

38. *Note on the Os PUBIS and ISCHIUM of ORNITHOPSIS EUCAMEROTUS**.

By J. W. HULKE, Esq., F.R.S., F.G.S. (Read March 22, 1882.)

[PLATE XIV.]

IN four communications on remains of this remarkable aberrant form of Dinosaur which the Society has published in its Quarterly Journal, I have described and figured its cervical and thoracic vertebræ, and noticed the affinity which these suggest with *Ceteosaurus oxoniensis*, and also with certain North-American Dinosaurs described by Profs. O. C. Marsh and Cope†. At the date of my last communication (1879), I was unable to lay before the Society any information respecting the vertebræ behind the thorax, or the girdle- and limb-bones. None of these had been found by Mr. Fox or myself in such close association with vertebræ of the forms I described as to demonstrate that they were parts of one skeleton; and in the absence of this, the expectation that the posterior vertebræ and the other bones should exhibit a textural and constructive agreement with the vertebræ known to us constituted during several years an insuperable obstacle to their identification.

The removal of this prejudice we owe to the recovery in Colorado of a large series of remains of allied forms, in excellent preservation, which demonstrate in the posterior vertebræ the absence of the side pits and chambers that are so conspicuous a feature in the cervical and thoracic centra, and the solidity of the posterior centra, as also of the girdle- and limb-bones‡.

The figures already published by Profs. O. C. Marsh and Cope have confirmed an identification that I made in 1873 of three bones then recently acquired by the late Rev. W. Fox; and they enable me now to make another step in the reconstruction of *Ornithopsis*. These bones, lately purchased as part of the Fox Collection by the British Museum, were bought by Mr. Fox with several of his finest typical thoracic vertebræ of *Ornithopsis*, and a couple of other vertebræ, which, considering them Ceteosaurian, he threw aside, as he never placed any value on these. Two of these bones appeared to me to be unmistakably ischia, and the third a pubis. Mr. Fox permitted me to take a rough sketch of them; but for a long time he would not allow their complete extrication from the rock, nor the readjustment

* Synonyms: *Eucamerotus*, Hulke; *Bothriospondylus* (in part), R. Owen; *Chondrosteosaurus*, R. Owen.

† Its affinity with *Camarosaurus*, Cope, was discussed by Prof. R. Owen in a paper in the *Ann. & Mag. Nat. Hist.* Sept. 1878, "Restoration of *Chondrosteosaurus*," the name substituted for *Bothriospondylus*, under which he had previously described (Pal. Soc. Mem. 1875-1876) some vertebral remains in the British Museum, including the centra (nos. 2239, 28362) upon which, in 1869, Prof. Seeley had founded the genus *Ornithopsis*.

‡ Prof. O. C. Marsh writes to me, under date Dec. 24, 1881, that he had nearly completed a memoir on these Sauroptoda, illustrated by 90 quarto plates.

of the many fragments into which they were broken. This has now been accomplished by the skilful mason of the national museum, under the instruction of Mr. Davies, who has succeeded beyond my expectation in joining together these valuable relics.

The *Os Pubis* (Pl. XIV. fig. 1, *P*) is an oblong flattened bar 73 centim. ($28\frac{3}{8}$ in.) long, with a breadth of 28·6 centim. ($11\frac{3}{8}$ in.) and 27·5 centim. ($10\frac{7}{8}$ in.) at its proximal and distal ends, and of 23 centim. ($9\frac{1}{8}$ in.) at its middle, where, however, the posterior border is mutilated. The proximal end is divided into two parts. Of these, the posterior, 10·1 centim. (4 in.) long by 5·5 centim. ($2\frac{1}{8}$ in.) wide, is an arc of a large circle; it is smooth, and evidently formed part of the circumference of the acetabulum. The other part of the proximal end, anterior in position to that just described, is 19 centim. ($7\frac{4}{8}$ in.) long, and 7·5 centim. (3 in.) wide at its middle, from which its width decreases forwards to the angle where the end meets the anterior border of the bone; this part, now somewhat damaged, was evidently united to the pubic process of the ilium. The anterior border, fortunately entire, stouter than the posterior, is slightly incurved near the ends, and intermediately throughout nearly its whole length almost straight. The posterior border, for a space of 20·3 centim. (8 in.) from the obtuse angle it makes with the upper end of the bone, is nearly straight, and throughout this extent it articulates with the ischium. Below this articular portion the remainder of the border, non-articular, takes first a deep incurve, and then curves outwards with the widening of the bone at its distal end. This strong incurve of the border between the two ends appears to have been interrupted at its middle by a slight projection, where also is a slight inflexion of the border towards the interior of the pelvis. The exact form of this part is no further ascertainable, some pieces having been broken off and lost. The distal end of the bone, now 27·5 centim. ($10\frac{7}{8}$ in.) across, was originally wider, as the posterior angle is mutilated. It is stout, being at the middle 9 centim. ($3\frac{1}{2}$ in.) thick; and inferiorly, and on its inner aspect, it has the roughness indicative of a symphysial union with its fellow bone of the other side of the pelvis.

