

SOME RECENT RESTORATIONS OF
DINOSAURS.

IF palæontologists are apt to be discouraged by the apparent hopelessness of ever arriving at a satisfactory conclusion as to the structure and affinities of some of the fossil vertebrates with which they have to deal, they ought assuredly to take fresh confidence from the marvellous advance which has taken place of late years in our knowledge of the organisation of those huge extinct reptiles commonly known as Dinosaurs. It was, indeed, as far back as 1824 that the carnivorous genus *Megalosaurus* was first made known to us by Buckland, from specimens obtained in the Great Oolite of Oxford, while the following year saw the first announcement by Mantell of the now well-known *Iguanodon* from the Sussex Wealden. These early pioneers in this branch of palæontology necessarily had, however, but a faint conception of the real structure, and still less of the morphological importance of the group of reptiles whose former existence they were the first to reveal. It was long, indeed (in spite of the efforts of anatomists like Cuvier, Owen, and Huxley), before the riddle of the structure of the pelvis of the *Iguanodon* was solved, the final solution being given by Mr. J. W. Hulke in a paper read before the Geological Society on June 9, 1875, and published in the following year. The appearance of this paper may be said, indeed, to mark the commencement of the epoch of rapid advance in our knowledge of Dinosaurs, for only two years afterwards (1878) was issued the first of Prof. O. C. Marsh's important series of memoirs on the American Jurassic Dinosaurs, from which it appears that the true nature of the *Iguanodont* pelvis had been independently discovered in America. About the same time that the first of the American

of which is typified by the *Iguanodon* (Fig. 5), and the other by *Hypsirophus* (Fig. 3).

In the first, or crocodile-like group (Sauropsida), we have the least specialised forms (Fig. 1), all of which were habitually four-footed, and distinguished by their solid limb-bones, and the excavation of the sides of the bodies of most of their vertebræ by large cavities, which may have been filled with air in the living condition. The pelvis, as will be seen from our figure, is of a comparatively normal structure, with a relatively short anterior process to the upper bone or ilium,¹ and with the lower bones known as the pubis and ischium respectively inclined forwards and backwards after the crocodilian fashion. Our figure is taken from Prof. Marsh's restoration of 1883, in which the skull is imperfect, but in a later figure given by the Professor the head is fully restored, with the characteristic spoon-like teeth in position. In referring to this restoration Prof. Marsh observes that "the diminutive head will first attract attention, as it is smaller in proportion to the body than in any other reptile hitherto known. The neck was very long and flexible. The body was rather short. The legs and feet were massive, and the bones all solid. The tail was very long and powerful. The animal during life must have been nearly sixty feet in length, and about fifteen feet in height. Its probable weight was more than twenty tons. *Brontosaurus* was herbivorous in habit, and its food was probably aquatic plants or other succulent vegetation. The skeleton here represented was found in the Upper Jurassic, in Wyoming, west of the Rocky Mountain range."

We may add that the first known members of this group were discovered in British strata, the *Cetiosaurus* having been described from the great oolite by Owen, in 1842, and the *Pelorosaurus* by Mantell, in 1850, on the evidence of a stupendous

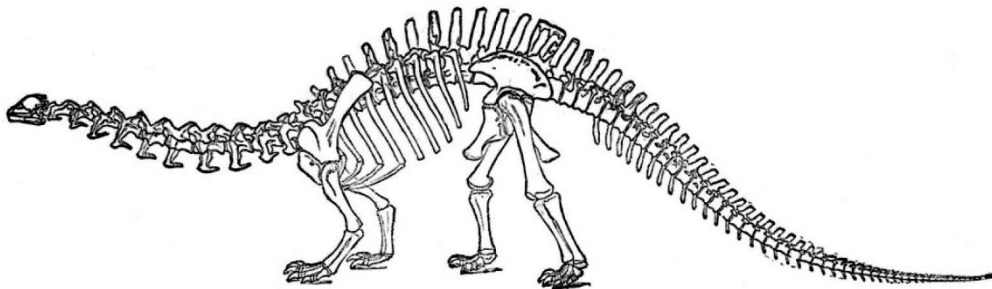


FIG. 1.—Restoration of the skeleton of *Brontosaurus excelsus*, $\frac{1}{16}$ natural size. The skull is imperfect and relatively too small. (After Marsh.)

palæontologist's memoirs saw the light the scientific world was startled by Monsieur E. Dupont's announcement of the discovery of numerous entire skeletons of *Iguanodons* in fissures of the Belgian coal-fields. And this unexpected and fortuitous discovery enabled Monsieur L. Dollo to publish in April, 1883, the completely restored skeleton of one of these monsters in its natural attitude.

