20. DESCRIPTION of PARTS of the SKELETON of an ANOMODONT REPTILE
(*PLATYPODOSSAURUS ROBUSTUS*, OWEN). Part. II. *The PELVIS*. By
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[PLATE X.]

THE pelvis of *Platypodosaurus*, which has been relieved from the matrix since the communication of the former paper*, includes five sacral vertebræ (Pl. X. fig. 1, 1-5), the right "os innominatum," 62-64, and a large proportion of the iliac constituent of that of the left side. Of the first, or foremost, sacral vertebra, s^1 , the part of the centrum in advance of the transverse processes, d^1 , is broken away, but so as to show the apex of the anterior conical articular cavity. The lumbar vertebra, which was articulated therewith, but had become dislocated therefrom, is preserved in the contiguous matrix; and the shape and depth of the articular cavity of its centrum are exposed (Pl. X. fig. 5).

The transverse process of the first sacral, d^1 , including both di- and pleurapophysial elements, is short and massive: measuring one inch and a half in antero-posterior diameter at its middle and narrowest part, it rapidly expands to its articulation (and what appears to be its confluence) with the ilium, 62. Behind the transverse process the centrum is moderately constricted, but expands to form the joint with the second sacral, of which joint the transverse diameter is 2 inches. The breadth of the entire vertebra is $4\frac{1}{2}$ inches.

The centrum of this second sacral vertebra (s^2) shows a greater degree of constriction and a narrower inferior or ventral surface. The transverse process (ib. fig. 1, d^2) extends from the anterior two thirds of the upper part of the side of the centrum, is narrower than that of the first sacral, but is longer, curving outward and backward, expanded at both ends, but most so where it abuts against the ilium. The breadth of the second sacral is 5 inches. The line of confluence with and abutment against the ilium is better marked than in the preceding vertebra.

The centurms of the third and fourth sacra are less expanded at their mutual junction than are those of the first and second vertebræ. The transverse processes are rather shorter, as in that of the third sacral, and this is narrower than those of the second and fourth vertebræ; that of the fifth sacral is the narrowest.

Each transverse process of the sacrum expands at its outer end so as to touch the contiguous one where it joins or coalesces with the ilium. The foramina or vacuities so circumscribed decrease in size from the foremost to the third pair, and change the oblong for the subcircular figure. The hinder articular end of the fifth sacral centrum, s^5 , is broken away, but in a minor degree than the fore

* Quart. Journ. Geol. Soc. for August 1880, vol. xxxvi. p. 414, plates xvi. & xvii.

part of the first vertebra; and a larger proportion of the articular concavity is there preserved. The entire breadth of this vertebra is $4\frac{1}{2}$ inches.

Turning to the dorsal aspect of the sacrum (Pl. X. fig. 3), the hinder end of a lofty but narrow crest of bone, *ns*, due to confluence apparently of the neural spines of the fourth and fifth sacrals, has been worked out. The entire breadth of the fifth sacral vertebra is 5 inches. The condition of the spines of the antecedent sacrum could not be determined. In the portion of a *Dicynodont* sacrum described in the 'Transactions of the Geological Society,' 2nd series, vol. vii. pl. xxxiii. figs. 4 & 5, the short and thick spines of the first and second sacrals are distinct, not confluent.

The section of the circular area of the neural canal of the fifth sacral of *Platypodosaurus* gives a diameter of 6 lines; that of the first sacral has a diameter of 9 lines; that of the last lumbar vertebra one of 8 lines. Thus we have an indication of an expansion in the sacral region for the lodgment of the part of the myelon transmitting the nerves to the pelvic extremities, which accords with the development of the limbs indicated by the femur of *Platypodosaurus* *. Comparing the sacrum above described with that of the larger and more entire pelvis, the subject of a paper in the 'Geological Transactions' above quoted, I incline to regard "five" as the total number of the sacral or pelvic vertebræ in *Platypodosaurus* †.

The degree of coalescence of these vertebræ is such as to sustain the anthropotomical or mammalian consideration of the coalesced mass as one bone or "sacrum;" but the ventral outlets are relatively larger and the wings consequently less ossified. The general shape, moreover, is quadrate rather than triangular, with deeper lateral concavities between the subcarinate bodies and the iliac bones. The present Reptilian sacrum consequently comes nearer in shape to that of the Megatherioid mammals: but it includes fewer vertebral constituents.

The length of such "sacrum" in *Platypodosaurus* is $7\frac{1}{2}$ inches; its breadth, greatest at the third vertebra, is $5\frac{1}{2}$ inches; it is consequently more mammalian in character than is the sacrum of *Dicynodon* ‡. In this larger example of the South-African reptilian pelvis the sacral centrums are more constricted between the articular ends, which are concomitantly more expanded. The space between these sacral bodies and the "ossa innominata" is relatively greater; the transverse processes are consequently longer, and retain more of the ordinary reptilian rib-like character.

