XXXI. (I.) *On the Dicynodont Reptilia, with a Description of some Fossil Remains brought by* H.R.H. PRINCE ALFRED *from South Africa, November* 1860. *By Professor* OWEN, *F.R.S. &c.*

Received January 23,—Read February 20, 1862.

ON the return of His Royal Highness PRINCE ALFRED from the Cape of Good Hope, in 1860, he honoured me by transmitting some fossil remains, with the following Note:—

"DEAR PROFESSOR OWEN,

"In the course of my journey in South Africa I met with two very interesting Fossil Remains; one, the larger, being the head of a *Dicynodon*: and I hope you will accept them from me as being the best specimens I obtained, upon the PRINCE CONSORT'S suggestion, on the occasion of your last Lecture, of which I retain the most agreeable recollection.

"Yours truly,

"ALFRED."

"Windsor Castle, November 15th."

I feel it a duty, at the present season of grief at a National bereavement, which becomes daily more appreciated, to communicate to the Society this evidence of the lamented PRINCE CONSORT'S unfailing interest in our sciences, as manifested by his desire that Lectures on Natural History should be delivered before the Royal offspring; and also as showing that, amidst the manifold occupations of the PRINCE CONSORT, he allowed no opportunity to escape in which his influence could be, in any way, exerted to aid in the direct advancement of science.

In the present instance, this influence, through the zealous fulfilment by PRINCE ALFRED of his father's suggestion, has procured for us valuable additional evidence of the peculiar structure and characters of some rare extinct animals, which, under any circumstances, I should have felt bound to submit to the Royal Society.

Some delay has been occasioned by the necessity of removing the very hard matrix from the varied and intricate surfaces of the imbedded petrified bones,—a labour requiring to be performed under my immediate supervision, or by my own hands.

The smaller of the two fossils referred to by H.R.H. PRINCE ALFRED, has thus proved to be one of the most perfect specimens of the petrified skull of a dicynodont Reptile which, hitherto, has come under my observation. It is figured, of the natural size, in Plates XIX. & XX. figs. 1, 2, 3, 4 & 5.

Ptychognathus Alfredi, Owen.

By the angular contour of the profile (figs. 1 & 3), in which the almost straight line of the vertex (*v o*) meets the equally straight occipital line (*o b*) at a right angle, and the straight facial or naso-premaxillary line (*v n*) meets that of the vertex at an obtuse angle, the specimen belongs to the subgeneric form of the dicynodont family called *Ptychognathus*.

The occiput (fig. 4) shows the same crocodilian extent of ossification as in other members of this singular family.

The articular tubercle is formed, as in *Ptychognathus declivis**, by the basioccipital (fig. 4, $_1$) at the lower and middle part, and, in less proportions, by the exoccipitals (*ib.* $_2$) which just meet at the upper part of the tubercle. The foramen magnum is a rather narrow oval, with the small end upwards, exclusively bounded, externally, by the exoccipitals; the basioccipital appearing at the interspace of the exoccipitals immediately within the cranial cavity. The basioccipital in advance of the tubercle, has its lower surface at first concave, and then convex, lengthwise; and is more deeply concave transversely (fig. 5, $_1$) through the production of its sides into the short and thick hypapophyses, figs. 4 & 5, *hy*. Its junction with the basisphenoid (fig. 5, $_5$) is by an almost straight transverse harmonia. The hypapophyses (*hy*) are divided by a short notch from the paroccipitals (fig. 4, $_4$), which abut, as in *Crocodilia* and *Chelonia*, against the inner side of the tympanics ($_{28}$), but here against their lower half, fixing these bones more firmly in their position. The paroccipitals, which, as in the Crocodile, are exogenous growths of the exoccipitals (*ib.* $_2$), are divided by a wider and more shallow notch from the exoccipital and mastoid, $_8$. The superoccipital (fig. 4, $_3$) forms the upper part of the occipital surface, is of a vertically oblong or subtriangular form, with the apex downward, and terminating some distance above the foramen magnum. The sides of the superoccipital concavity are formed by the backwardly projecting and slightly diverging hinder end of the parietals (fig. 4, $_7$); between which and the exoccipitals and tympanics the broad and angular mastoid (*ib.* $_8$) are wedged, forming the upper, outer, and posterior outstanding backwardly bent ridge, for the attachment of the cervical muscles, and presenting the sutural surface to the upper end of the tympanic, $_{28}$. The upper surface of the parietal (fig. 2, $_7$) presents a roughish non-articular tract of about 8 lines in breadth, at the fore part of which is the venous foramen. This median tract is made slightly concave across by the elevation of the ridges (*t*, *t*) bounding the smooth, longitudinally concave, tracts affording origin to the temporal muscle.

The frontals ($_{11}$, $_{11}$) form the chief part of the flattened vertex or upper platform of the cranium (figs. 2 & 4, *f*, *t*). They extend longitudinally from the foramen parietale forward to about one-third of an inch from the prefronto-nasal ridge (fig. 2, *f*); and transversely to the superorbital ridges (*s*), of which they form about the middle third part. The median or frontal suture may be traced along a great part of their extent: the surface is slightly raised at this part, and is depressed laterally, between the median

* Quarterly Journal of the Geological Society, vol. xvi. (April 1859) p. 49, pl. 1. figs. 3–5.