An oval foramen, 8·3 centim. ($3\frac{2}{8}$ in.) in its long diameter, pierces the pubis near its upper end in the angle included by the acetabular and ischiatic margins.

The *Ischium* (Pl. XIV. fig. 1, *Is*.) is a narrower, stouter, and more curved bar than the os pubis, than which it is also shorter, a straight line joining its extreme points measuring 65 centim. ($25\frac{5}{8}$ in.). Its greatest breadth nearly in the mid-level of the pubic articulation is 19 centim. ($7\frac{4}{8}$ in.), its distal end is 17·7 centim. (7 in.) wide, and the middle is its narrowest part, being somewhat more than 10 centim. ($3\frac{1}{2}$ in.) across. Its upper end, like that of the os pubis, consists of two parts. Of these, the posterior, very stout, rises high above the other. It has a rudely oval sectional outline 14 and 7·7 centim. ($5\frac{4}{8}$ and $2\frac{6}{8}$ in.) in its two diameters; and its surface has a roughness which plainly speaks of its junction with the ilium. The other part of this end lying in front of that just described is a curved, smooth

surface, plainly acetabular. It is continuous with the adjoining smooth acetabular part of the os pubis, than which it is slightly wider. The distal end of the ischium is thin, and quite unlike that of the os pubis; it is devoid of indications of symphysial union with its fellow bone of the other side; and since it is nearly perfect it may be regarded as certain that no such union was ever present. The posterior border, stout and rounded, forms a large simple curve from end to end. It is the stoutest part of the bone, attaining its greatest thickness in the iliac process, and decreasing from this towards the distal end. The anterior border, much less stout than the posterior, has near the acetabular end a flat straight surface by which it was connected with the os pubis. In the rest of its extent it is non-articular. A change in the direction of its surfaces towards its ends gives the ischium the illusive appearance of a twist. At the upper end a line drawn across the bone in the direction this is thought to have had in the articulated skeleton would be approximately parallel to the vertebral column, whilst a second line drawn across the surface near the lower or distal end of the bone would cut the first line at a small angle.

The cortical bony tissue of the os pubis and ischium is compact, and its external surface is smooth; but these characters are much less pronounced than in the chambered thoracic and cervical vertebræ, and the cancellous tissue makes no approach to the megacellular texture so conspicuous in them.

A moment's comparison of the side views of the pelvis of *Iguanodon** and *Ornithopsis* (Pl. XIV. fig. 1) will suffice to show how widely different are the form and arrangement of the constituent bones of the os innominatum. In *Iguanodon* the ischium and the long, slender, rod-like part of the os pubis (post-pubis as Prof. O. C. Marsh terms it), which is the homologue of the os pubis of *Ornithopsis*, are much more slender than the broad, flattened, plate-like form of the same bones in this latter. In *Iguanodon* they are placed parallel to each other, whereas in *Ornithopsis* their distal ends are widely separated. The ischium of *Ornithopsis* in those respects in which it differs greatly from that of *Iguanodon* roughly resembles that of *Megalosaurus*. It was this resemblance which chiefly guided me in 1873 in my determination of the skeletal position of the bone.

It is, however, in the pelvis of *Ceteosaurus oweniensis* amongst British Sauropsida that the strongest resemblance to that of *Ornithopsis* is to be found. The similarity of their os pubis and ischium is so evident as to need no comment other than that it is an additional evidence of their affinity, to which in 1871 I called attention upon the evidence of their vertebral remains. But a still closer resemblance is to be found in the pelvis of *Atlantosaurus immanis*. If we exclude some very trivial details, the figure of this given by Prof. O. C. Marsh, in his 'Principal Characters of American Dinosauria,' shows, as regards the os pubis and ischium, an extremely close agreement with those of the Wealden Saurian (Pl. XIV. fig. 2).

In the similarity of the constituents of its haunch-bone to those

* Quart. Journ. Geol. Soc. vol. xxxii, p. 365, fig. 1.

of *Ceteosaurus oxoniensis* and *Atlantosaurus*, *Ornithopsis* departs from the original Dinosaurian scheme as typified by *Iguanodon*, and takes the direction of Lacertilia, in which the postpubic extension, so developed in the os pubis of *Iguanodon*, is absent, and there is no os-teally closed obturator foramen. It differs, however, from the Lacertilian haunch-bone in the absence of ischial symphysis, unless I have been deceived on this point; and also from the Crocodilian form notably in the inclusion of the os pubis in the acetabular circle.

These and other associated departures from the typical Dinosaurian patterns have led Prof. O. C. Marsh to place *Atlantosaurus* with other of the newly discovered Colorado Sauria in a special sub-order of Dinosauria, the Sauropoda, in which *Ornithopsis* clearly finds its proper place.

