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On Reptilian Remains from the Trias of Elgin

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VI.—*On Reptilian Remains from the Trias of Elgin*

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[Plates 11–15.]

I. *Hyperodapedon Gordoni*, Huxley.

The reptile from the Elgin sandstone on which Huxley bestowed this name in 1859,* and which had so great a bearing on the determination of the age of the deposits in which it was found, has lately been the object of further investigation on the part of Professor R. Burckhardt, who, after a study of the specimen from which Huxley drew up his second account,† gave a new interpretation to some of the bones of the skull.‡

It was very much to be desired that further remains should be discovered in order to bring fresh light on the litigious points. I was therefore highly gratified at hearing from my friend Mr. William Taylor, J.P., of Lhanbryde, of the discovery of two new skulls at Lossiemouth, near Elgin, and I gladly accepted his kind offer to send me the specimens for examination. I have not been disappointed in my expectation, and it will be seen that the new material affords a substantial supplement to our knowledge of the Triassic Rhynchocephalians.

Thanks to the kindness of Dr. A. S. Woodward, I was allowed to have the fossils further developed in the Geological Department of the British Museum by Mr. Hall, the mason to whom the second specimen of *Hyperodapedon*, described by Huxley, had been entrusted, and to compare them with those already in the Museum.

In no other respect is the condition of the skeleton on which previous accounts were based more deficient than in the information it affords of the structure of the palate. It is, therefore, highly satisfactory that, imperfect as they otherwise are, the fossils placed at my disposal by Mr. Taylor just happen to supply the desired information.

The remains of the skull referable to *Hyperodapedon Gordoni*, obtained from the

* 'Quart. Journ. Geol. Soc.,' vol. 15, 1859, p. 460.
† 'Quart. Journ. Geol. Soc.,' vol. 43, 1887, p. 675.
‡ 'Geol. Mag.' (IV.), vol. 7, 1900, p. 486.

East Quarry at Lossiemouth, in 1900, indicate a specimen of very nearly the same size as the two already known from Elgin, as may be seen from the following measurements :—

	Millims.
Length (without præmaxillary beak) . . .	125
Width in front	45
Greatest width behind	195

The block of sandstone containing the skull was split horizontally, in the plane of the palate, the upper half containing the cranium with part of the palate, the lower half the mandible with the rest of the palate and the hyoid bones. The bones are in bad condition, and it needed all the skill of Mr. Hall to prevent their crumbling away in his attempt at removing as much as possible of the very hard matrix. Fortunately, there was no need to do anything to the bones of the palate, the outlines of which were fairly well exposed by the splitting of the block (Plate 11).

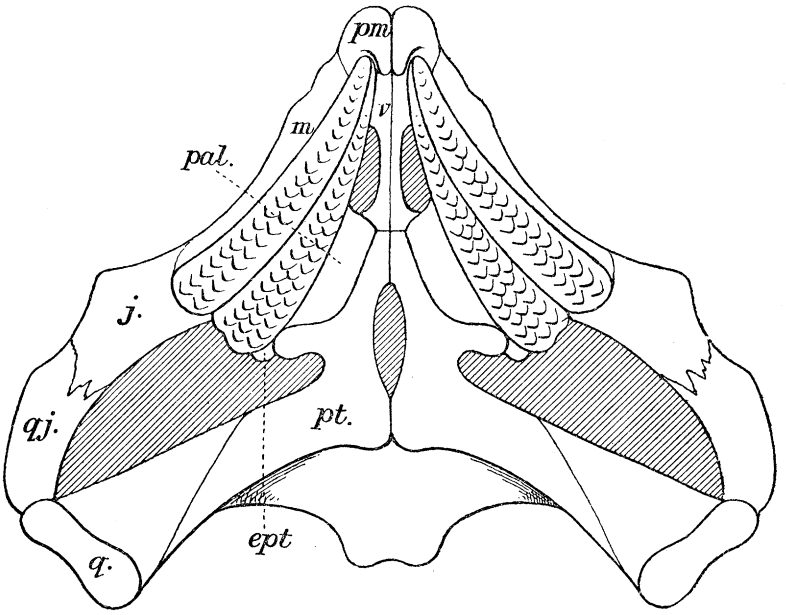

Fig. 1.—Restoration of ventral aspect of skull of *Hyperodapedon Gordoni*.

ept. Ectopterygoid. *j.* Jugal. *m.* Maxillary. *pal.* Palatine. *pm.* Præmaxillary. *pt.* Pterygoid. *q.* Quadrate. *qj.* Quadratojugal. *v.* Vomer.

The structure of the palate is seen to have been very different from what Huxley had surmised, and shows a much nearer approximation to that of *Sphenodon*. It first shows that Burckhardt was right in throwing doubts on the position assigned to the choanæ by Huxley, who regarded them as probably very small and situated immediately behind the basis of the præmaxillary beak ; whilst Burckhardt suggested that they are more likely to be found "in the gap between the posterior margin of the

palate-bones, if the lower jaw could be separated from the rest of the skull." They are now clearly shown to have been elongate-oval and situated between the palatine and the vomer at some distance behind the præmaxillaries.

In the specimen described and figured by HUXLEY in 1887, vertical compression by crushing has caused the maxillary and palatine bones to approximate towards the median line and thus cover nearly the whole palatal surface, only a small portion of the vomers appearing in the open space left behind the base of the præmaxillary beak. Evidence of such a displacement is to be found in the fact that, were the mandible of the same specimen shifted forwards to its natural position, with the bifid extremity embracing the curved-down extremity of the beak, as correctly restored by HUXLEY, the series of teeth with which its edge is beset would fall outside the series of maxillo-palatine teeth instead of fitting, as they should, in the groove between them. This crushing has also caused a fracture in the maxillary bone, a fracture which has been regarded by BURCKHARDT as a suture between maxillary and palatine; but I have been unable to convince myself of the existence of such a suture in the position assigned to it by that observer. One proof of the distinctness of a toothed maxillary bone from the palatine in HUXLEY'S specimen lies in the fact that the dentigerous edge of the right maxillary bone, as determined by HUXLEY, has, through displacement, become more widely separated, in the vertical direction, from the corresponding palatine than the left on the same specimen; a correct idea of the state of things is conveyed by HUXLEY'S figure 3, but not at all by BURCKHARDT'S outline drawing, a great fault with the latter being the omission of the maxillo-palatine groove which is clearly visible in the skull from which his figure is taken, and better still in the new specimen which is the subject of this note. I should have felt perfectly satisfied from an examination of the specimen in the British Museum, that HUXLEY'S interpretation of the tooth-bearing bones was correct. But the matter is further settled by the skull entrusted to me by Mr. TAYLOR, which, on the right side, shows the three dentigerous elements, maxilla, palatine, and dentary, *in situ*. The anterior extremities of the two former, perfectly distinct, are seen in the upper half of the block, together with the rest of the maxillary, whilst the greater part of the palatine has remained in the lower half.