rising and the slightly elevated orbital borders. There is no trace of the pair of tubercles which, in *Ptychognathus declivis**, stand transversely on the frontal platform, in the line bisecting the middle of the orbits: they have not been chipped away in clearing off the matrix, either in the present skull or in that of *Ptychognathus latirostris*†. The median rising at the frontal suture is continued backward over the part where it divides to go to each tubercle, leaving an intermediate shallow depression, in *Ptychognathus declivis.* The frontal tubercles may be, therefore, reckoned among the cranial characters distinguishing *Ptychognathus declivis* from *Ptychognathus latirostris*, and from the skull of the species under description. In this, as in the previously defined species of *Ptychognathus*, the vertex or upper surface of the skull is bounded anteriorly by a low ridge (fig. 2, *f*, *f*), extending transversely with a slight curve, convex forward, from the fore part of one superorbital border to the other. The ridge is formed by the nasals (fig. 2, $_{15}$) at the middle, and by the prefrontals (*ib.* $_{14}$) at the sides. The latter are strong, large, angular bones (figs. 1, 2 & 3, $_{14}$), dividing by a prominent tuberosity the fore from the upper borders of the orbit: the frontal surface of the prefrontal is divided by the before-described ridge from the facial surface; both are slightly concave, the latter of greater extent, reaching almost to the hinder angle of the external nostril (figs. 1 & 3, *n*), and articulating with the nasal (*ib.* $_{15}$) above, and with the lacrymal (*ib.* $_{73}$) below. The nasals ($_{15}$), divided by a median suture, bend abruptly, at the prefronto-nasal ridge, from the upper to the fore or facial part of the skull, at an open angle. They are united for about an inch as they slope upon the face (fig. 2), and then diverge to form the upper border of the nostrils, receiving at the angles, so formed, the upper and hinder ends of the coalesced premaxillaries, *ib.* $_{22}$. The premaxillaries continue the facial line, begun by the nasals, straight to the upper margin of the mouth, which is directed forward. There is a slightly elevated line along the place of the obliterated medial suture (fig. 2, *m*), parallel with which is a pair of similar linear ridges (fig. 2, *p*, *p*), dividing the median from the lateral surfaces of the premaxillary: these surfaces have almost the same breadth, except that the lateral surface (fig. 1, $_{22}$) increases near the oral border; it is narrowest where it forms the fore part of the nostril, *n*.

The maxillary (figs. 1 & 3, $_{21}$) is chiefly remarkable, as in the rest of the genus, for the strong ridge-like prominence (*r r*) of the socket of the long and large canine tusk, *c*. Between this and the outer premaxillary ridge (fig. 1, *p*) the sides of the face are slightly sinuous, the convexity above gradually changing to a deeper concavity below, in the transverse or vertical direction; lengthwise the sides of the face are slightly concave as they converge towards the mouth; except at the canine alveoli, which are a little convex lengthwise at their fore part. Above, the maxillary bounds the lower part of the nostril, and there unites with the premaxillary ($_{22}$) and lacrymal ($_{73}$); below, it is continued from the canine-socket inward and downward, forming the edentulous sectorial border which meets the corresponding part of that border of the mandible ($_{32}$), the fore part of which, in advance of the maxillary, is strongly bent upward ($_{32'}$) to meet the eden-

* Quarterly Journal of the Geological Society, vol. xvi. p. 50, pl. 1. fig. 3. † Ibid. p. 51.

tulous trenchant border of the premaxillaries, *n*. The back part of the maxillary is continued beneath the orbit in a pointed form, articulating by a strong, oblique and extensive suture with the malar (fig. 1, 26), by which and the lacrymal the maxillary is removed from the orbital border itself.

The lacrymal (73), forming the middle of the fore part of the orbit, extends upon the face apparently to the nostril. The malar curving back along the lower part of the orbit, the border of which it there forms, bifurcates behind to connect itself with the postfrontal (figs. 2 & 4, 12) above and with the squamosal (fig. 1, 27) behind; but their limitary sutures I cannot satisfactorily make out. There is no other bony bridge overspanning the temporal fossa except the normal malo-squamosal zygomatic arch. The squamosal combines with the mastoid in affording the articular sutural surface to the upper end of the tympanic.

The squamosal (fig. 1, 27) is compressed, of 8 lines in vertical extent, by 2 in transverse; and increases vertically as it passes backward. The tympanic pedicle is of great length, broad and compressed from before backward at its upper part, becoming narrower as it descends, but gaining in thickness to where it receives the broad abutment of the paroccipital; below which it slightly expands in every direction to form the convex articular surface for the mandible. The tympanic pedicle is fixed immoveably, and by its size and connexions forms an unusually strong 'point d'appui' for the vigorous actions of the lower jaw. It consists of two bones, united by a broad overlapping squamous suture. The upper portion includes the mastoid and squamosal elements; the latter extends to near the articular condyle, along the fore part of the pedicle; the lower portion, or tympanic proper (28), forms the lower half of the back part of the pedicle, and expands below to form the joint.

The mandible of *Ptychognathus* (fig. 1, 30–32) resembles that of the *Chelonia* in its edentulous condition, general proportions, and comparative simplicity of structure, and that of the *Crocodilia* in the vacuity left between the dentary (32), angular (31), and surangular (30) elements; but it is peculiar and ptychognathic in the sudden vertical expanse and upward curve of its symphysial end (32′), the vertical diameter here being three times that of the articular end. I cannot distinguish an articular from a surangular element: the suture between this and the angular extends near and runs parallel with the upper border of the surangular to the vacuity, towards which it bends. No coronoid process is developed, nor is there any coronoid or complementary ossicle as in modern Lizards, Chelonians, and Crocodiles. The splenial element (fig. 5, 29) extends far back, as in *Chelonia*. The dentary elements, confluent at the symphysis, are deeply notched at their narrow hinder part, the upper projection being the longest. A horizontal ridge extends from the upper part of the notch forward as far as the depression, lodging the end of the canine tusk when the mouth is shut. The vacuity is situated halfway between the two ends of the mandibular ramus, not in the posterior third as in the Crocodile. The symphysis is broad as well as high, and the rami meet there so as to form, below, an arch or curve, concave backward, fig. 5, *s*. The fore part of the symphysis is convex both ver-

tically and transversely. The longitudinal ridge on the outside of the dentary, parallels that formed by the canine alveolus of the maxillary; and the alveolar borders in both incline inwards, to meet at the oral margin behind the great tusks. The mandibular ridge resembles the maxillary one in *Oudenodon*; and one is led to speculate whether in that genus the maxillary ridge may have related to a rudimentary upper canine, and the mandibular ridge to that of a lower one, in the embryo. In both *Ptychognathus* and *Oudenodon*, however, these parallel ridges in the upper and lower jaws, with the inward convergence of the alveolar plates, recall the structure of those parts in *Scelidosaurus* *, and which is indicated by the mandibles to have existed, in a certain degree, in *Hylæosaurus* and *Iguanodon*.