Although as far back as 1861, Sir R. Owen had described the greater portion of a Dinosaurian skeleton from the Dorsetshire Lias, M. Dollo's figure was the first complete restoration of the skeleton of a Dinosaur based on actual specimens. Scarcely, however, had this figure appeared when Prof. Marsh (August, 1883) gave us the restoration of the entire skeleton of an American Dinosaur (*Brontosaurus*), of still more stupendous bulk than the *Iguanodon*, and belonging to a group hitherto but very imperfectly understood. From that date till 1891 (although much important work on the group was being done) there seems, however, to have been a lull in the work of Dinosaurian restoration, no foreign worker having apparently made any attempts at further complete restorations of the skeletons of these reptiles. In the United States specimens both from the Jurassic and the newly explored Cretaceous strata were, however, steadily accumulating; and during that year Prof. Marsh published restorations of the skeletons of two forms, which for strangeness and uncouthness exceed the wildest flights of the imagination.

In glancing at some of the more striking features of these different Dinosaurian restorations, we may remind our readers that Dinosaurs may be divided into three main groups, of which the first is represented by the *Brontosaurus* (Fig. 1), the second by the *Megalosaurus*, of which an authentic restoration has but recently been published, while in the third we have two sub-groups, one

humerus from the Wealden. The fragmentary and disassociated condition of the English specimens rendered it, however, quite impossible to refer with certainty the various teeth, vertebra, and limb-bones to their respective owners until we had the American skeletons as a standard for comparison, and even with that advantage we are not altogether clear on these points. There is, moreover, still some degree of doubt as to the right of some of the American forms to be separated generically from their European allies.

Till 1892 we had no fully authentic restoration of the skeleton of any of the larger members of the Carnivorous, or *Megalosaurian* group; but this want has been supplied by Prof. Marsh, from whose figures the accompanying illustration (Fig. 2) has been reproduced. It will be seen that, with the exception of the anterior vertebræ of the back, the skeleton is nearly complete; and since the missing vertebræ are known from European specimens, there can be no doubt as to their general form. On account of the presence of bony protuberances on the skull of the species figured, as well as from certain other peculiarities, such as the soldering together of the bones of the pelvis and metatarsus, Prof. Marsh regards the American form as generically distinct from the European *Megalosaurus*, and has accordingly suggested for it the name of *Ceratosaurs*. We are persuaded, however, that Prof. Cope is right in regarding the two as generically inseparable.

Passing on to the third or bird-footed (Ornithopodous) group of these reptiles, we come to some of the most specialised forms, none of which attain, however, the stupendous dimensions reached by some of the first group. The more typical representatives of this third assemblage are characterised, it need

¹ For these bones, see Fig. 3.

scarcely be said, by the generally bird-like arrangement of the pelvis, in which the front part of the ilium is much produced forwards, while the pubis has its main shaft (when present) directed backwards alongside of the ischium in a bird-like fashion (Fig. 3), and also giving off an anterior process which must not be confounded with the main shaft of the pubis of the Brontosaurus (Fig. 1). The bird-footed Dinosaurs are subdivided into the armoured and the typical sections, of which the former has but lately been fully made known to us.