The maxillary and palatine teeth are much worn down in front, where they form a single series; further back, as far as they are preserved in this fossil, they are disposed in two series on the maxillary, and in three on the palatine, and shaped like subtriangular pyramids, as described and figured by Mr. LYDEKKER in *Hyperodapedon Huxleyi*.* But they are quite unlike the figure of *H. Gordoni* given by that author;† this figure, stated to be made from the right palato-maxilla of the specimen described by HUXLEY in 1887, is a fanciful restoration most likely to mislead.

The fossil shows well the elongate rhomboidal vacuity between the pterygoid

* 'Rec. Geol. Surv. Ind.,' vol. 14, 1881, p. 5, Plates 1 and 2, and 'Cat. Foss. Rept.,' vol. 1, p. 299.

† 'Cat. Foss. Rept.,' vol. 1, p. 298.

ending at the point where they converge before diverging again towards the quadrate, to the massive anterior branch of which they are suturally united. The ventrally projecting extremity of the ectopterygoid and its corresponding process of the pterygoid are also distinctly traceable.

It will be seen from the annexed restoration, that the palate of *Hyperodapedon* bears great resemblance, in its general structure, to that of the living *Sphenodon*, the principal differences, apart from the dentition, residing in the smaller bony roof of the mouth and the narrower vomers. So far as the evidence of this part of the skeleton is concerned, there is every reason for regarding *Hyperodapedon* as more nearly related to the existing Rhynchocephalia than to any of the Proterosauria with which we are acquainted.

II. *Stenometopon Taylori*, G. et sp. nn.

The second Rhynchocephalian skull, at first believed to be of *Hyperodapedon*, was obtained by Mr. Taylor in the West Quarry at Lossiemouth, in 1902. When it reached me, it was embedded in a large block of sandstone split into three, and only showed, rather vaguely, the outlines of the rostral region and anterior part of the mandible and of the left side of the rest of the skull. By picking out some of the sandstone, it was soon found that a very valuable specimen had been secured, which differed very considerably from *Hyperodapedon Gordoni*, and indicated a quite new type of Rhynchocephalian. The largest piece of the block (A), which contains the left side of the skull, was first taken in hand. With the help of Mr. Hall, the whole inner surface of the temporal region was cleared of the matrix and became very clearly exposed, the rest of the same side of the skull being shown by the natural splitting of the block. The fossil in this condition was then photographed by Mr. J. Green (Plate 12), and a cast of it was made by Mr. Barlow. The second piece of the block (B), which fitted into a concavity of the preceding, and showed the outlines of the left orbit and supra-temporal region, was likewise photographed and cast; whilst the third piece (C), with both sides of the rostral part of the skull, and a part of the right side as far back as the temporal region, was divided into two, and the anterior or rostral section was entirely cleared from the matrix.

It then appeared that by a skilful treatment of this fossil most of the bones in the largest of these pieces could be disengaged, and after consulting with Dr. Smith Woodward, and Messrs. Hall and Barlow, it was decided to do away with the matrix of the side of the skull which had been cast and photographed, and by re-embedding them in plaster, to clear the bones from the outside and thus obtain a complete view of that part of the skull. This difficult task was successfully accomplished by Mr. Hall, and, as may be seen from the annexed figures (Plate 13), the nearly complete skull of a reptile allied to but quite distinct from *Hyperodapedon* has been brought to light.

One of the most striking features of *Hyperodapedon* as compared with its New

Zealand ally, *Sphenodon*, resides in its much broader and more massive skull. The skull of the new Rhynchocephalian, although agreeing in its general structure with *Hyperodapedon*, is not broader and hardly more massive than that of *Sphenodon*, from which it differs, however, very much in shape. The rostrum has quite a different direction from either of these skulls, the tusk-like præmaxillaries, instead of being bent downwards into recurved processes, are directed forwards in a gradual slope from the frontal region to their extremities, which project beyond the turned-up