The fossil skull above described was obtained from a greenish sandstone of the Rhenosterberg. As it manifests specific distinctive characters, I propose to refer it to a species of *Ptychognathus*, under the name of the young Prince by whom it has been made available in advancing our knowledge of South African fossils.

The *Ptychognathus Alfredi*, like *Ptychognathus latirostris*, differs from *Pt. declivis* in the more circular orbits, the absence of the frontal tubercles, the right angle at which the occiput and vertex meet, and the greater depth and thickness of the facial part in proportion to its length.

But on comparing *Ptychognathus Alfredi* with *Ptychognathus latirostris*, the facial part of the skull presents less breadth in proportion to its length and depth, and the lower jaw is narrower in proportion to its length; the paroccipital is also relatively narrower.

The occipital region in *Ptychognathus declivis* (Plate XXI. fig. 2) shows nearly the whole extent of the masto-tympanic pedicle, and well exemplifies the singular breadth of the hinder surface of the cranium in these dicynodont reptiles. It also shows the pre-condyloid foramina, and the small vacuity between the exoccipital and masto-tympanic bones. The side view of the skull of *Ptychognathus latirostris* (Plate XXI. fig. 1) well exemplifies the ridged structure of the jaws and the composition of the mandible.

In the corresponding view of the skull of *Ptychognathus Alfredi* (Plate XX. fig. 3) is shown the extent of the pulp-cavity of the canine (*c*), closely conforming to that in the instances of ever-growing tusks in the mammalian class. As in former specimens of true *Dicynodon*, the section made to show the base of the tusk exhibits no trace of any germ of a successional tooth. The tusk curves forward, downward, and slightly inward. The points of both tusks have been broken away.

Dicynodon tigriceps, Owen.

The larger fossil, obtained by H.R.H. Prince Alfred from the Karoo-beds, in the district of Graaf Reinet, is a skull of a true *Dicynodon*, equalling in size that of the *Dicynodon tigriceps* †. It has been obliquely crushed, but under circumstances of sur-

* "Monograph on British Fossil Reptiles," Palæontological Society's volume for 1860, p. 12, pls. 4 & 5.

† Transactions of the Geological Society, 2nd Series, vol. vii. p. 233.

rounding support, which have kept the lower jaw in its natural connexions with the tympanic pedicle.

In the breaking up of the hard rock in which this fossil has been imbedded, the right maxillary, tympanic, and zygomatic arch have been removed; the fore part of the upper jaw, from the beginning of the sockets of the canine tusks, and the corresponding end of the lower jaw, are also broken away. The length of the remaining portion of the skull now exposed is 1 foot 6 inches; but this is somewhat more than it would naturally be, owing to the left half of the broad occipital region (Plate XXII. $_{4,\ 28}$) having been bent backward from the transverse to almost the longitudinal position, in the line of the skull's axis, and this with so little disturbance of the connexions of its elementary bones as exemplifies, with other similar condition of the skull, the gradual operation of the disturbing force, and the condition of surrounding support that has made the pressure act upon the brittle fossil as if it had been a plastic material. For, after close observation and reflection upon all the appearances presented by this fossil, I infer that the cosmic movements affecting the matrix have operated after the sediment in which the dead body of the old reptile was buried had become, with its contents, hardened into stone.

After careful removal of the matrix from the remaining petrified bones of the right side of the skull, the occipital tubercle ($_{1}$) was worked out in its whole length: it projects from the lower plane of the basioccipital (*h*) to the extent of 1 inch 8 lines, and from the foramen magnum (*f*) about 1 inch 4 lines; the vertical diameter of the base of the tubercle is 1 inch 6 lines; it slightly expands to its articular convexity. The right side of the tubercle having been broken away, the compact or close granuloid texture of the bone is here displayed.

The occipital hypapophyses (*h*) are 2 inches in length; the left paroccipital ($_{4}$) expands to a breadth of 5 inches, where it abuts against the broad masto-tympanic pedicle ($_{28}$). An extent of 6 inches by 4 inches of the smooth posterior surface of this singularly expanded lamelliform bone is here preserved. The small vacuity (*a*) between the par- and exoccipitals has been converted into a foramen by the meeting of extensions of ossification from $_{2}$ to $_{4}$. The foramen magnum (*f*), naturally of a vertically oval form, is here made narrower by the slow lateral squeezing of the occiput; its long diameter is 1 inch 4 lines. The lower angle of the superoccipital ($_{3}$) is preserved, making an extent of the well-ossified occipital plane reaching to 4 inches above the occipital tubercle.

The removal of the outer part of the maxillary and the zygomatic arch has brought into view part of the interorbital septum, and the upper and outer part of the bony palate; structures that have not been shown by previous specimens of *Dicynodon*.

The descending cranial plate of the frontal, where it forms the inner wall of the orbit and the rhinencephalic continuation of the cranial cavity, is shown at $_{11}$, Plate XXII.

The basisphenoid (*ib.* $_{5}$) is short and deep, and sends out a process uniting with one from the pterygoid, to abut against the tympanic pedicle.