As our first example of the former, we take the skeleton of the Jurassic *Hypsirophus* represented in Fig. 3. The existence of this type of Dinosaur was first revealed by the discovery in 1875 of a considerable portion of a skeleton (now in the British Museum) in the Kimeridge clay of Swindon, which was described by Sir R. Owen during the same and following years under the name of *Omosaurus*;—a term which unfortunately proved to be a preoccupied one. This skeleton comprised many

of a most marvellous monster. The Professor tells us that this restoration is based on a specimen which "had the skull, skeleton and dermal armour together when entombed, and almost in the position they were when the animal died. . . . In this restoration the animal is represented as walking, and the position is adapted to that motion. The head and neck, the massive fore-limbs, and, in fact, the whole skeleton indicate slow locomotion on all four feet. The longer hind limbs and the powerful tail show, however, that the animal could thus support itself as on a tripod, and this position must have been easily assumed in consequence of the massive hind-quarters. . . . The neural spines of the vertebræ have their summits expanded to aid in supporting the massive dermal armour above them. The limb-bones are solid, and this is true of every other part of the skeleton. The feet were short and massive, and the terminal phalanges of the functional toes were covered by strong hoofs. There were five well-developed digits in the fore foot.

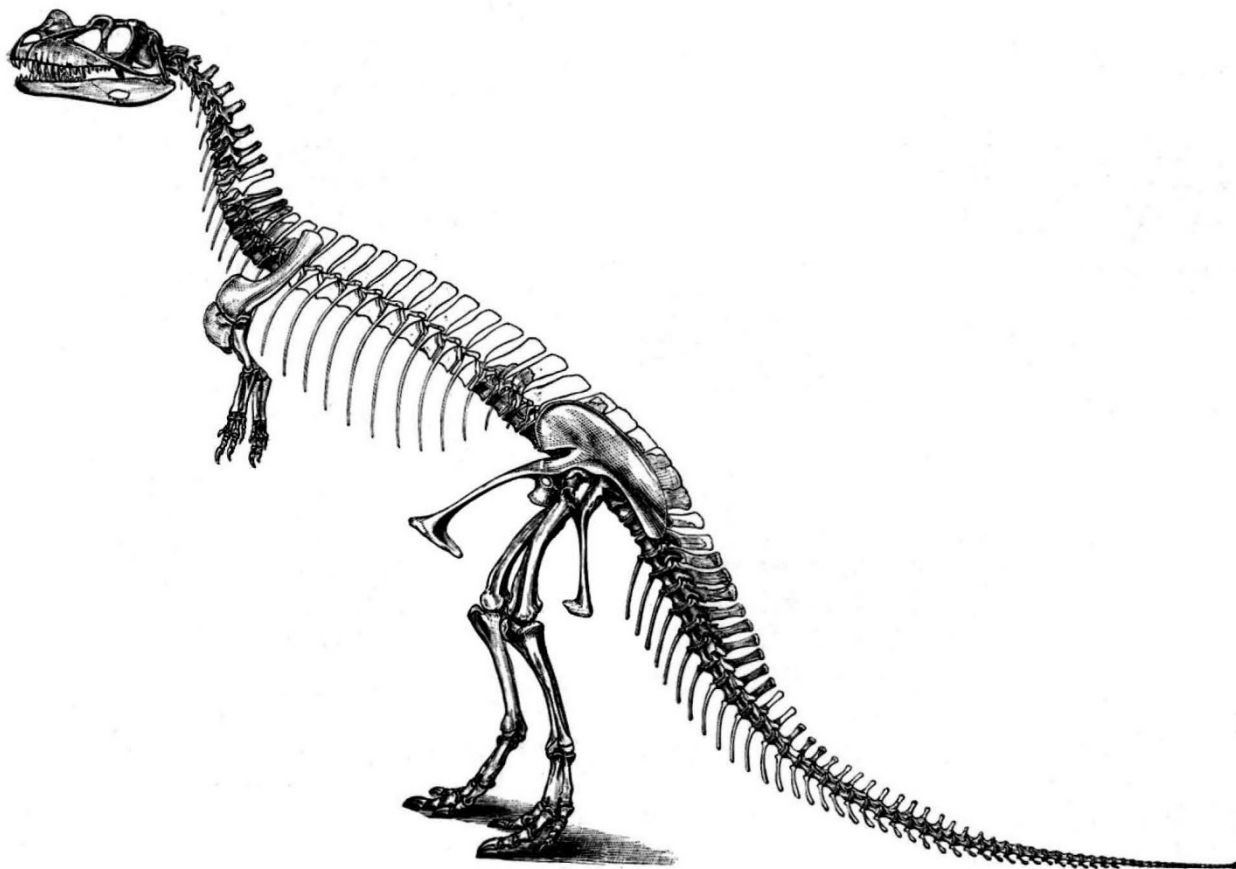


Fig. 2.—Restoration of a skeleton of a Carnivorous Dinosaur, $\frac{1}{3}$ natural size. (After Marsh.)

