian tooth from Brixton Bay, in the Isle of Wight, of which he was unable to determine the affinity, the figure being subsequently reproduced by Sir R. Owen in his 'British Fossil Reptiles' ‡ and provisionally referred to *Cetiosaurus* or *Pelorosaurus*. This specimen has now come into the possession of the British Museum (No. R. 964), and from its close resemblance to the tooth of the American *Morosaurus*, figured by Prof. Marsh, there can be no doubt that it belongs to the Sauropoda, while from its large size I am inclined to refer it to *Ornithopsis* rather than to *Cetiosaurus*. A figure of its inner surface is given in Plate III. fig. 4. So far as

* Vol. xlii. pp. 156-160. I take the opportunity of correcting two misstatements on p. 159 of that paper. First, it appears that the beds regarded by Prof. Marsh as Upper Jurassic are classed by Prof. Cope as Lower Cretaceous, so that *Amphicelias* and *Camarasaurus* are of the same age as *Brontosaurus*, and may be identical with that or some of the allied forms. Secondly, misled by Sir R. Owen's reference of Iguanodont vertebræ to *Cetiosaurus brevis*, I have stated that the vertebral centra of that genus are solid.

† Ser. 2, vol. x. p. 90 (1852).

‡ Ser. 2, vol. iii. p. 422.

I know, no similar detached tooth has yet been found; but some months ago Mr. William Davies, F.G.S., called my attention to the portion of the right maxilla of a large reptile, represented in Plate III. figs. 1, 2, 3, which he regarded as Dinosaurian. This specimen was one of those collected by the late Mr. Fox in the Isle of Wight, and is likewise in the National Collection. When it came into my hands it merely showed the nine empty dental alveoli seen on the outer border; closer examination showed, however, on the inner side of the first alveolus, what appeared to be the section of the summit of a tooth (figs. 1, 3 *a*) with a spatulate, crescentoid crown, and on chipping away a portion of the matrix and bone there was revealed the summit of a tooth precisely like Dr. Wright's specimen. Further development gave indications of a more imperfect tooth (fig. 1 *b*) in a similar relative position to the later alveoli. These teeth are only partially protruded, and were evidently destined to replace those which originally occupied the empty alveoli; the latter, in their oval form and small size, agreeing with the constricted roots of Dr. Wright's specimen. The maxilla is remarkably depressed, and thereby closely resembles that of a Crocodile; it exhibits three, apparently vascular, foramina situated in a horizontal line on the outer surface. Compared with a very minute figure of the skull of *Brontosaurus* given by Prof. Marsh, the specimen appears to accord perfectly with the maxilla; and as it also agrees with the latter skull, in being of relatively small size in proportion to the vertebræ of *Ornithopsis*, I am confirmed in my conclusion that both Dr. Wright's specimen and the maxilla under discussion are referable to *Ornithopsis*.

I may next mention two other bones, one of which I refer certainly, and the other provisionally, to *Ornithopsis*, both being among the Fox Collection. The first (No. R. 212) is the distal half of a scapula agreeing so closely with the same portion of the corresponding bone of *Brontosaurus* figured by Prof. Marsh as to leave no doubt of its belonging to the present form, and thereby confirming the affinity of the latter with the American genus. A fragmentary bone in the collection of Mr. Hulke I believe to be the distal half of a coracoid, also agreeing very closely with the corresponding bone of *Brontosaurus*.

The second specimen (No. R. 156) is a bone which has long puzzled me, but which, thanks to a suggestion of Mr. Hulke, I now believe to be a left posterior sacral rib. This bone corresponds fairly well with the rib of the fourth vertebra of the sacrum of *Brontosaurus*, figured by Prof. Marsh in the 'American Journal of Science,' vol. xxi. pl. xvi (1881), and is very nearly of the same dimensions. I cannot regard it as belonging to *Iguanodon*, in which genus the flattened plate of the bone is placed vertically instead of horizontally.