The presphenoid (*ib.* $_{9}$) projects forward as a compressed plate 10 lines in vertical dia-

meter; in its length or extent of ossification it exceeds that in the *Chelonia*, and more resembles that in the *Crocodilia*; at its base there arise some thin rays of ossification, which ascend to unite with a similarly attenuated lamelliform base of the orbitosphenoid. I infer that there was persistent cartilage in this part of the skull. The orbitosphenoid (*ib.* 10) becomes thicker as it ascends to unite with the under part of the hinder third of the frontal, and with part of the parietal. It is perforated by a foramen opticum of elliptical form, 6 lines in long diameter.

Below and anterior to the presphenoid is seen a small part of the vomer (*ib.* 13), where it expands laterally to join the palatine (*ib.* 20) and pterygoid, *ib.* 24. The pterygoid, about 5 inches in length, contracts as it extends backward, bounds above or mesially the outer part of a long elliptical foramen (posterior nostril, *ib.* *n*), and then bends downward and outward to join the basisphenoid and abut against the lower end of the tympanic.

There appears to have been a part of the interorbital space unossified, about 3 inches in length, $1\frac{1}{2}$ inch broad below, but suddenly contracting to a width of $\frac{1}{2}$ an inch at the upper part.

The exposed bottom of the right socket of the canine tusk (*ib.* fig. 1, *c*) shows the similarly exposed pulp-cavity of the beginning of that tusk, which measures $1\frac{1}{2}$ inch across. The walls of the tusk increase in thickness to about 3 lines in an extent of $1\frac{1}{2}$ inch. A greater extent of the left socket (Plate XXII. fig. 2) is preserved, showing the concentrically lamelliform structure of the base of that tusk.

Sufficient of the mandible is preserved to demonstrate its characteristic dicynodontal composition. The alveolar border of the dentary element is toothless. The ramus rapidly augments in depth towards and at the symphysis, where a portion is broken away. The posterior part of the dentary (*ib.* fig. 1, 32) is notched or bifurcates to form an oblong vacuity at the middle of the mandibular ramus. Traces of a long surangular (*ib.* fig. 1, 30), which developes no coronoid process, of a broader or deeper angular (*ib.* 31), and also of a splenial (*ib.* 29), are discernible amongst the elements of the lower jaw.

As a whole, the present instructive specimen exemplifies the near equality in size of some of the strange extinct two-tusked reptiles of South Africa to the existing Walrus; it also shows that in the structure of the bony palate the *Dicynodon* combines, as in other parts of the skull, crocodilian with chelonian and lacertian characters.

Explanation of the Plates.

PLATE XIX.

Fig. 1. Side view of skull of *Ptychognathus Alfredi*: nat. size.
Fig. 2. Upper view of the same skull: nat. size.

PLATE XX.

Fig. 3. Side view, with section of tusk, of the same skull: nat. size.
Fig. 4. Back view of the same skull.
Fig. 5. Under view of ditto.

PLATE XXI.

Fig. 1. Side view of skull of *Ptychognathus latirostris*: nat. size.
Fig. 2. Back view of *Ptychognathus declivis.*

PLATE XXII.

Dicynodon tigriceps.

Fig. 1. Side view of skull: $\frac{1}{3}$ nat. size.
Fig. 2. Socket and base of canine tusk: nat. size.

(II.) *On the Pelvis of the* DICYNODON. *By Professor* OWEN, *F.R.S. &c.*

The following description is taken from a part of the petrified skeleton of a *Dicynodon* equalling in size the species, *D. tigriceps*, Ow., to which the cranium described in the preceding paper belongs, and exemplifying the structure of the pelvic part of the trunk of that extinct animal.

This instructive fossil is from the same locality in the Graaf Reinet district as that from which the specimen of the skull of the *Dicynodon tigriceps* was obtained which is described in the seventh volume of the 2nd Series of the Geological Transactions *. It formed the nucleus of a huge nodule of greyish-blue argillo-ferruginous limestone, transmitted from that locality by A. G. BAIN, Esq., F.G.S., and is now in the British Museum.

In a front view of this specimen (Plate XXIII. fig. 1) seven successive vertebræ are seen; but there is an appearance of slight dislocation at the expanded and co-adapted articular ends of the two anterior of these (D & S 1), which indicates that they were not anchylosed together; the rest seem to have coalesced, although traces of the intervertebral articulations remain. One-half of the last vertebra (Plate XXIV. S 6) is broken away. The length of the six entire centrums is 1 foot 2 inches.

The first vertebra (Plate XXIII. fig. 1, D) supports a pair of long, comparatively slender curved ribs (*pl*), articulated to strong outstanding transverse processes (*d*). These were the last or hindmost pair of free ribs, and indicate great breadth in that part of the trunk.

The second vertebra (*ib.* S 1), which is the first of the sacral series, sends out a pair of broad and thick parapophyses (*ib. p*), to each of which is attached a longer and broader pleurapophysis (*ib. pl*). This rapidly expands as it extends outward, and underlaps, or

* 4to. 1855, p. 233.

passes anterior to, the iliac bone (*ib.* 62). It resembles in shape the human scapula, but is much thicker. The hinder and inner border of this sacral rib is thick, and smoothly rounded; the front border is thinner, and is slightly concave; the outer border appears to have been straight, but is somewhat mutilated. This expanded termination of the rib rests on the ventral side of the ilium, concealing much of that bone in a front view of the pelvis. It has not been anchylosed therewith; decomposition of the ligamentous uniting matter, and subsequent partial dislocation, have allowed the matrix to insinuate itself between the sacral rib and the ilium, as seen at *a*, fig. 2, Plate XXIII.