of the vertebræ and limb-bones together with some long spines similar to those represented at the end of the tail in Fig. 3. The skull is, however, missing, and there are no traces of the huge plates of bone shown in the restoration. If, however, we imagine the body of the reptile to which this skeleton pertained to have been drifting in the water sufficiently long to have lost its head by the action of decomposition, there is nothing more probable than that the row of plates along the back should have likewise disappeared. From 1877 onwards Prof. Marsh has been gradually completing our knowledge of allied reptiles from the upper Jurassic of Colorado and Wyoming, to which he applied the name *Stegosaurus*, but which appear to have been previously described by Prof. Cope under the title of *Hypsirophus*. First we had descriptions of some of the vertebræ and limb-bones, with isolated specimens of the plates and spines of the armour; then we had the head; and finally we are favoured with the restoration shown in the figure, which is certainly that

and only three in the hind foot, the first toe being rudimentary, and the fifth entirely wanting."

"In life the animal was protected by a powerful dermal armour, which served both for defence and offence. The throat was covered by a thick skin, in which was embedded a large number of rounded ossicles, as shown in the figure. The gular portion represented was found beneath the skull, so that its position in life may be regarded as definitely settled. The series of vertical plates extended above the neck, along the back, and over two-thirds of the tail is a most remarkable feature, which could not have been anticipated, and would hardly have been credited had not the plates themselves been found in position. The four pairs of massive spines characteristic of the present species, which were situated above the lower third of the tail, are apparently the only part of this peculiar armour used for offence. In addition to the portions of armour above mentioned, there was a pair of small plates

just behind the skull, which served to protect this part of the neck."

"All these plates and spines, massive and powerful as they now are, were in life protected by a thick horny covering, which must have greatly increased their size and weight. This covering is clearly indicated by the vascular grooves and impressions

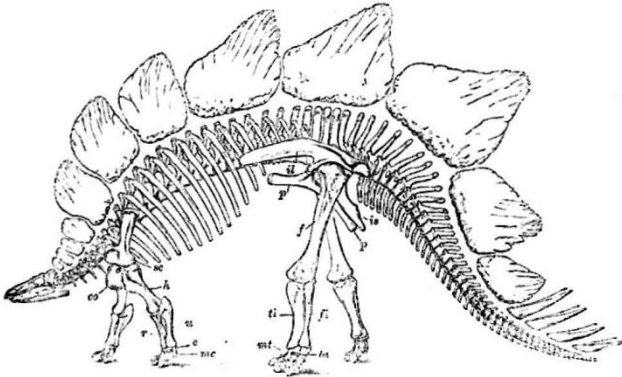


FIG. 3.—Restoration of the skeleton of *Hyspriosiphus unguilatus*, $\frac{1}{2}$ natural size. *sc.*, scapula; *co.*, coracoid; *h.*, humerus; *r.*, radius; *u.*, ulna; *c.*, carpus; *mc.*, metacarpus; *il.*, ilium; *p.*, pubis; *is.*, ischium; *fe.*, femur; *t.*, tibia; *fi.*, fibula; *ta.*, tarsus; *mt.*, metatarsus. (After Marsh.)

which mark the surface of both plates and spines, except their bases, which were evidently implanted in the thick skin."

To this graphic description of one of the most extraordinary creatures that lived in a world of monsters, it may be added that the remarkably tall neural arches of the dorsal vertebræ and the concomitant elevation of the proximal ends of the ribs nearly to the level of the summits of their neural spines appear to be for the purpose of aiding in the support of the enormous weight of the armour of the back.