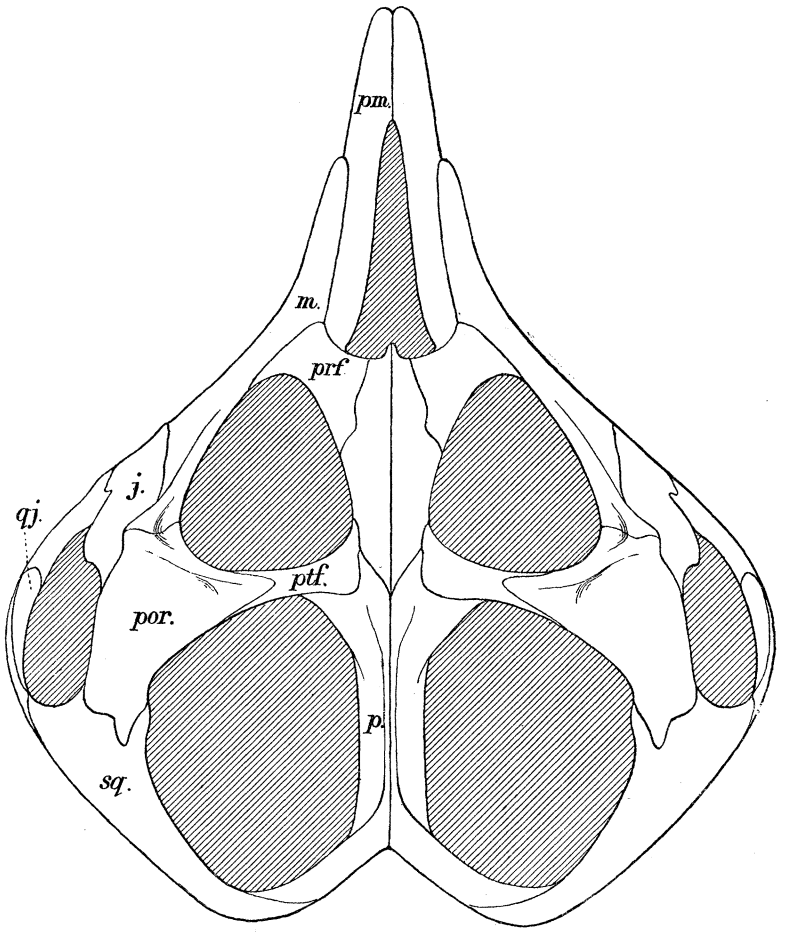

Fig. 2.—Restored skull of *Stenometopon Taylori*, upper view. (The bone bearing no lettering is the frontal.)

j. Jugal. *m*. Maxilla. *p*. Parietal. *pm*. Præmaxilla. *por*. Postorbital. *prf*. Præfrontal. *ptf*. Postfrontal. *qj*. Quadratojugal. *sq*. Squamosal.

extremities of the mandibular rami. This is practically the reverse of the condition in *Hyperodapedon*, where the strongly curved premaxillary "tusks" are received between the outwardly directed rostral processes of the mandible.

As in *Hyperodapedon*, the nasal aperture is single, but, in accordance with the shape of præmaxillaries, it is more elongate, its length being to its width as $2\frac{1}{3} : 1$; its posterior border extends to the level of the orbits, which are entirely directed upwards.

The inter-orbital region is much narrower than in *Hyperodapedon*, especially behind, where its width is only two-fifths the greatest diameter of the orbit. The supra-temporal fossæ are very large, separated from the orbits by the narrow post-orbital arch, and from each other by the sharp median crest of the parietals. The latero-temporal fossa is kidney-shaped and proportionally larger than in *Hyperodapedon*, but smaller than the supra-temporal fossa. The maxillary bone is deep and nearly vertical, with an oblique ridge extending downward and backward to the jugal; the maxillary teeth, so far as they are preserved, appear very similar to those of *Hyperodapedon*, and form a single series in front and two behind. The palate is imperfectly preserved, but what is left of it agrees in essential points with *Hyperodapedon*; the palatine teeth are disposed in three series behind.

The cranial characters of the three genera forming the family Rhynchosauridæ may be defined as follows:—

1. *Rhynchosaurus*. Skull of moderate width, with large orbits directed outwards and upwards; præmaxillary beak recurved, received between short, obtuse processes of the mandible; maxillary and palatine teeth in a single series.

2. *Hyperodapedon*. Skull very wide, with small orbits directed outwards and upwards; præmaxillary beak recurved, received between pointed diverging processes of the mandible; maxillary and palatine teeth in two or more series.

3. *Stenometopon*. Skull of moderate width, with small orbits directed upwards; præmaxillary beak directed forwards, not embraced by the extremities of the mandibular rami, which are curved upwards; maxillary and palatine teeth in two or three series.

I may now proceed to a more detailed description of the preserved parts of this skull, beginning with the measurements:—

	Millims.
Length to extremity of parietal crest	177
,, ,, supra-temporal arch	190
Greatest width (at temple)	160
Length of præorbital region	77
,, narial aperture	63
Width of ,, ,,	26
Longitudinal diameter of orbit	44
Transverse ,, ,,	37
Width of inter-orbital region in front	40
,, ,, ,, behind	16
Least width of post-orbital arch	5
Least width of upper temporal arch	15
,, lower ,,	20
Longitudinal diameter of supra-temporal fossa	60
Transverse ,, ,, ,,	47

	Millims.
Vertical diameter of latero-temporal fossa . . .	45
Horizontal ,, ,, ,, . . .	38
Greatest depth of skull (at orbits)	77
Depth of maxillary bone	60

The præmaxillary bones are massive and compressed, converging forwards and closely in contact with each other in front of the nasal aperture; they project for about half of their length from the maxillary bones to form the so-called rostral beak; each half of the beak is about twice as deep as broad, rounded above, obtusely keeled beneath. The nasal aperture is bounded at the sides by the præmaxillaries, and behind by the præfrontals and the frontals, the latter produced forwards in a short median process which indicates the presence, in life, of a cartilagious internarial septum. Behind the beak the sides of the præmaxillaries are nearly entirely covered

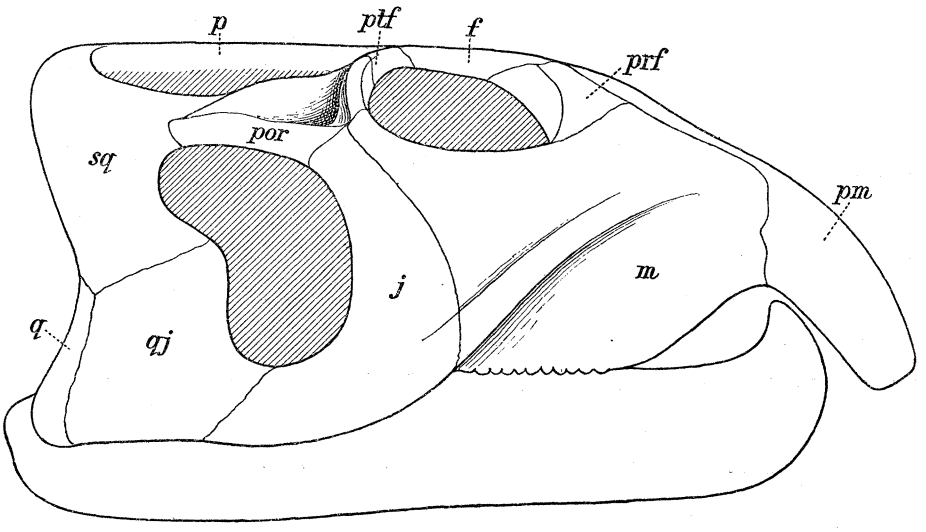

Fig. 3.—Restored skull of *Stenometopon Taylori*, side view.