Of the short, thick, transversely extended ribs of the five succeeding sacral vertebræ, the left of the penultimate (*pl*) is the best preserved towards the pelvic cavity; it presents a smooth convex or rounded surface about an inch in breadth, is slightly bent with the concavity towards the outlet of the pelvis, and abuts against the ischium.

The bodies of the sacral vertebræ (*s* 1....5) are contracted at the middle, and slender there in proportion to the pelvis, but are rapidly and much expanded at their articular ends; consequently they are very concave lengthwise, both below and at the sides; but are smooth and convex transversely, yielding a semicircular transverse section. The parapophyses go off near the base of the neural arch. The first centrum (s 1) is nearly 3 inches in length, and as much in breadth at the articular end, but is only 1 inch 3 lines across the middle; the rest (2....5) slightly diminish in length as they approach the tail.

The ilium (Plates XXIII. and XXIV. 62) is a strong straight triangular bone, at least 10 inches in length from the upper border of the acetabulum (Plate XXIII. fig. 2, *c*); above which it is contracted to a breadth of $3\frac{1}{2}$ inches and a thickness of 2 inches, and then expands to a breadth of $8\frac{1}{2}$ inches, measured along its oblique anterior border or labrum, Plate XXIV. fig. 4, *l l'*. The front part of the anterior two-thirds of the ilium expands into a rough flattened surface, 6 inches in length, and 3 inches in breadth anteriorly (*ib.* fig. 4, *r*), to which the back surface of the expanded first sacral rib is ligamentously attached. The inner surface of the ilium extends 6 inches behind this articulation, and is almost flat, but rather sinuous: coarse bony ridges or rays of ossification appear on this surface, near the labrum (*i'*), diverging thereto. The outer surface of the ilium is moderately concave transversely. This anterior expanded part of the ilium passes behind and in advance of the last pair of free ribs; the relations of which, and of the first sacral ribs, remind one of those of the answerable vertebræ in the pelvis of birds. The ribs of the second and third sacral vertebræ also abut against the ilium.

The ischium (Plates XXIII. and XXIV. 63), behind or beyond the acetabulum, forms a short and very thick prominence (*ib.* fig. 2, *t*), which receives the abutment of the ribs of the fifth sacral (Plate XXIV. *pl* 5): below or behind this it receives a similar abutment from the ribs of the last sacral vertebra (*pl* 6). The space, corresponding to the 'great ischiadic foramen' in Edentate mammals, is thus divided into two vacuities. The ischium becomes thinner, but is of great breadth where it forms the lower wall of the pelvis and converges towards its fellow to form, with the pubis, the long symphysis (Plate XXIII. fig. 2, *y*); here it again increases in thickness. A fracture, with a slight

dislocation on the left side, has taken place where the suture with the pubis may originally have existed; but on the right side no trace of such suture is visible; and the perfect state of the surface of the pelvis at this part demonstrates as complete a confluence of the two bones, with each other and the ilium, to form a large 'os innominatum,' as in mammals.

The pubis (Plates XXIII. and XXIV. 63) is remarkable for the bold and broad anterior convexity (*b*) of its iliac half, the inner part of which is perforated by an elliptical aperture (figs. 1 & 4, *f*), answering to that in the pubis of the Monitor*. The outer part of the bone is produced into a short obtuse process (*r*), less developed proportionately than that in the Monitor's pubis. Beyond this process the inferior border of the pubis bends downward and forward, rendering the antero-inferior surface of the half of the bone next the symphysis concave. The symphysis makes a slight angle near its beginning (Plate XXIII. fig. 1, *y*), projecting towards the pelvic cavity: the suture, there, is obliterated. The inferior or symphysial wall of the pelvis measures 14 inches across in a straight line from the border of one acetabulum to that of the other. The length of the symphysis (*ib.* fig. 2, 63, *y*, 64) in a straight line cannot have been less than 8 inches; but the upper or anterior margin is wanting (*ib.* fig. 1, 63). Its external contour is first concave, then convex, lengthwise. The broad, subquadrate ischio-pubic walls of the pelvis on each side the symphysis are slightly concave, outwardly, both vertically and transversely; the hinder three-fourths of these appear to have been formed by the ischium (64): there is no 'obturator' space or vacuity, merely the outlet of the pubic perforation appears externally. Both ischia and pubis combine to form a continuous tract of bone at the symphysis, which presents a thick protuberance at its lower or outer part near its termination (Plate XXIII. 64). The thick posterior border of the ischium is concave below the acetabulum, lengthwise, expanding into an angular tuberosity.

The outlet of the pelvis (Plate XXIV. fig. 3) is of a semielliptic form, 9 inches in transverse and 4 inches in the fore-and-aft diameters. If the inlet or brim of the pelvis (Plate XXIII. fig. 1) be defined by the smooth thick convex border of the first sacral ribs (*pl*), it presents an oval form, and measures 11 inches in transverse and 10 inches in fore-and-aft diameters, the latter being taken from the middle of the first sacral vertebra to the symphysis.

From the study of the above-described most interesting portion of the dicynodont skeleton, we learn—

1st. That there were no lumbar vertebræ, *i. e.* none bearing the technical anatomical characters of such†; but that free ribs continued to be developed to the pelvic or sacral series.

2nd. That the sacral series includes six vertebræ.

3rd. That the ilium, ischium, and pubis coalesce into an 'os innominatum.'

* Cuvier, 'Ossemens Fossiles,' pl. 17. fig. 39, *b*.

† This negative character is open to the same kind of objection as that relative to the 'hippocampus minor' in animals below man.

4th. That the junction of the ossa innominata with the vertebral column is effected in two ways—by an overlapping or squamous syndesmosis, and by the usual abutments: thus the anterior bony wall or surface of the pelvis, analogous to that formed by the expansion of the iliac bones in mammals, is here formed by the expanded ribs of the first sacral vertebra.

