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ORIGINAL ARTICLES.

I.—ON LARGE TERRESTRIAL SAURIANS FROM THE RHÆTIC BEDS OF WEDMORE HILL, DESCRIBED AS *AVALONIA SANFORDI* AND *PICRODON HERVEYI*.

By H. G. SRELEY, F.R.S., Professor of Geology in King's College, London.

(PLATE I.)

IN 1894 Mr. W. A. Sanford described, in the Proceedings of the Somerset Archæological Society (vol. xl, 1894, p. 234), the geological circumstances of the discovery of a large fossil reptile. The fossil bones were found by the Rev. Sydenham H. A. Hervey and himself in the Rhætic beds in the parish of Wedmore, in the Vale of Glastonbury; and compared to *Megalosaurus* in its large size and carnivorous character. The remains were generously presented to the British Museum (Natural History) at South Kensington. I have now to redeem a promise made by Mr. Sanford in his paper that I would name and describe the specimens.

The fossils comprise teeth, bones of the hind limb, dorsal and caudal vertebræ, and ribs. The discoverer remarks upon the way in which the bones appear to have been broken, crushed out of form, and scattered in the deposit. These results are partly due to transport of the specimens at the time of deposition; and partly, apparently, to movements of the strata associated with the uplifting of the rocks in that part of England.

Only two teeth were saved; they indicate two distinct genera. One tooth (p. 2, Fig. 1) is of a generalized *Megalosaurian* type, and has the summit of the crown greatly worn with use, and rounded. The crown is broad and thick, 12 mm. wide and 7 mm. in thickness; but towards the base of the crown, the width from front to back increases faster than its thickness. The anterior margin is rounded from side to side, as well as convex from above downward. If any serrations were ever developed, they were in the proximal part, which is worn away. In type the tooth resembles *Zanclodon* and *Euskelesaurus*. Those types agree with *Megalosaurus* in the limitation of the anterior serrations to the upper margin of the tooth in the lower jaw. Mr. Sanford states that the root of the tooth crumbled, and that portions of the lower jaw were found. Taken by itself the

crown suggests affinity rather with *Zanclodon* than *Megalosaurus*. The serrations on the hinder border are at right angles to the margin. I refer this tooth to *Avalonia*, the fossil being found in Avalon, the district associated with King Arthur and his Knights of the Round Table.

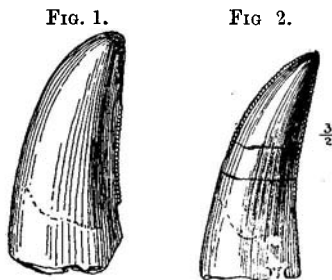


FIG. 1.—Tooth of *Avalonia Sanfordi*, Seeley.

FIG. 2.—Tooth of *Picrondon Herveyi*, Seeley.

Rhætic Beds: Wedmore (Vale of Glastonbury).

The second tooth (Fig. 2) is also represented by an imperfect crown. It is from the lower jaw, but of a very different type. It is $\frac{1}{2}$ inch long and $\frac{1}{16}$ inch wide at the base. It is sharp-pointed and slender, and the only tooth which at all resembles it in form is one from the collection of the late Rev. P. B. Brodie, found near Warwick, now in the British Museum (Natural History), which I refer to the same genus. This acuminate tooth, manifestly smaller than the tooth of *Avalonia*, and imperfectly preserved, is flattened externally and rather convex on the inner side, where there are three or four short slight ribs towards the lower half of the crown, which somewhat recall the ribs in the teeth of *Suchosaurus*, which the type resembles in form; but the crown differs from that genus in being more pointed, and especially in having the anterior and posterior margins serrated. The anterior serrations are limited to the summit of the crown. Their general direction is at right angles to the curved surface, but they have a perceptibly greater upward tendency. The posterior serrations are also directed upward. This constitutes a distinct resemblance to *Thecodontosaurus* and a difference from *Megalosaurus*, in which the serrations are at right angles to the cutting margins of the tooth, as they are in the short crown of *Palæosaurus*. The nearest approximation to this kind of serration is made perhaps by the French genus *Dimodosaurus*. But the serrations, except for their direction, are similar to those of *Megalosaurus*, and there is no median ridge running down the length of the tooth such as is figured by M. Gaudry. The tooth indicates the genus *Picrondon*. I have therefore no doubt that the remains of the skeleton preserved belong to two distinct though closely allied animals, of which the second was the smaller.