The iliac bone in *Platypodosaurus* rapidly expands from its attachment to or confluence with the first sacral transverse process; it extends and curves forward, outward and dorsad, with the convexity mesiad, the concavity lateral. The extreme breadth is $4\frac{1}{2}$ inches; and the anterior margin of the ilium runs almost parallel with the

* *Loc. cit.* p. 422, pl. xvii. figs. 6 & 7.

† Compare also with page 40, plate xxxvi. (pelvis of *Dicynodon*), in the 'Catalogue of Fossil Reptilia of South Africa,' 4to, 1876.

‡ *Loc. cit.*

portion of the long, slender, last lumbar rib (Pl. X. fig. 5, *pl*) here preserved. The outer border of the above expanse of the ilium is produced into a narrow margin; but this subsides at the level of the articulation with the second sacral vertebra, where the ventral border of the ilium becomes thick, smooth, and convex. It thins off to the dorsal border, which is here sharp; and the breadth of the ilium is reduced to $2\frac{1}{2}$ inches. As the bone recedes it assumes a columnar character, with an oval transverse section, gradually expanding, where the right innominatum has been fractured, opposite its junction with the hinder sacrals, to a dorso-ventral diameter of $2\frac{1}{2}$ inches, and a transverse one of $1\frac{1}{2}$ inch (ib. fig. 4).

The expansion of the bone after quitting the sacrum rapidly augments to the acetabulum (ib. fig. 2*a*), to which it contributes the anterior and dorsal walls, the posterior and postero-ventral wall (completing the circumference of the cup) being formed by the ischial, 63, and pubic, 64, constituents of the "os innominatum." The breadth of the iliac part of the acetabulum is 4 inches; the diameter of the outlet of the cavity is 3 inches. There is a well-marked oblong fossa, $1\frac{1}{3}$ inch in breadth, at the bottom of the cavity. The depth of the cavity here is $1\frac{1}{2}$ inch; and the wall is entire, and nearly an inch in thickness.

The ischium, Y, contributes a rather larger share to the cavity (Pl. X. figs. 1 & 2, 63) than does the pubis. Beyond the acetabulum the ischium contracts to a breadth of 2 inches 4 lines, where it may contribute to the foramen (ib. fig. 2*c*). This is subcircular and an inch in diameter. Beyond the foramen the ischium loses thickness and gains breadth; but the confluence with the correspondingly lamellate pubis is such as to leave no trace of their relative shares in forming either the above foramen or the ventral wall of the pelvic outlet. This wall, 6 inches in breadth, is strongly concave outwardly, convex towards the pelvic cavity; both surfaces are smooth; and the plate of bone so formed thins off to a symphyseal border from from three to four lines in thickness, and probably four inches in extent.

The pubis (ib. figs. 1 & 2, 64) gradually thins and expands as it passes from the acetabulum to the foramen, *o*. The border forming the subacetabular "brim of the pelvis" is from 7 to 8 lines in thickness; its border has been chipped; but, though not entire, it is free from any indication of pectineal process, or of a prominence for the support of a marsupial bone. The utmost care in exposing this part of the pelvis failed to bring to light any such bones, or portions of them.

An accidental fracture, after exposition of the above-described part of the pelvis, about 2 inches in advance of the acetabulum, gives the transverse section (Pl. X. fig. 4) of that most contracted part of the iliac constituent.

The dorso-ventral diameter of the anterior outlet of the pelvis is 8 inches; the extreme transverse diameter is $5\frac{1}{2}$ inches.

The place of the ischiadic notch, *i*, which in most Bruta becomes a foramen, is marked only by a feeble concavity of the postaceta-

bular border of the ischium: the "tuberosity" is indicated at *t*, fig. 2. The extensive ischio-pubic symphysis (fig. 2, *y, y*) may have been obliterated by continuous ossification, as in the pelvis of *Dicynodon* above compared*, where it projects, ridge-like, between the broad, outwardly concave, ischio-pubic plates. The parts of the dorsal surface of the plates of *Platypodosaurus* exposed in the block of matrix show the hinder half of a continuous crest of bone (ib. fig. 3, *ns*), due to confluence of the neural spines of the third, fourth, and fifth sacrals. It may have been continued further forward.

The last lumbar vertebra (ib. fig. 5) shows the hinder concave articular surface of the centrum, *c*, which is 2 inches 3 lines in diameter. The margin of the concavity is thick and convex, as in the dorsal vertebra (*loc. cit.* p. 414, pl. xvi. fig. 3) of the preceding paper on *Platypodosaurus*. The neural canal, *m*, is 7 lines in diameter at its hinder outlet, *m*. The neurapophyses, *n, n*, rise to 10 lines before sending off the diapophyses, which are broad and flat above, and give attachment to a slightly curved pleurapophysis, *pl*, $4\frac{1}{2}$ inches in length and 9 lines in breadth; at its free end it almost comes into contact with the iliac labrum.