5th. That the ischium of the right side joins that of the left, and the right pubis joins the left pubis; and that both pairs of pelvic hæmapophyses are coextended and confluent, not only along a continuous ischio-pubic symphysis, as in mammals, but so as to obliterate the intervening vacuities called '*foramina ovalia* seu *obturatoria*,' thereby repeating the character of the connate abdominal hæmapophyses in the chelonian plastron.

In the comparison of this new and, at present, unique type of pelvic structure, it is interesting to observe, in connexion with the mammalian tusks in the skull, a mammalian condition of the ischio-pubic symphysis. I lay less stress on the degree of coalescence expressed by the term 'innominate bone,' because in some lizards I have observed a like confluence of iliac, ischial, and pubic bones, yet never with that amount of expansion of the iliac element which the *Dicynodon* shows, and in which, again, may be discerned a mammalian characteristic. If the remains of the huge reptiles of the extinct Dinosaurian order had not revealed to us an extent of sacrum so much surpassing that of all living Saurians, one would have laid more stress on the character of the six sacral vertebræ in the *Dicynodon*, as repeating that in some mammalia. But in this modification we may not be justified in inferring more than that, like the *Megalosaurus* and *Iguanodon*, a heavy trunk was in part supported on a pair of huge hind limbs, and the weight thereupon transferred by a larger proportion of the vertebral column in the *Dicynodon* than in the prone, crawling Crocodiles and Lizards of the present day.

As the lacertian characters prevail in the skull of the *Dicynodon*, so likewise do they in the pelvis: the backward production of the iliac bones, their confluence with the ischium and pubis, never met with in Crocodiles or Chelonians, and, above all, the oblique perforation of the pubis near its acetabular expansion, are all repetitions of structures known only, among existing Reptilia, in the lizard tribes. But the massive and entire anterior or ventral bony walls of the pelvis, the thick tumid acetabular halves of the pubic bones, and the great expanse of the over- or rather under-lapping pleurapophyses of the first sacral vertebra, are dicynodontal specialities, and suggest immense strength in this part of the massive framework of these strange extinct Reptilia.

Explanation of the Plates.

PLATE XXIII.

Dicynodon tigriceps.

Fig. 1. Front view of pelvis: $\frac{1}{4}$ nat. size.
Fig. 2. Side view of pelvis: $\frac{1}{4}$ nat. size.

PLATE XXIV.

Fig. 3. Back view of sacrum and pelvis: $\frac{1}{4}$ nat. size.
Fig. 4. Os innominatum, inner surface: $\frac{1}{4}$ nat. size.
The outline restored by dots, where abraded.

(III.) *Notice of a Skull and parts of the Skeleton of* RHYNCHOSAURUS ARTICEPS. *By Professor* OWEN, *F.R.S. &c.*

The rocks in South Africa containing the Dicynodont Reptilia, appear, by other fossils, especially of some plants, to belong to the Triassic period. It is in the New Red Sandstones of Europe and of our own island, that reptilian remains have been discovered which offer the nearest approach, though the gap is wide, to the dicynodont type.

A lizard which, in biting, with trenchant edentulous jaws, may also have pierced its prey by a pair of produced weapons analogous to the tusks of *Dicynodon*, has left its remains in the New Red Sandstone of the Grinsill quarries near Shrewsbury. In this singular species (*Rhynchosaurus articeps**) the premaxillary bones, by their shape and structure—the bony tissue of the produced tips acquiring the hardness and almost the texture of dentine—and by the production of their sharp end (Plate XXV. fig. 2, $_{22'}$) beyond the mandible (*ib.* $_{32}$), may have inflicted wounds and served a purpose, like those of the upper curved tusks of the *Dicynodon*.

I take the present opportunity of briefly noting a second example of this exceedingly rare fossil reptile, found, like the first, in the Grinsill sandstone, and liberally transmitted to me for examination and description by the Directors of the Museum of Natural History at Shrewsbury. This fossil consists of the skull almost entire (Plate XXV. figs. 1 and 2), with about fifteen of the anterior vertebræ (*ib.* figs. 3 and 4) more or less mutilated; and in the same slab of stone are parts or impressions of several ribs, a humerus (*ib.* fig. 3, $_{53}$), antibrachial (*ib.* $_{54}$, $_{55}$) and metapodial (*ib.* $_{57}$) bones. All these parts agree sufficiently in size and other characters with the first-discovered specimen to be referable to the same species.

The apparent greater breadth of the cranium is due to its having been crushed almost flat (fig. 1), which has correspondingly expanded the mandibular rami (fig. 3, $_{31}$, $_{31}$); but the force has been applied either so gradually, or, whether gradually or suddenly, with such equable support from the surrounding matrix, that there has occurred little fracture or dislocation.

The temporal muscles have encroached upon the sides of the parietal (fig. 1, $_{7}$), so as to develope a straight median crest along that bone. The outer and back part of the temporal fossa is bounded by a strong triangular mastoid (*ib.* $_{8}$), which unites by an oblique suture with the long postfrontal, $_{12}$. The prefrontals are seen at $_{14}$ in fig. 1. A portion of the lower or true zygomatic arch, not preserved in the first specimen, is

* Transactions of the Cambridge Philosophical Society, vol. vii.