POSTSCRIPT.

For reasons stated in a former paper I adhere to the prior generic name *Ornithopsis*, given by Prof. H. G. Seeley; and since this genus was founded on two vertebral centra (Nos. 2239, 28362, Brit. Mus. Catal.) which there are grounds for referring to distinct species, I adopt *Eucamerotus* as the specific name of the subject of this note, and reserve the specific name *Hulkei*, given by Prof. Seeley, for the Saurian indicated by the fossil No. 2239. The annexed list contains all the references I can find to papers giving descriptions of fossils referable to this genus.

List of Papers on Ornithopsis.

1. Mantell, G. A. Fossils of the British Museum, p. 250. 8vo. London, 1851.
(Notice of no. 2239 fossil in Brit. Mus., regarded by author as tympanic of *Iguanodon*.)
2. Mantell, G. A. Geology of S.E. of England, pp. 305-306, pl. ii. fig. 5.
(Notice of same fossil.)
3. Owen, R. Report on British Fossil Reptilia in Reports of Brit. Assoc., vol. for 1841, p. 124.
4. Owen, R. Monograph of Foss. Rept. of Wealden Formation in Pal. Soc. vol. for 1854, p. 18, pl. x.
(3, 4. Notice of same fossil. The author accepts Mantell's determination, but suggests it may have belonged to *Ceteosaurus* or *Streptospondylus*.)
5. Seeley, H. G. On *Ornithopsis*, a Gigantic Animal of the Pterodactyle kind from the Wealden. Annals & Mag. of Nat. Hist. ser. 4, vol. v. p. 279 (1870).
(A paper on the fossil no. 2239, recognized by the author as a vertebral centrum, and on another centrum, no. 28362 in Brit. Mus.; read before Camb. Phil. Soc. 22 Nov. 1869.)
6. Hulke, J. W. Note on a new and undescribed Wealden Vertebra. Quart. Journ. Geol. Soc. vol. xxvi. p. 318 (1870).
(Description of the neural arch of a thoracic vertebra under the name of *Eucamerotus*.)

7. Hulke, J. W. Appendix to above note. *Op. cit.* vol. xxviii. p. 36 (1871).
(*Eucamerotus*, Hulke, identified with *Ornithopsis*, Seeley.)
8. Owen, R. *Bothriospondylus magnus*, Monograph Brit. Foss. Rept. Mesozoic Formation, part ii. pl. viii. Pal. Soc. vol. for year 1875.
(Description and figure of fossil in Brit. Mus. no. 28362).
9. Owen, R. *Chondrosteosaurus magnus*, synonym *Bothriospondylus magnus*. Foss. Rept. Wealden and Purbeck Formations, supp. no. vii. p. 7 (1876).
10. Owen, R. On the Occurrence in North America of Rare Extinct Vertebrates found fragmentarily in England. Part I. Restoration of *Chondrosteosaurus*. Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 201, pls. x., xi. (1878).
11. Hulke, J. W. Note (3rd) on *Eucamerotus*, Hulke (*Ornithopsis*, H. G. Seeley). Quart. Journ. Geol. Soc. vol. xxxv. p. 572 (1879).
12. Hulke, J. W. Supplementary Note on the Vertebrae of *Ornithopsis*. Quart. Journ. Geol. Soc. vol. xxxvi. p. 31, pls. iii. iv. (1880).

EXPLANATION OF PLATE XIV.

- Fig. 1. Pubis and Ischium of *Ornithopsis eucamerotus*, one fourth nat. size. *P.* Os pubis: *ac*, its acetabular part; *il*, its iliac part; *f*, foramen; *v*, its dilated ventral symphyseal end. *Is.* Ischium: the letters indicate the same parts as do the corresponding letters in the pubis.
2. Pubis of *Atlantosaurus immanis*, O. C. Marsh, one twentieth natural size. *I.* Ilium. *P.* Pubis. *Is.* Ischium. (Copied, reversed, from the 'American Journal of Science and Arts,' ser. 3, vol. xvii. pl. vii. fig. 2.)

DISCUSSION.

Prof. SEELEY asked for the evidence on which these bones were referred to *Ornithopsis*. He agreed with the author as to the similarity of this and certain American forms, and also as to their affinities with other reptilian types. He thought the evidence should have been given on which it was proposed to separate into two species the two vertebrae which he had first described as belonging to *Ornithopsis Hulkei*, as supposed by Cope and the author, before referring these pelvic bones to either species, supposing them to be distinct.

The AUTHOR replied that the pelvic bones were found imbedded in the same block with several vertebrae of *Ornithopsis*. The similar American pelvic bones were associated with vertebrae wonderfully like those of *Ornithopsis*. He thought that the form and proportions of the two vertebrae in the British Museum, on which the genus was founded, were so different that we are justified in believing them to have belonged to two distinct species.