f. Frontal *j*. Jugal. *m*. Maxillary. *p*. Parietal. *pm*. Præmaxilla. *por*. Postorbital. *prf*. Præfrontal. *ptf*. Postfrontal. *q*. Quadrate. *qj*. Quadratojugal. *sq*. Squamosal.

by the maxillary bones, which are nearly vertical, and bear a raised obtuse ridge as in *Hyperodapedon*, this ridge extending obliquely downwards towards the oral border of the jugal. Nasal bones appear to be absent. The præfrontal bones, as shown in the section obtained by severing the rostral part of the skull from the block to which it was first attached, are rather large, but as in *Sphenodon* they are to some extent hidden under the upward laminæ of the maxillaries; they do not extend backward to meet the post-frontals, and border the anterior two-fifths of the orbit, as shown by a section of the right frontal region in the piece designated above as C.

The parietals (Plate 13, fig. 2) are very similar to those of *Sphenodon*, forming a median crest showing distinctly the sagittal suture, but they do not embrace a pineal foramen.

The crest is produced forward to between the orbits, where it joins the frontals, whilst the sides diverge forwards and join the post-frontals and the post-orbitals.

The post-orbital and temporal arches, which have been nearly entirely cleared from the matrix, are extremely well preserved, and show admirably, both inside and outside, the sutures between the component bones, as represented on the annexed figure (Plate 13, fig. 1). Just below the orbit the post-orbital bears a strong obtuse transverse ridge, followed by a depression as in *Sphenodon*. The kidney-shaped latero-temporal fossa (Plate 12) is bordered by the post-orbital, the squamosal, the jugal, and the quadrato-jugal; the squamosal forms a large plate on the temple and tapers towards the parietal, which it joins to form a rather slender supra-temporal arch. On the outer surface, the quadrate is covered to a great extent by the quadrato-jugal, whilst the articular extremity, in the remains at hand, is only represented by an impression.

The section of the block (B) containing the parietal bones has been excavated below and shows the anterior part of the brain-cavity, with the imperfectly preserved but perfectly recognisable metapterygoids or columellæ cranii, which appear to have been quite similar to the same elements in *Sphenodon*. On the left side of this cavity we see remains of the diverging posterior branches of the pterygoids, on which the base of the metapterygoid rests, and in front the much damaged palate and oval border of the maxillary with badly preserved teeth. The anterior processes of the pterygoids are seen, as well as the vacuity between these bones, which is of very small size. The vomers are preserved in the part of the block containing the rostral region of the skull (Plate 13, fig. 3); they are a pair of bones diverging in front to join the maxillaries below the base of the "beak," and forming behind a narrow septum between the choanæ. Nothing more, unfortunately, can be said of the palatal aspect of the skull.

III. *Ornithosuchus Woodwardi*, E. T. Newton.

The third reptile, for the study of which I am indebted to Mr. William Taylor, is represented by parts of a whole skeleton which must have been about 6 feet long, and of the entire mandible, together with the anterior portion of the skull of a second specimen of nearly the same size. These remains were obtained in the West Quarry at Lossiemouth, in 1901. By the kind permission of Dr. A. S. Woodward they have been developed, whenever practicable, by Mr. Hall in the Geological Department of the British Museum.

In sending these fossils, Mr. Taylor had pointed out to me that they appeared to be referable to the genus *Ornithosuchus* described by Mr. E. T. Newton,* differing, however, in the much larger size and somewhat in the dentition. I had no difficulty in convincing myself of the correctness of Mr. Taylor's provisional generic determination, and as I was allowed to compare the type specimen of *Ornithosuchus Woodwardi* preserved in the British Museum, the question I had to settle was merely whether

* 'Phil. Trans.,' 1894, p. 586.

the new fossils represented older individuals of the same reptile, or a distinct species.

The skeleton so carefully described by Mr. Newton indicates a reptile about $2\frac{2}{3}$ feet long, and was obtained by the Rev. Dr. G. Gordon at Spynie, near Elgin, the locality which yielded the celebrated *Telerpeton elginense*, remains of which have also turned up at Lossiemouth, as I am informed by Mr. Taylor.

The second specimen alluded to above is the more suitable for a comparison with the type, since its dentition is better preserved. It consists of a large block of sandstone broken into four, a right piece (*a*) containing the rostral part of the skull and a corresponding part of the mandible; a left piece (*b*) containing, mostly as impressions, the right border of the rostral part of the skull and the posterior three-fifths of the right mandibular ramus; the third and fourth pieces (*c* and *d*) are the counter-slabs of the two others, and show, partly as bones, partly as impressions, the left præmaxilla and maxilla and the corresponding ramus of the lower jaw, together with its symphysis, and the hyoid cornua.

The skull of the type of *Ornithosuchus Woodwardi* measures 115 millims. in length, the mandible 110 millims. The anterior part of the head in the right piece (*a*) of the second specimen here described and figured (Plate 14), measures 150 millims., and indicates, assuming the proportion of the remainder of the skull to have been the same as in *O. Woodwardi*, a skull 270 millims. long, whilst the complete left ramus of the mandible of the same individual measures actually 235 millims. The head of this new specimen thus proves to have been a little over twice the length of the type with which I will compare it. In this comparison I find the length of the largest tooth, or rather of the part which projects out of the socket, to be 26 millims. as against 11 millims., the greatest depth of the skull at the nares 44 millims. as against 21 millims., the length of the nasal aperture 43 millims. as against 22 millims. The left side of the anterior part of the head is better preserved than the right and has been skilfully chiselled out of the matrix by Mr. Hall. The very tip of the snout, with the first tooth, is, however, broken away, but its right side is preserved entire, as an impression, in the other slab (*c*), and the upper part of the snout remains embedded in the stone, which could not safely have been removed; its outline is fortunately well shown on the left side. The left side (Plate 14, fig. 1) shows the same number of teeth as figured in *O. Woodwardi*, and they are disposed much in the same manner, viz., three præmaxillaries, a hiatus, three maxillaries increasing in size, a hiatus, and five further maxillaries, the alveolar border of the maxillary bone being broken after the fifth. The upper slab (*c*) of the right block shows, however, that four præmaxillary teeth were present in an uninterrupted series, the first being only represented as an impression of its base; and that when all the teeth were in place, no hiatus existed after the third maxillary tooth, which was followed by six in regular succession. As they are seen on the left side of piece *a*, only three of the five hinder maxillary teeth are fully developed, the two intermediate ones having been lost in life, and being in process of replacement,