seen at $_{24}$, in fig. 2. The long, slender, curved and dense premaxillaries ($_{22}$) are in the same good state of preservation. The lower jaw is likewise preserved *in situ*, as when the mouth is shut. There is the same compound structure and entire or imperforate outer surface of the ramus as in the original specimen. The symphysis is very short, fig. 3, *y*. A long and slender bone, on the inner side of the articular end of each ramus, appears to be a part or 'cornu' of the hyoid apparatus, fig. 3, $_{40}$, $_{40}$. The vertebræ are biconcave, with broad horizontally flattened zygapophyses and a moderately high, subquadrate compressed, fore-and-aft extended spine. The ribs acquire thoracic length at about the eighth vertebra from the head, and are longitudinally grooved as in the Ichthyosaur. There is an impression of a broad scapula (*ib.* $_{51}$) and broader coracoid (*ib.* $_{52}$) near the remains of the proximal half of a humerus, *ib.* $_{53}$. The humerus has an expanded proximal end, and a concave outline behind; it has also a large medullary cavity with a compact wall. The radius (*ib.* $_{54}$) and the ulna (*ib.* $_{55}$) are distinct. The remains of apparently a metatarsus show two of the larger and two of the rather more slender of these bones. All bespeak a reptile capable of progression on dry land, as well of swimming in the sea; of one that might leave impressions of its foot-prints on a tidal shore.

The skull of a rare New Zealand Lizard is figured in Plate XXV. fig. 5, as coming nearest to the Rhynchosaur in the proportions of the divided premaxillaries (*ib.* $_{22}$), each with a large and long tooth, which, were it completely confluent with the bone, would add still more to its resemblance to the New Red Sandstone fossil.

Explanation of the Plate.

PLATE XXV. *Rhynchosaurus articeps.*

Fig. 1. Upper view of skull.
Fig. 2. Side view of skull.
Fig. 3. Under view of the mandible and fore part of skeleton.
Fig. 4. Portion of the vertebral column.
Fig. 5. Side view of the skull of *Rhynchocephalus* (recent).

All the figures are of the natural size.

Fig. 1.

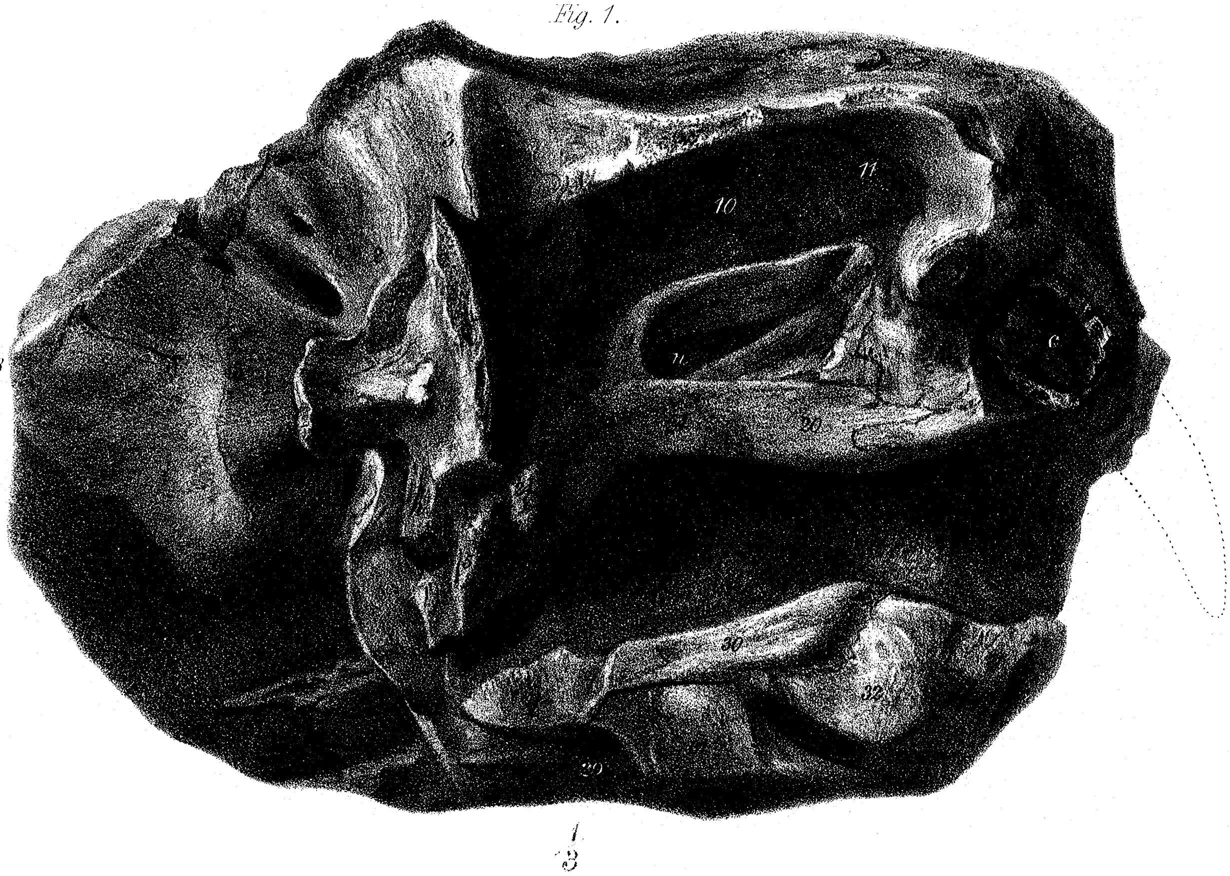
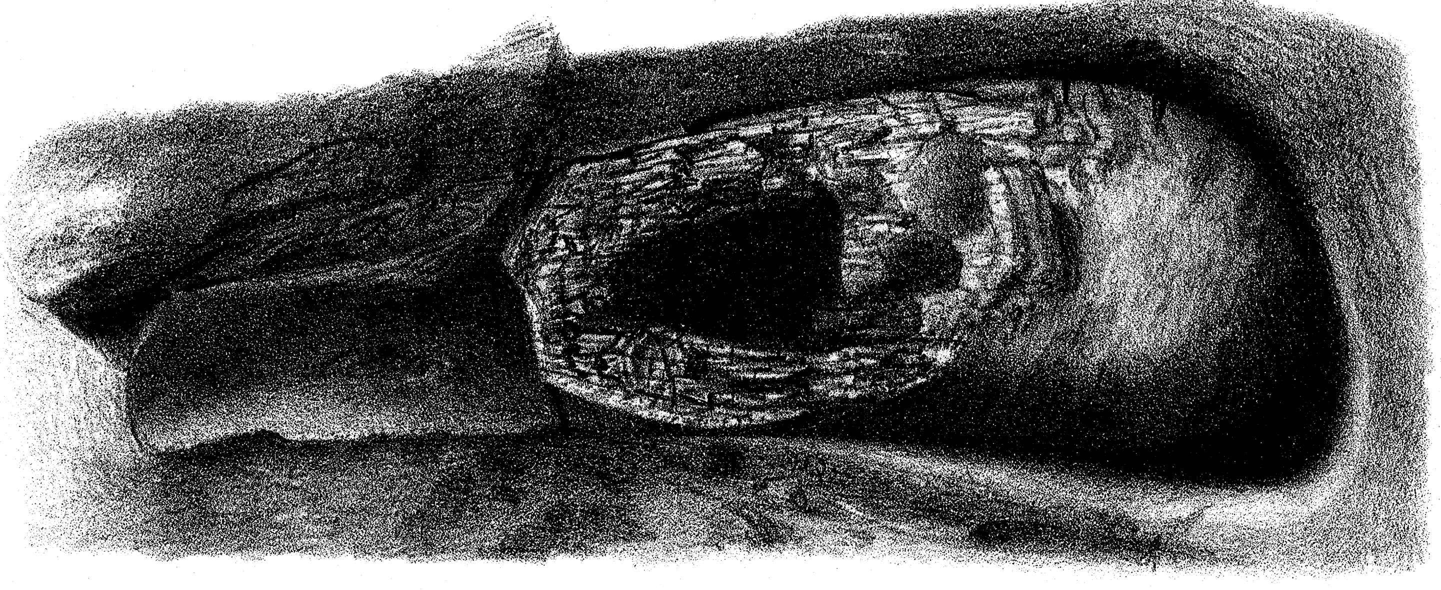