The true nature of the larger animal, *Avalonia Sanfordi*, is indicated by the remains of the femur and other parts of the hind limb. The

femur (Pl. I, Fig. 1) is about 38 inches long. It is a moderately strong bone, compressed from front to back, with the proximal and distal ends in the same plane. There is no trace of a sigmoid curve such as is seen in *Palæosaurus*, and to some extent in *Megalosaurus* and *Dimodosaurus*. The least transverse width of the proximal end is $9\frac{1}{2}$ inches and the greatest width $10\frac{1}{2}$ inches. Of this width, at least $2\frac{1}{2}$ inches is due to the inward direction of the convex articular surface, which measures 6 inches from front to back in the middle of the articulation, is flattened above, and is round from above downward as it extends inward. Below the proximal articulation towards the outer border, the front of the bone is impressed for a width of about 3 inches. This condition somewhat approximates to that seen in the corresponding part of the femur of *Euskelesaurus Browni*; only in that type the transverse expansion of the head of the bone is much less, and the shaft of the bone is nearly cylindrical, shorter, and relatively stouter. The lower border of this impression is an oblique ridge, which passes downward and outward, but is not appreciably elevated; it is 4 or 5 inches long, and is the only representative of the proximal trochanter of *Megalosaurus*, which is scarcely developed in *Euskelesaurus* and *Palæosaurus*, is almost lost in *Massospondylus* and *Dimodosaurus*, and passes away in some *Zanclodonts*. This is one of the most distinctive characters of the bone. Below the termination of the ridge the external lateral contour of the bone is concave in length, and this causes the shaft to narrow from a width of 7 inches to $5\frac{1}{2}$ inches in its middle length, below which it widens again to $11\frac{1}{2}$ inches towards the distal end. The middle length of the inner lateral border is occupied by a trochanter, which is now broken away but had the backward direction seen in carnivorous genera of Saurischia. Its broken base is a foot long, is perfectly straight, and occupies the middle third of the length of the bone. Above the trochanter the concave inner border is approximately parallel to the convex external border. The widening of the distal end of the bone is similarly due to an inward extension of the bone below the trochanter in a concave contour. This inner side is flattened and inclines slightly forward, being supported by the large inner distal condyle. The length and position of the lateral trochanter are distinctive; in *Euskelesaurus* it occupies the middle of the bone, and in *Massospondylus* it is towards the middle, but in both the African genera it is relatively shorter, while in *Palæosaurus* and *Megalosaurus* the proximal position of the trochanter is as pronounced as in *Zanclodon*; so that this also is a distinctive feature of the bone.

The distal end is about $11\frac{1}{2}$ inches wide. In front there is a slight concave longitudinal channel, slightly external to the middle width. The distal extremity is truncated. The larger inner condyle seen behind is 7 inches from front to back, and separated from the outer condyle by a moderately deep concave channel about 2 inches wide. The back-to-front measurement between the two channels exceeds 4 inches. The outer posterior surface external to the lesser condyle is oblique, and has the usual compressed aspect.

The bone is manifestly that of a new *Zanclodont* Saurian, and the pelvis and other parts of the skeleton may be expected to conform to the types at Stuttgart and Tübingen. The shaft of the femur is much straighter than in *Megalosaurus*, and the other characters all tend to remove the genus *Avalonia* from the types in which the pubic bones are slender and rod-like, and refer it to types in which those bones are flattened plates.