the points of the new teeth projecting out of the sockets. The length in millimetres of the teeth in the left upper jaw is as follows, proceeding from front to back, the missing teeth being indicated by queries:—Pm. ?, 15, 23, 10*; M. 18, 19, 26, ?, 20, ?, 17, ?, 15. The mandible, on the left side, shows only the two anterior teeth and the socket of the third; the first is small and directed forward, and followed, after a hiatus, by two larger teeth, the second of which, well shown on the other side, bites in a notch of the upper jaw at the junction of the præmaxillary and maxillary bones, the suture between which, hidden by the tooth in the type specimen, is here clearly visible. The three first mandibular teeth measure 11, 25, and 25 millims. respectively. Remains of four further teeth are seen on the right ramus. What is preserved of the lower jaw shows the symphysis to have been 45 millims long, or about one-fifth of its total length, and formed entirely by the dentary bones, the posterior vacuity 58 millims. in length and 20 millims. in depth, and its posterior extremity to have extended but slightly (12 millims.) beyond its articulation with the skull.

In his description, Mr. Newton states that "all the teeth, so far as can be seen, are recurved, pointed, and compressed, with acute anterior and posterior edges. Some of the larger teeth show the hinder edge of the crown to be serrated throughout its length, and the front edge for about half its length. The basal parts of the teeth are rounder than the crowns and are not serrated." However, several of the crowns being broken away, the statement as to *all* the teeth being compressed and sharp-edged was made with due reserve, and I find on examination of the type specimen that nothing contrary to what I have to describe from better material can be said to exist.

The first mandibular tooth is not compressed, its anterior border shows neither an edge nor a serration. These are present on all the other teeth, and on the second maxillary the serration even extends along the whole length of the part projecting out of the socket. The denticles of the serrated edge are directed rather obliquely towards the distal end of the tooth (see Plate 14, fig. 3), not straight outwards as figured in Mr. Newton's Memoir. The longest, or third maxillary tooth, has the crown more strongly curved backwards than in the figure of *O. Woodwardi*. Another difference from the type is to be found in the præmaxillary teeth, which are shown by the size of the sockets to have been sub-equal in the small specimen, whilst in the larger one here described the basal diameter of the third tooth is one and a half that of the others. The comparison I have made of skulls of recent crocodiles shows, however, that such differences in the relative size of the teeth, or rather of their sockets, are just what one would expect to find in individuals of the same species at different ages, as may be seen from the measurements, in millimetres, of the sockets of the three corresponding præmaxillary teeth (1, 2, 3) in four skulls of the Indian crocodile, *Crocodilus porosus*:—

* Point broken off.

Length of skull.	1.	2.	3.
150	$2\frac{1}{2}$	3	3
350	7	8	10
500	12	14	18
700	15	20	28

The comparison of this specimen with the type of *Ornithosuchus Woodwardi* has failed to bring out any differential characters which may not be dependent on age, and nothing, in my opinion, would justify its reference to a distinct species.

I have mentioned above that the ossified cornua of the hyoid are to be seen in sections *c* and *d* of the block. These are not short and stout as in crocodiles, but long and slender as in *Sphenodon*. Much of the bone of the left cornu, and a complete impression of the right (Plate 14, fig. 4) are preserved. The length is 72 millims.; the greatest diameter $4\frac{1}{2}$ millims.

But in addition to the skull and hyoid, this same specimen shows, in a detached stone, a few cervical shields, and, towards the posterior end of sections *b* and *d*, at a distance of 40 millims. from the posterior extremity of the mandible, the nearly complete right clavicle, together with remains of the interclavicle. The clavicle, which measures 63 millims., is widely expanded at its inner extremity, its greatest width being nearly 25 millims.; it converges obliquely forwards towards its fellow and it overlaps, to a slight extent, the anterior extremity of the interclavicle (Plate 14, fig. 5).

The second example is still more important than the first, as it consists not only of a part of the skull and nearly the whole mandible, but also of a considerable portion of the body.

The skull is broken in several blocks and the right and left side do not exactly join. The right block (Plate 15, fig. 1), which has now been much reduced by Mr. Hall's skilful chisel, shows the right upper surface of the skull, from the præfrontal region to the occiput, and much of the inner surface, where the block was split by the quarrymen, revealing an important point in the structure of the palate, which Mr. Newton had to leave unsolved. The bones having been displaced before fossilisation took place, it is possible to ascertain the exact limits of the pterygoid and palatine at their junction on the inner side of the aperture regarded as the inner nostril, and the pterygoid is also seen to join the vomer, as shown by the annexed sketch. The same block also shows the posterior portion of the right maxillary bone, with two imperfectly preserved teeth, the latero-temporal fossa with its arches, and a small portion of the mandible with its large vacuity, the rest of the posterior part of the latter bone being seen as an impression on a separate piece of stone.

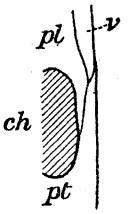

Fig. 4.

ch. Choanæ.
pl. Palatine.
pt. Pterygoid.
v. Vomer.

An examination of this fossil as well as of the type specimen suggests a slight departure from Mr. Newton's restoration of the sutures between the various bones bordering the orbit above and the supra-temporal fossa.

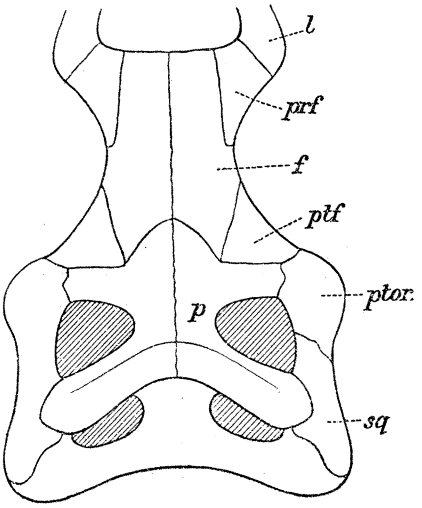

Fig. 5.—Restoration of vertex and back of skull.

f. Frontal. *l.* Lachrymal. *p.* Parietal. *prf.* Præfrontal. *ptf.* Post-frontal. *ptor.* Post-orbital. *sq.* Squamosal.