Now comes the consideration of the humerus (No. 28266) from the Wealden of Cuckfield, in Sussex, on which the late Dr. Mantell founded his genus *Pelorosaurus*. This huge bone, which is clearly Sauropodous, is peculiar in having a distinct median cavity; but

since all other described limb-bones are solid, I am inclined to think that this hollow may be due to *post-mortem* decay. This bone is distinguished from the humerus of *Cetiosaurus oxoniensis*, by its more slender form and the greater prominence of the deltoid crest; and in the latter respect, so far as I can see from the small-sized figures published by Prof. Marsh, accords more nearly with the homologous bone of *Brontosaurus*. The question then arises whether this form may not be generically identical with *Ornithopsis*, in which case, in strict right of priority, that name should yield place to the older *Pelorosaurus*. It should be observed that Mantell identified with *Pelorosaurus* the caudal vertebræ which we may regard as the types of *Cetiosaurus brevis* of Sir R. Owen; and I observe, in a recent note, that Prof. Seeley* now not only accepts this identification, but regards both forms as belonging to *Ornithopsis*. The occurrence of the remains of both *Pelorosaurus* and *Cetiosaurus brevis* in the Sussex area is, so far as it goes, in favour of their belonging to one and the same form; but since anterior caudal vertebræ of the latter occur (as I shall mention immediately) in the Isle of Wight, I do not think much stress can be laid upon this point, one way or the other. On Professor Seeley's view all the remains of large Wealden Sauropoda (excepting *Thecospondylus* and *Titanosaurus*) will be referable to *Ornithopsis*; but the British Museum possesses cervical vertebræ †, from the Isle of Wight, which are greatly longer than those of *Ornithopsis Hulkei*, and in this respect are much more like those of the American *Morosaurus*; and as I shall show that the latter appears to be the Transatlantic representative of *Cetiosaurus*, there is a considerable probability that these specimens may be referable to *C. brevis*. The anterior caudal vertebræ of the latter differ, moreover, from those of *Brontosaurus* (the ally of *Ornithopsis*) by the absence of distinct postzygapophyses, by the broad angulated faces of their centra, and their articulation by two facets with the open chevrons. A series of associated specimens in the British Museum, from Brook (Nos. 36559, 28640), belonging to *C. brevis*, and comprising the last lumbar vertebra, the sacrum, and an anterior caudal vertebra, also affords evidence tending in the same direction. Thus the last lumbar vertebra has small lateral pits, but is otherwise solid, while the sacrum consists of four hæmally flattened vertebræ, solid throughout, as in the sacrum of *Morosaurus* ‡; that of *Brontosaurus* being, on the other hand, completely hollowed. These specimens are, moreover, much too small to have belonged to *Ornithopsis*; while in the Fox Collection there is the imperfect right half of a vertebral centrum (No. R. 209) of the latter, which I regard as belonging to the last of the lumbar series, and which is much larger than the last lumbar of the preceding specimen, and differs by the more extensive lateral pits, and the complete honeycombing of the body of the centrum. Again, I find part of the centrum of a trunk-vertebra from the Wealden of Sussex differing considerably from the dorsals of *O. Hulkei*. So

* Geol. Mag. 1887, p. 479.

† Nos. R. 96 and 46780.

‡ See Marsh, "Classification of Dinosauria," in Rep. Brit. Assoc. for 1884.

far, therefore, as the vertebral evidence goes, it tends to show that *Cetiosaurus brevis* is much more nearly allied to *C. oxoniensis* than to *Brontosaurus*; and I cannot consider it by any means proved that it even belongs to the same family as *Ornithopsis*, while I shall have to mention a specimen which may indicate its distinctness from *Cetiosaurus*. The somewhat remarkable fact still, however, remains, that I can find in the Wealden no anterior caudal vertebræ of the type of those of *Brontosaurus* which I can refer to *Ornithopsis*; but this is counterbalanced by anterior caudals, shown me by Mr. Hulke, of which drawings have been found in association with his *Ornithopsis Leedsi* (of which more anon), which are of the characteristic *Brontosaurus* type.

With regard, then, to *Pelorosaurus*, all that can be safely stated is that the type humerus approximates to the *Brontosaurus*-rather than to the *Cetiosaurus*-type, and that such approximation is in favour of its reference to *Ornithopsis*. I do not, however, think it would be safe to say, at present, that these two genera are certainly the same; and even if it be eventually shown that they are so, I am inclined to think that this would be an occasion where strict adherence to priority would be a disadvantage rather than otherwise, and that it would be advisable in any case to retain the name *Ornithopsis*.

A humerus closely resembling, in general contour, the type specimen of *Pelorosaurus*, but with a perfectly solid shaft, is the one from the Kimeridge Clay of Dorsetshire figured by Mr. Hulke in vol. xxx. pl. ii. of the Society's 'Journal,' under the name of *Cetiosaurus humerocristatus*, and now preserved in the British Museum (No. 44635). I find, however, on comparing this bone with the smaller humerus (No. 41626) from this formation, figured by the same writer in vol. xxv. pl. xvi. of the 'Journal,' and subsequently made the type of the genus *Ischyrosaurus*, Hulke, that the latter, which has lost the side bearing the deltoid ridge*, evidently belongs to a closely allied form, and can only be distinguished from the former by its inferior dimensions.