Only 16 inches of the proximal end of the left tibia is preserved. The proximal end is greatly expanded, especially towards the anterior crest of the bone. The proximal surface is truncated in the usual way, and is triangular. It measures 12 inches from front to back, and 9 inches from side to side behind, indicating, as the femur is nearly a foot wide, that the fibula had the usual slender form. The inner side of the bone is smooth and convex from front to back; the fibular side has a shallow channel for the fibula. The posterior side is concave in the middle width at the proximal end. These characters are too few to greatly elucidate the characters of the animal, but they are in harmony with the proximal end of the tibia in the genera which have resemblances to the femoral bone.

The hind foot is evidenced by digital and terminal claw phalanges. In all characters these bones are so remarkably like those which I have figured in *Euskelesaurus* (*Annals Nat. Hist.*, ser. vi, vol. xiv, p. 332, 1894) that I can point to no differences between them. The transverse width of the claw phalange removes the animal from all allies of *Megalosaurus*. It is not quite so wide as the same bone in *Cetiosaurus*, and conforms to the type of *Zanclodon* preserved at Tübingen. The digital phalanges are $2\frac{2}{5}$ inches long, as wide behind, narrower in front; $1\frac{3}{8}$ inch deep behind, depressed in front. The bone narrows superiorly, and has the trochlear extremities completely ossified. The claw phalange exceeds 4 inches in length, being more than one-tenth of the length of the femur, and nearly twice the length of a penultimate phalange. Its articular end is trapezoidal, fully 2 inches deep, and as wide below the middle. The usual vascular grooves extend in arched curves along the sides of the bone, and are continued transversely beneath the articular end. The limb bones probably indicate an animal less than six feet high.

The vertebræ preserved appear to indicate two animals. The dorsal vertebræ all agree in the anterior face being flattened and relatively small, while the posterior face is concave and much larger. In this they resemble the vertebræ of *Avalonia*. But since one type has the centrum 5 to $5\frac{1}{2}$ inches long, with the anterior face 6 inches deep, while the posterior face is 8 inches deep, I conclude that it indicates a distinct animal from the second type, in which the centrum is $5\frac{1}{2}$ to 6 inches long, with the articular faces vertically ovate instead of circular, $4\frac{1}{2}$ inches deep in front, and 5 inches deep behind. After making all allowances for the effects of compression and distortion, I am compelled to refer the larger vertebra to the animal with the larger tooth, and suppose that the animal with the smaller tooth was represented by the smaller dorsal vertebra. The large size of the centrum exceeds

anything seen in British carnivorous saurians, and is especially large as compared with the dorsal vertebræ of *Megalosaurus*, in which the vertebræ are as unlike the fossil as are the limb-bones.

The large dorsal vertebra of *Avalonia Sanfordi* is somewhat crushed, and has the body of the centrum unusually constricted, both at the sides and the base. Above the middle of the side, and a little behind the middle length, is a concave impression, pinching the sides till they are about 3 inches apart. The flattened anterior face is not well preserved, and the margin of the deeply concave posterior face is rounded. The measurements indicate a moderate arching of the back. The neural canal is $2\frac{2}{5}$ inches high in front and 2 inches wide; behind it is wider than high.

The neural arch has a strong elevated caputular facet 2 inches deep and $1\frac{1}{2}$ inch wide, vertical and flat, with the anterior border straight and the posterior border convex. It is an elevation upon and expansion of the anterior buttress of the arch, just as the tubercular facet (which is lost with the transverse process) is supported by the posterior buttress, which is a narrow oblique ridge. Hence there is a concavity between the facet and the ridge, which extends under the transverse process. The large posterior zygapophyses extend back beyond the neural spine; and the buttresses below them, which face obliquely outward and backward, are excavated for the reception of the pre-zygapophyses. The neural spine is compressed and vertical, about 3 inches from back to front and half an inch thick, though there is no certain indication of its height. The transverse width over the neural arch as indicated was ten inches. The height of the vertebræ up to the summit of the neural spine may have been 20 inches. The transverse elevation of the caputular facet an inch above the base of the neural arch is a remarkable and distinctive character. The large size of the vertebra is somewhat Cetiosaurian.