A large slab contains an impression of the symphysial part and the left ramus of the lower jaw, with here and there remains of the bones and of a few teeth. The whole mandible measures 20 centims., the symphysis about 50 centims. Assuming the left ramus to be in undisturbed position, the width between the outer borders of the mandible at its articulation with the skull would be 13 centims. In the type of *Ornithosuchus Woodwardi* the greatest width of the skull at the quadrates is a little less than three-fifths its length, whilst in the present specimen it would be rather more than three-fifths.

The articular end of the right quadrate, together with the corresponding extremity of the mandibular ramus, forms part of a further block (Plate 15, fig. 2), containing the right side of the neck and part of the right fore limb. There is, unfortunately, a slight solution of continuity at the occiput, but the upper surface of the right ex-occipital is exposed on the other aspect of the block or slab.

The neck, which measures 14 centims. to the clavicles, is shown in the two larger slabs (Plate 15, fig. 2). The form and number (apparently eight) of the cervical vertebræ are very similar to those of a crocodile, but the neural spines are in contact with each other distally; the form of the centra is not very clearly defined, but they appear to have been biconcave. Nothing can be said of the hypapophyses.

Above the left side, over the neural spines of the vertebræ, can be seen two series of dermal plates with feeble sculpture. On the neck these plates are rather small, tapering outwards; they gradually increase in size towards the shoulders, and become large and juxtaposed on the body. The concentric striation of the larger plates agrees well with Mr. Newton's description and figure, except that it is less strongly marked. One of the anterior cervical shields is 16 millims. long and 23 millims. wide,

whilst on the anterior part of the trunk, just behind the shoulders, a shield measures 25 millims. in length as well as in width.

The two large slabs which contain the neck and the dermal shields also show the general outline of the clavicles and interclavicle, and of a considerable portion of the fore limb, as represented on Plate 15, fig. 2. Not much is left of the clavicles, but just enough to show that their shape was as in the other specimen described above, whilst the interclavicle is seen on the counter-slab to have been arrowhead shaped as in the *Herpetosuchus Granti* described and figured by Mr. Newton.

Of the greatest importance is the information which these slabs afford as to the plastron or so-called system of abdominal ribs. That such a kind of plastron existed in *Belodon* had long ago been suspected, and is shown by a well-preserved angulate median piece in the British Museum. Now we have at last before us the set of bones in its perfect, undisturbed condition, at least of about the second third of the body. This plastron (Plate 15, figs. 2, 3) resembles very closely that of *Sphenodon*, each segment being formed of a median angulate piece, wider at the angle, to which a lateral limb is attached; the segments are, however, much closer together than in the New Zealand reptile, about 35 of them being present on a space 115 millims. long, or, I should think, about half of its length.

In addition to the parts here described, we have remains of a considerable portion of the tail, of the limbs, and of the pelvis, which are either too fragmentary for description, or would require an amount of careful, laborious prepartion for which there is, at present, no opportunity.

The points to which I have limited my attention in this contribution are, however, sufficient to show, as a supplement to Mr. Newton's description, the exact nature and affinities of the reptile named *Ornithosuchus Woodwardi*.

Much as I admire Mr. Newton's description of *Ornithosuchus*, a model of completeness and accuracy, I cannot, any more than I did at the time of its publication,* endorse his conclusions as to the systematic position of the reptile, conclusions put forward, it is true, with due reserve and diffidence. Dr. Smith Woodward was nearer the truth when he compared it to *Aëtosaurus*. The additional evidence brought to light by Mr. Taylor's specimens shows that *Ornithosuchus* cannot be included among the Dinosaurs, but must be placed in the vicinity of *Belodon*. Much of the hesitation which some authors have experienced in assigning certain Triassic Reptiles their correct position in the system is due to the wide limits usually allowed to the Orders Crocodilia and Dinosauria, which preclude any sharp comparative definition of the two. Huxley's division of the Crocodilia into *Para-*, *Meso-*, and *Eusuchia* is open to criticism, as it has often been pointed out that the difference between the first and second Sub-orders is so very much greater than that between the second and the third. And now that the structure of the Parasuchia, to which *Belodon*, *Stagonolepis*, *Aëtosaurus*, *Herpetosuchus*, *Ornithosuchus* belong, is getting better known, it is clear

* *Cf.* 'Zool. Record,' 1894, Rept., p. 35.

that they agree quite as much, if not more, with the Rhynchocephalia, the Pelycosauria, and the carnivorous Dinosaurs as with the Crocodilians. I therefore regard them, in agreement with various authorities,* as constituting an Order, equivalent in rank to Dinosaurs and Crocodilians (Emydosauria), for which the earlier name *Thecodontia*, Owen (1860) should be used. The Order Dinosauria, as usually understood, ought to be restricted to the carnivorous forms, the others deserving to form an equivalent Order under the name of Orthopoda, Cope, 1869 (= Predentata, Marsh, Ornithischia, Seeley).

The Thecodontia agree with the Pelycosauria, Emydosauria, and Dinosauria, to which they are very closely and nearly equally related, and differ from the Rhynchocephalia in the truly thecodont dentition (teeth in sockets, with hollow roots in which the replacement teeth develop at the base of the old ones); they agree with the Rhynchocephalia and Pelycosauria, and differ from the Emydosauria and Dinosauria in the presence of clavicles, whilst they show close resemblance to the Rhynchocephalia proper in the structure of the plastron or system of abdominal ribs, the condition of which in the Pelycosauria is still unknown. The presence of clavicles and the condition of the pelvis, in which the pubis enters the acetabulum, together with other characters showing greater generalization, afford ample justification for the separation of the Thecodontia, as a group of ordinal rank, from the Emydosauria.