Since we have already given more than one notice in NATURE of various portions of the horned armoured Dinosaurs of the Cretaceous of the United States, as represented by *Agathaumas* (= *Ceratops* and *Triceratops*), our notice of Prof. Marsh's recent restoration of this creature (Fig. 4) will be but brief. That these reptiles were nearly related to the Armoured Dinosaurs is undoubted; they attained, however, greater specialisation in the skull, which was of enormous size and armed with bony horn-cores, arranged as a pair above the eyes and a single one over the nose. The enormous size of the head and the proportionately large fore limbs indicate that these animals were always in the habit of walking on all fours; and, as we have previously suggested, the loss of the posterior shaft of the pubis, so well shown in the figure, is probably due to a reversion to these quadrupedal habits.

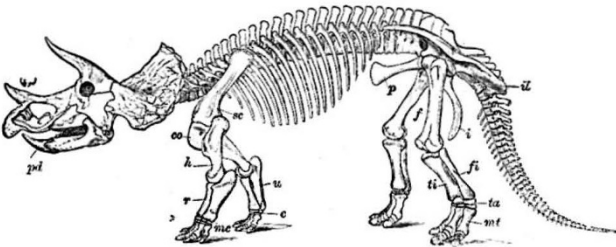


FIG. 4.—Restoration of the skeleton of *Agathaumas prorsus*, $\frac{1}{10}$ natural size. Letters as in Fig. 2. (After Marsh.)

In regard to this restoration Prof. Marsh remarks that "the skull is, of course, without its strong horny covering on the beak, horn-cores and posterior crest, and hence appears much smaller than in life. The neck seems short, but the first six

cervical vertebræ are entirely concealed by the crest of the skull, which in its complete armature would extend over one or two vertebræ more. . . . No attempt is made in this restoration to represent the dermal armour of the body, although in life the latter was more or less protected. Various spines, bosses, and plates, indicating such dermal armour, have been found with remains of this group, but the exact position of these specimens can at present be only a matter of conjecture. . . . The size in life would be about twenty-five feet in length and ten feet in height."

The extraordinary contrast between the skeletons of *Agathaumas* and *Brontosaurus* will be sufficiently apparent from a comparison of the respective figures.

The typical section of the bird-footed Dinosaurs, as represented by the *Iguanodons* (Fig. 5) is now so well known that but few remarks are necessary. They differ from the armoured forms in their perfect adaptation to a bi-pedal mode of progression, their digitigrade feet, hollow limb-bones, and absence of armour; the *Iguanodons* being further distinguished by the curious modification of the thumb into a stout conical spine. Those who have visited of late years the Brussels Museum will not fail to retain a vivid impression of the imposing show made by two mounted skeletons of these enormous reptiles displayed in a case in the court-yard of the museum. According, however to a striking picture which appeared a couple of years ago in the *Graphic*, these two skeletons have now been removed to within a special gallery in the Museum, where, together with three others, they must excite the admiration and wonder of all who have the good fortune to behold them. With such a lavish display of their own, it is, perhaps, scarcely too much to hope that the authorities of the Royal Brussels Museum may before long see their way to enriching our own National Collection



FIG. 5.—Restored skeleton of *Iguanodon leynissartensis*. About $\frac{1}{2}$ natural size. (After Dollo.)

either with an original specimen, or at least with a plaster reproduction of one of the already mounted *Iguanodon* skeletons.

Although there is no lack of work remaining to be done among the Dinosaurs, yet when we reflect that practically our whole definite knowledge of the group dates from within the last twenty years, and that all the five restorations at which we have glanced have been made within the last ten, we cannot but fail to be gratified at the enormous progress that has been made by this branch of palæontology within that comparatively short period. If this progress cannot be justly entitled to be termed one advancing by "leaps and bounds," yet we think that it may, on the whole, be truly described as "slow and sure."

R. LYDEKKER.

THE INTERNATIONAL MARITIME CONGRESS.

DURING nearly the whole of last week a most important congress was being held in London at the Institution of Civil Engineers. This was the International Maritime Congress, an institution founded in Paris in 1889, when no less than