The ribs were strong; one fragment, more than 15 inches long, is 3 inches deep at the fracture towards the proximal end, where the external surface is reflected somewhat backward, and as the rib extends outward its plane becomes twisted, so as to present a wider and oblique lateral superior surface, the measurement being about $1\frac{1}{2}$ inch at the fracture at the distal end.

The remainder of the vertebræ are referred to *Picrodon Herveyi*. They comprise dorsal vertebræ, with the body of the vertebræ compressed from side to side, and relatively more elongated, but with the front of the centrum narrower than the back. There is a distinct suture between the neural arch and the centrum. And the neural arch has strong upwardly converging buttresses, supporting the transverse processes. The articular faces are deeper than wide; the width does not exceed $4\frac{1}{2}$ inches.

A caudal vertebra, showing the base of the transverse process, has the centrum about 5 inches long, and the base of the transverse process $2\frac{1}{2}$ inches from front to back, by $1\frac{1}{4}$ inch deep. The articular face is about 5 inches deep, by less than 4 inches wide, but the preservation does not show whether chevron bones were developed at the hinder border. A later caudal, with the articular surface

fully $2\frac{1}{2}$ inches deep and the centrum 4 inches long, has no transverse process, and shows no indication of a chevron facet, though the base of the articulation is somewhat thickened behind. A still later vertebra has the centrum 3 inches long, and the articular face $1\frac{1}{2}$ inch deep by $1\frac{1}{10}$ inch wide. The caudal vertebræ continue to diminish in length, and the neural arch becomes compressed from side to side, but remains well developed, and nearly an inch longer than the centrum. The pre-zygapophyses look obliquely upward and forward, and receive the wedge of the posterior zygapophyses between them. There appear to be faint indications of very small chevron bones in these latest vertebræ. It is possible that the smaller caudal vertebræ belong to *Avalonia*.

These vertebral characters indicate an animal closely allied to *Avalonia*, but well distinguished by the lateral compression of the centrum, supported by the singular form of the tooth crown, obliquely serrated at the margin, and ribbed on the inner side.

EXPLANATION OF PLATE I.

Avalonia Sanfordi, Seeley.

- FIG. 1.—Anterior aspect of left femur. *a*, articular head; *b*, ridge representing the trochanter major; *c*, broken base of the inner lateral trochanter; *d*, inner of the larger distal condyle.
 FIG. 2.—Posterior aspect of a dorsal vertebra.
 FIG. 3.—Right side of a dorsal vertebra, showing (*f*) the capitular and (*t*) tubercular facets, and the xygapophyses.
 FIG. 4.—Side view of claw phalange and penultimate phalange of hind foot.
 FIG. 5.—Articular end of claw phalange.

Pterodon Herveyi, Seeley.

- FIG. 6.—Dorsal vertebra, posterior aspect.
 FIG. 7.—Same vertebra, lateral aspect.
 FIG. 8.—Early caudal vertebra, lateral aspect.
 FIG. 9.—Late caudal vertebra.

Rhætic Beds: Wedmore Hill (Vale of Glastonbury), Somerset.