EXPLANATION OF THE PLATES.

Plate 11.

Hyperodapedon Gordoni.

Slab and counter-slab, showing lower aspect of skull, $\frac{3}{4}$ natural size. The upper figure represents the lower half of the slab.

Plate 12.

Stenometopon Taylori.

Left inner side of skull, as seen before the removal of the matrix from the outer side, $\frac{3}{4}$ natural size.

Plate 13.

Stenometopon Taylori.

Fig. 1. Upper view of rostral part and left side of skull (same specimen as figured on Plate 12), cleared from the matrix.

Fig. 2. Frontal and back part of skull of the same specimen.

Fig. 3. Lower view of rostral part of the specimen represented on fig. 1, showing the vomers separating the choanæ.

The three figures of the natural size.

* Owen, 1860; Cope, 1869; McGregor, 1901; F. v. Huene, 1902.

Plate 14.

Ornithosuchus Woodwardi.

Fig. 1. Left side of jaws of second specimen (p. 183), natural size.
Fig. 2. Right side of same.
Fig. 3. Part of maxillary tooth, enlarged $2\frac{1}{2}$ diameters to show serration.
Fig. 4. Left hyoid cornu, natural size.
Fig. 5. Restoration of clavicles and interclavicle, about $\frac{3}{4}$ natural size.

Plate 15.

Ornithosuchus Woodwardi.

Fig. 1. Upper view of fragment of skull, right side, of first specimen (p. 185).
Fig. 2. Lower view of a considerable part of the body of the same specimen, $\frac{1}{2}$ natural size.
Fig. 3. Median part of plastron, from counter-slab of fig. 2, natural size.
Fig. 4. Cervical and anterior dorsal scutes of the same specimen, $\frac{1}{2}$ natural size.

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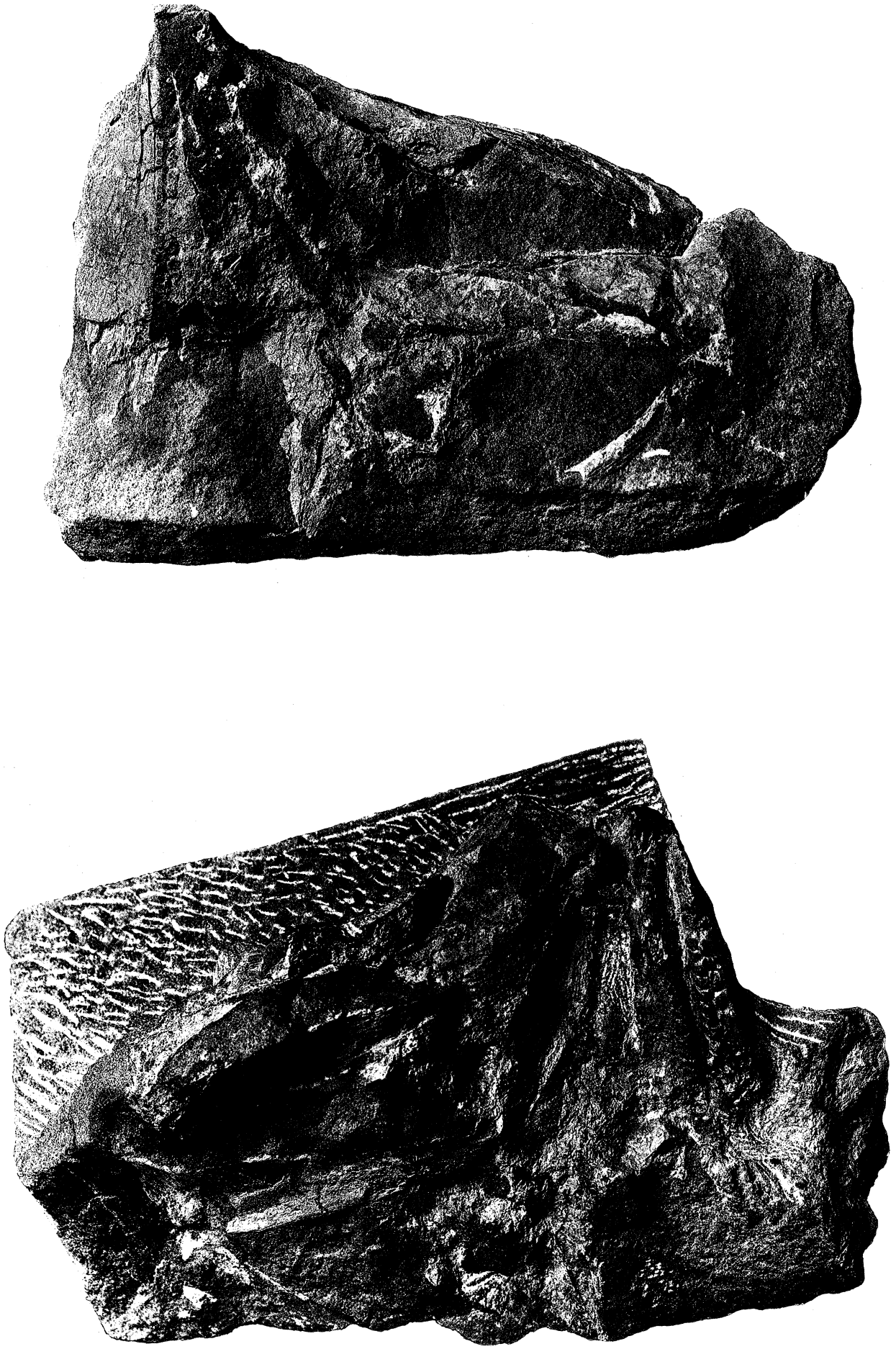

HYPERODAPEDON GORDONI.

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STENOMETOPON TAYLORI.