Under these circumstances the obvious course would be to refer *Cetiosaurus humerocristatus* to *Ischyrosaurus*, were it not for other considerations. In the first place, the name *Ischyrosaurus* is pre-occupied by Prof. Cope, and accordingly cannot stand. Secondly, Prof. Seeley has described some Sauropodous remains from the Kimeridge of Ely, which there is a strong presumption for thinking are specifically the same as *C. humerocristatus*, under the name of *Gigantosaurus megalonyx*. If this be so, there would be grounds for adopting the name *Gigantosaurus* for the form in question; but as the types of the former have never been figured, the name can only be regarded as a manuscript one. I do not, however, think that it will be necessary to make a new generic name for these huge Kimeridge Dinosaurs, because it appears to me that there is every reason for believing that the larger Dorsetshire humerus, at least, is generically, and very probably also specifically, identical with the

* Mr. Hulke did not apparently notice this imperfection, and was thus led to refer the two specimens to different genera.

Dinosaur from the Kimeridge of Peterborough, of which one side of the pelvis* is figured by Mr. Hulke on p. 697 of the preceding volume of the Journal under the name of *Ornithopsis Leedsi*. The latter is evidently a member of the Atlantosauridæ, and I agree with Mr. Hulke in regarding the characters of the pelvis as not generically different from those of the Wealden form. Under these circumstances we may, I think, pretty safely refer the so-called *Cetiosaurus humerocristatus* to *Ornithopsis*, and I would venture to suggest that there are no grounds for separating *O. Leedsi* from that species. The type of Mr. Hulke's *Ischyrosaurus* may also be provisionally placed in the same genus, and, if adult, will indicate a second and smaller species, which we may call *O. Manseli*, from a MS. name of Mr. Hulke's.

With regard to *Cetiosaurus*, in which I take *C. oxoniensis*, Phillips, of the Great Oolite as the type, the caudal vertebræ agree with those of the North-American *Morosaurus* in their open chevrons, articulating by double facets; while the humerus is of the same broad and massive type, and the scapula has also its distal extremity similarly expanded. I find, moreover, that by reversing the relative position of the pubis and ischium in Phillips's diagram (in which the incorrect position has been pointed out by Mr. Hulke) these bones closely accord in contour with those of the American genus, the ischium being directed backwards, with the middle of the acetabular portion placed far above the axis of the shaft, and the latter slender and devoid of distal expansion †. There appears, therefore, to be but little doubt as to the close alliance between *Cetiosaurus* and *Morosaurus*, and further evidence is required as to the right of the latter to distinction. I have already mentioned *Cetiosaurus brevis* under the head of *Pelorosaurus*, but I may here bring to notice an associated humerus, radius, and ulna, from the Wealden of the Isle of Wight, in the collection of Mr. S. H. Beckles, of which the British Museum possesses casts (No. 28701). The length of the humerus is 0·620 (24·5 inches); its shaft is much shorter than that of the corresponding bone of *C. oxoniensis*; but it approximates to that type in its widely expanded head, and there appears a probability that these bones may belong to *C. brevis*, in which case that form would differ widely from the type species, and would likewise be certainly distinct from *Pelorosaurus*. On the other hand, these limb-bones may perhaps be referable to *Titanosaurus*, or possibly even to a new genus. *Titanosaurus* itself is, I find, represented, not only in the Wealden, but also by a postmedian caudal vertebra (No. 32390) of a larger form from the Upper Greensand of the Isle of Wight; and this leads me to think that the imperfect limb and pelvic bones from the Lower Greensand of Hythe, figured by Sir Richard Owen in his 'Cretaceous Reptilia' (Mon. Pal. Soc. pt. 1, pls. xii., xiii.) under the name of *Polyptychodon*, but subsequently regarded by the

* I am indebted to Mr. Hulke for the inspection of a larger photograph of this specimen.

† In *Brontosaurus* and *Ornithopsis* the middle of the acetabular portion is placed on the axis of the shaft, and the distal end is much expanded.

same authority as Dinosaurian, and named *Dinodocus Makesoni**, and may possibly belong to this genus.

The limb-bones of the Indian species of *Titanosaurus* are of the solid Sauropodous type, and since the caudal vertebræ of the type species agree with those of *Cetiosaurus* in the absence of distinct postzygapophyses, and in having open chevrons articulating by double facets, I am disposed to revert to my original view of regarding *Titanosaurus* as nearly allied to *Cetiosaurus*.