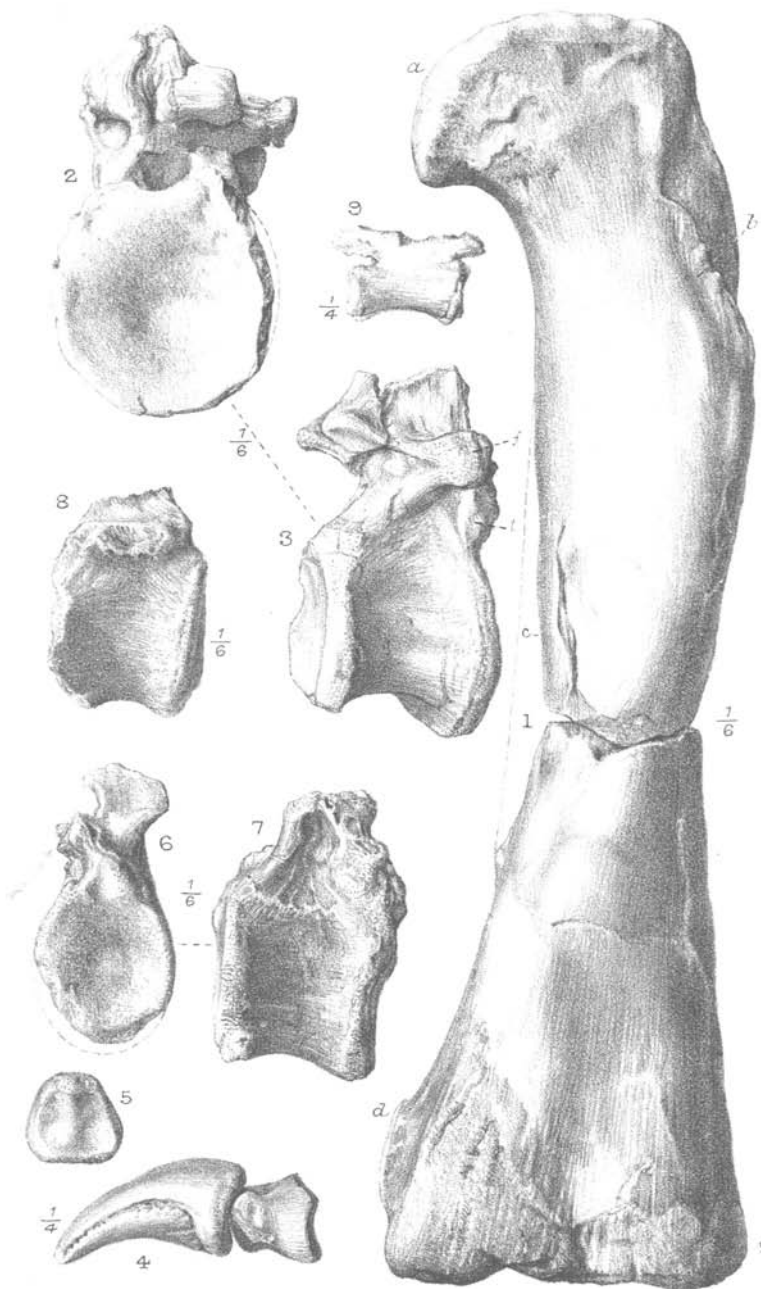
See also note on some Rhætic Foraminifera from Wedmore, by F. Chapman, 1895, *Ann. and Mag. Nat. Hist.*, vol. xvi, p. 305.

II.—RECENT OBSERVATIONS ON EUROPEAN DINOSAURS.

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DURING the past summer, it was my privilege to attend the International Congress of Geologists at St. Petersburg, as an official delegate from the United States, and this gave me an opportunity to see a number of museums and collections in Europe which I had not before visited. I thus had the privilege of inspecting personally many interesting reptilian remains that I had not previously known, and of examining others which were more or less familiar to me from figures and descriptions.

In the present paper, I have only time to speak of the Dinosaurs, in which I have long taken a special interest, and have endeavoured to study all the known specimens of importance, both in this country and in Europe, having in view the preparation of a series



G.M. Woodward del. et lith.

West, Newman imp.

Figs. 1-5, *Avalonia Sanfordi*. Figs. 6-9, *Picrodon Herveyi*.
(Seeley) *(Seeley)*
Rhaetic Beds, Wedmore Hill.