Of all the examples of pelvic structures in extinct Reptilia which have come under my observation, the type of pelvis exemplified in *Platypodosaurus* departs furthest from any of the modifications of that part of the skeleton known in existing Reptilia, and at the same time makes the nearest approach to the Mammalian pelvis. This is seen, not only in the number of sacral vertebræ, but in their breadth, due to the outward extension of their expanded transverse processes. The Mammalian character is more marked by the breadth of the iliac bones, and by the extent of confluence of the similarly expanded ischia and pubes, together with their further confluence at the ischio-pubic symphysis (which, though the bones are here fractured in the present example, may be inferred to have existed from the general resemblance of the pelvis of *Dicynodon* to that of *Platypodosaurus*).

The small solution of continuity between the ischium and ilium shown by the foramen (*o*, fig. 2, Pl. X.) closely accords with the foramen in a similar part of the pubis of many modern lizards, which gives passage to the "superficial femoral artery." It may, however, if the ischium be actually continued into its periphery in *Platypodosaurus*, be regarded as a trace of a "foramen obturatorium."

EXPLANATION OF PLATE X.

Platypodosaurus robustus.

- Fig. 1. Front view of pelvis: $\frac{1}{2}$ nat. size.
2. Side view of acetabulum, ischium, and pubis: $\frac{1}{2}$ nat. size.
3. Back view of sacrum and iliac bones: $\frac{1}{2}$ nat. size.
4. Section of ilium anterior to the acetabulum: nat. size.
5. Back view of last lumbar vertebra: nat. size.

* *Loc. cit.*

DISCUSSION.

Mr. HULKE asked if the lateral view of the pelvis of *Platypodosaurus* really bore out the view of the author as to its remarkable Mammalian affinities, and especially whether the acetabulum is in front of or behind the vertical of the sacro-iliac junction. He further remarked that most reptiles have not one but many series of teeth; and such would seem to have been necessary for carnivorous animals, in which the teeth are continually liable to damage. He stated that the canine described in this specimen seemed different from what had been described as characteristic of the order Theriodontia.

Prof. SEELEY inquired whether the ilium of *Platypodosaurus* resembled that of a Seal. So far as he could judge from the single diagram, the whole pelvis closely resembled that of *Dicynodon*; and if so, its affinities with other orders of fossil reptiles were more important than its presumed analogies with the Mammalia. This type of pelvis was approximated to by certain Dinosaurs, and, but for their prolonged iliac bones, was even more closely paralleled by the pelvis of some Solenhofen Pterodactyles. Even should the marsupial bones suspected by Prof. Owen have existed, the character need not be mammalian, since it is well developed in the Pterodactyle group.

With regard to the Theriodontia, he was unable to admit the importance of the characters and presumed characters on which the order was founded. The teeth of existing Lizards would, by the variety of types which they present, as well sanction ordinal subdivisions as the Anomodontia. The Dinosaurs also, with their carnivorous and herbivorous types of teeth, presented greater variety among themselves than that which was held to separate the fossil described from its Anomodont allies. He could not see how the circumstance of the so-called canine tooth being better nourished and growing larger could in these animals be an ordinal character. He thought it premature to infer the absence of successional teeth as an ordinal character—because the animals described were mature, and succession of teeth may well have occurred in early life. Not only were there no such characters dividing these animals from Anomodonts as separate Crocodiles from Lizards or Turtles from Crocodiles, but there was absolutely no important difference of plan in the structure of the skulls of Anomodonts and the so-called Theriodonts. Prof. Owen had long ago classed these animals as Cynodontia, forming a family of the Anomodonts; that classification he thought excellent, but he could not accept the family as an order or adopt its new name.

Mr. TWELVETREES had just returned from the district of widely spread Permian deposits of Russia. So far as he knew, these rocks had only exhibited two types of Reptilian structure, the Labyrinthodontia and the Theriodontia. He asked for information as to the relations between the latter and several genera described by Prof. Cope.

Prof. OWEN said that the sacrum of the Dinosaurs approached that of birds rather than that of mammals. He was not aware of

any Pterodactyle pelvis which resembled that of *Platypodosaurus*. He admitted that the dentition of the Lizards varied, but asserted that it never approached to that of the Theriodontia, in which the teeth were not ankylosed to the jaw. He was not able to compare these forms with the genera of Prof. Cope, in the absence of sufficiently large and detailed figures to illustrate the descriptions given by that naturalist.