With respect to the above-mentioned dorsal vertebra from Cuckfield (B.M. No. 2239), figured by Sir R. Owen as the quadrate of an *Iguanodon*, then made one of the types of *Ornithopsis* by the founder of that genus, and subsequently figured by the former writer under the name of *Bothriospondylus magnus*, I am very undecided as to its affinities. It is certainly specifically distinct from the Isle-of-Wight *Ornithopsis*, and the relatively narrower centrum induces me to regard it as in all probability likewise generically different. Although of rather smaller dimensions, it appears to approximate to the imperfect dorsal vertebra from Sussex, which I have mentioned under the head of *Cetiosaurus brevis*, and it may perhaps have belonged to a smaller individual of that species, although there is no reason against its being referable either to *Titanosaurus* or to the same form as that to which the above-mentioned casts of limb-bones pertained, if such form be distinct from both *C. brevis* and *Titanosaurus*. Finally, there appears to be no possibility of arriving at any conclusion as to the identity with, or distinctness from, any of the above-mentioned forms of the genus *Thecospondylus* † founded upon the natural cast of part of a sacrum, which is regarded by its describer as not improbably belonging to the present group.

Theropoda.—In respect of this suborder, the remarks that I have to make are very brief. First, I find that the vertebræ from the Kimeridge Clay, on which Sir R. Owen founded the genus *Bothriospondylus*, appear to indicate a Dinosaur, closely allied to the genus *Creosaurus*, described by Prof. Marsh from the Upper Jurassic of North America, which is included by its founder in the Megalosauridæ; and it may therefore be a question whether some of the teeth hitherto referred to *Megalosaurus* may not belong to the former genus. In regard to *Megalosaurus* itself, some of the teeth from the Wealden agree with the tooth from the corresponding formation of Germany, recently figured by Dr. Koken ‡ under the name of *M. Dumkeri*, in showing no trace of serrations on the anterior border of the crown. A large series of specimens shows, however, that this feature is due to abrasion, and a complete transition is observable from teeth with well-marked, though small, serrations to those in which they have completely disappeared. The small size of the serrations and their tendency to early disappearance seems, however, to be a good specific character distinctive of

* History of British Fossil Reptilia. List of woodcuts.

† Quart. Journ. Geol. Soc. vol. xxxviii. p. 457 (1882).

‡ Palæontologische Abhandlungen, vol. iii. p. 316, pl. xxxi. fig. 2 (1887).

the Wealden form from *M. Bucklandi*, and still more from the Kimeridgian *M. insignis* of Deslongchamps, and I am accordingly disposed to adopt Dr. Koken's name for the former.

Conclusion.—In conclusion I may observe that the foregoing brief survey of the English generic forms referable to the Sauropoda shows how extremely unsatisfactory is our knowledge of these reptiles, and how little hope there is of arriving at any certain conclusion as to the number of genera that should really be maintained. This unsatisfactory state of things teaches us, I venture to think, a lesson as to the extreme caution which should be observed in founding new genera in this and other groups, upon the evidence of one or two bones, or even fragments of a single bone, and still more upon yet more unsatisfactory specimens. It is the easiest thing in the world to apply a new name to any specimen that turns up; but when we find one genus founded upon a humerus, another on a cervical vertebra, a third on a caudal vertebra, and a fourth on a cast of a sacrum, the evil results of such a system are self-apparent. In the old days of Palæontology it was natural and right that every specimen of importance should be definitely named; but I venture to suggest that in the present state of our knowledge the time is past for applying new generic terms, except in those cases where it can be shown with almost complete certainty that the forms to which such terms are applied are distinct from all that have been previously named. It would, indeed, be advantageous if we were beginning *de novo* to take one particular part of the skeleton, and say that on the evidence of that part, and that part alone, generic terms should be made; but now, even if we could get such a rule assented to and enforced, its application would not be of much value, owing to the heterogeneous materials on which our genera have been founded. Still, even now, something may be done in this direction, if Palæontologists will but refrain from applying new generic names to specimens belonging to parts of the skeleton totally different from those upon which allied genera have been founded. A specimen, to my mind, is quite as interesting and quite as important if left without a generic name, as it is when made the type of a so-called new genus to which we are unable to assign its proper position in the system, and which, for all we know, may be not separable from a form which has already received one or more names.