Fig. 2.



J. Dinkel del. et lith.

J. Basire imp.

J. Dinkel del. et lith.

J. Basire imp.

Fig. 3.

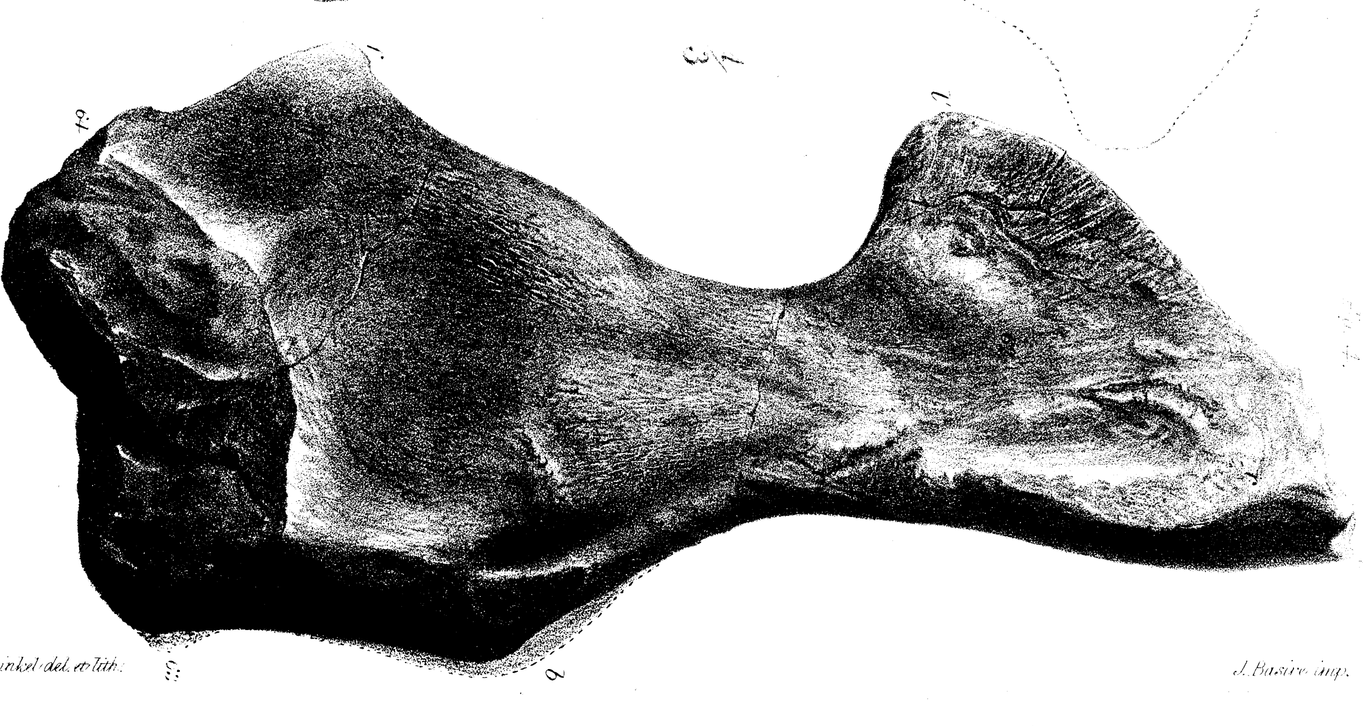


Fig. 4.

J. Dinkel del. et lith. J. Basire imp.

J. Dinkel del. et lith.

J. Basire imp.