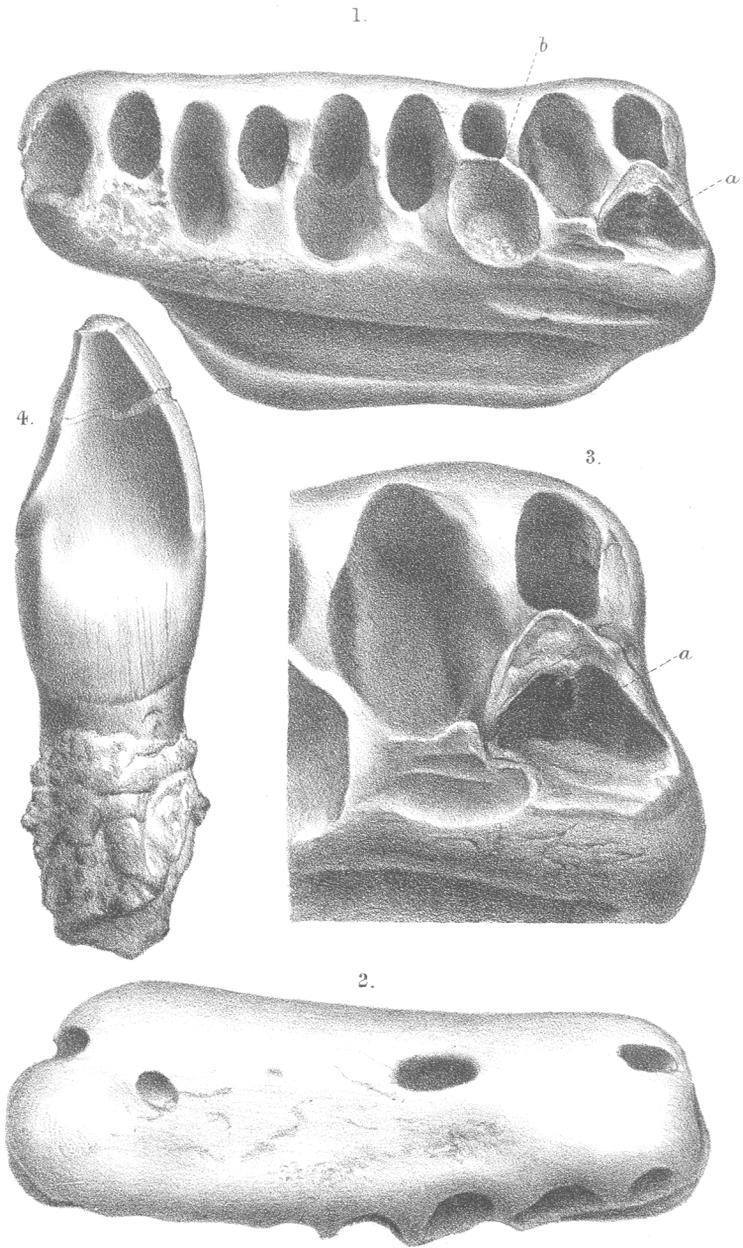
EXPLANATION OF PLATE III.

Figs. 1 & 2. Palatal (1) and outer (2) aspect of the greater portion of a right maxilla, probably referable to *Ornithopsis Hulkei*, from the Wealden of the Isle of Wight (Brit. Mus. No. R. 751). $\frac{1}{4}$ nat. size.

3. Anterior extremity of the same specimen. Nat. size.

4. Inner aspect of a tooth referable to the same species as the preceding, from the Wealden of Brixton, Isle of Wight (Brit. Mus. No. R. 964). Nat. size.

In figs. 1, 3, *a* indicates the tooth; while in fig. 1, *b* shows the shell of a tooth.



DISCUSSION.

The PRESIDENT agreed with the Author that judgment ought to be used in applying names to isolated fragments of organisms, though such a course was often unavoidable.

Prof. SEELEY congratulated Mr. Lydekker on the additions he had made to our knowledge of Dinosauria. With many of the conclusions arrived at he was disposed to agree. The attempted correlation of evidence from American fossils was an important addition to the fragmentary evidence available in this country, as in the instance of the teeth and food of *Ornithopsis*. The whole group of Iguanodonts being extinct, their structure could only be made out in detail; evidence from existing orders as to their classification was worthless. The paper was one of wide grasp.

Dr. H. WOODWARD said Mr. Dawson, the discoverer of some of the fossils described, deserved great praise for his energy in collecting, and for the valuable specimens contributed by his assistance to the Museum.

Mr. LYDEKKER, in reply, thanked the speakers for their criticisms.