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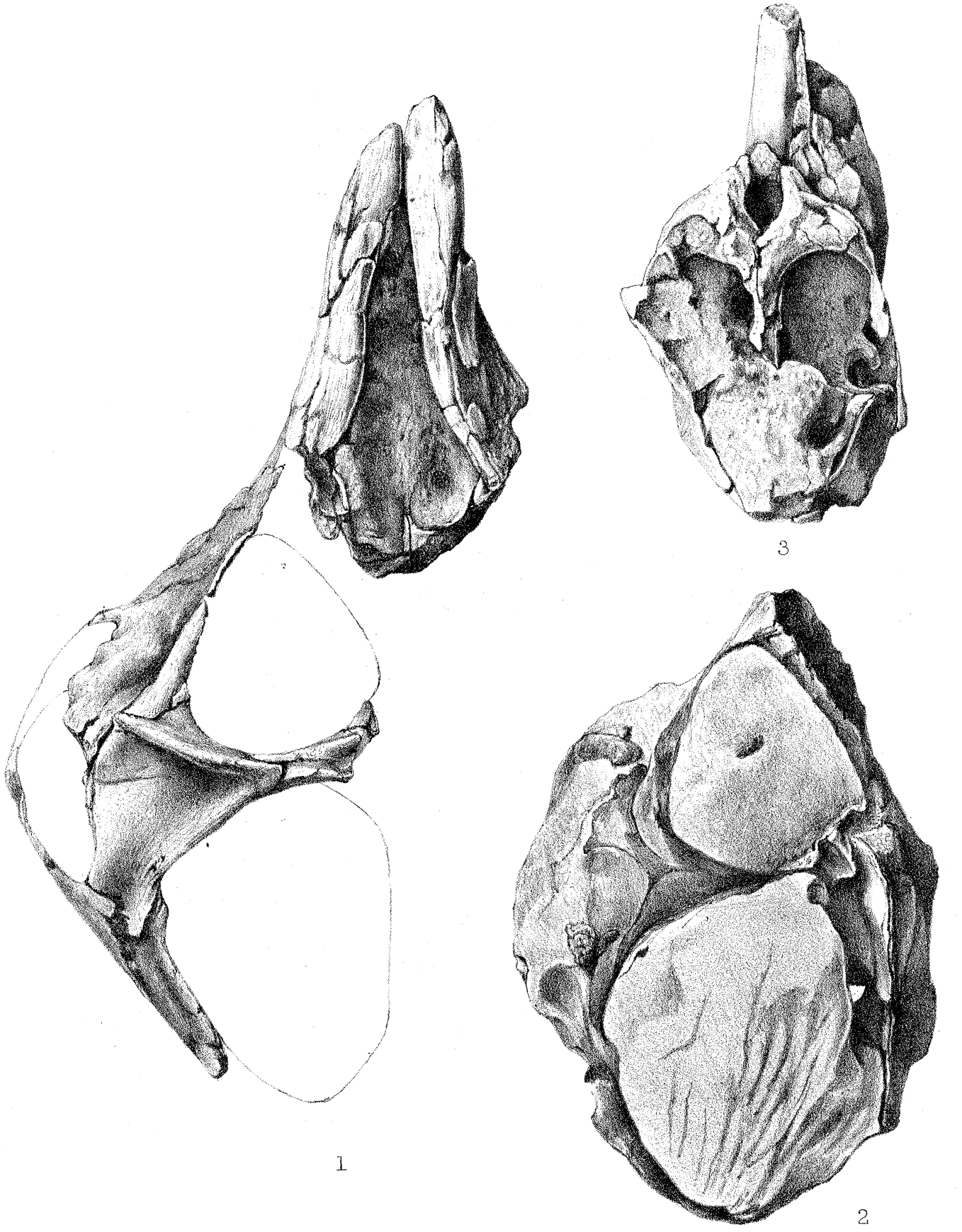

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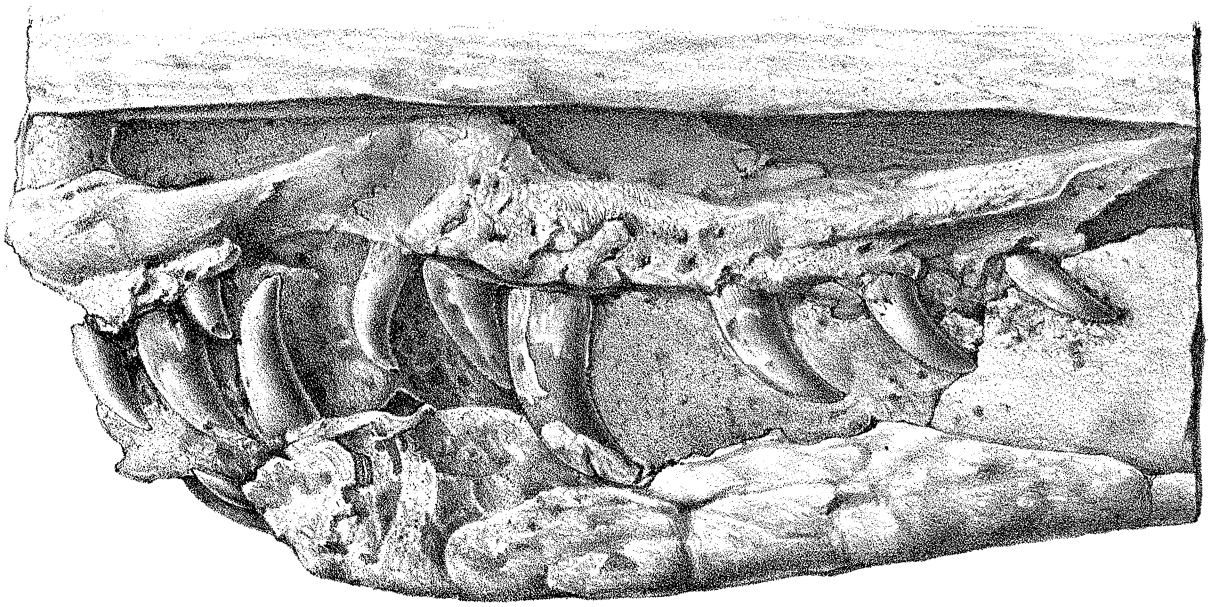
J. Green del. et lith.

West, Newman imp

STENOMETOPON TAYLORI

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES



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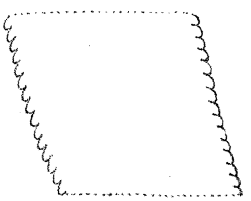

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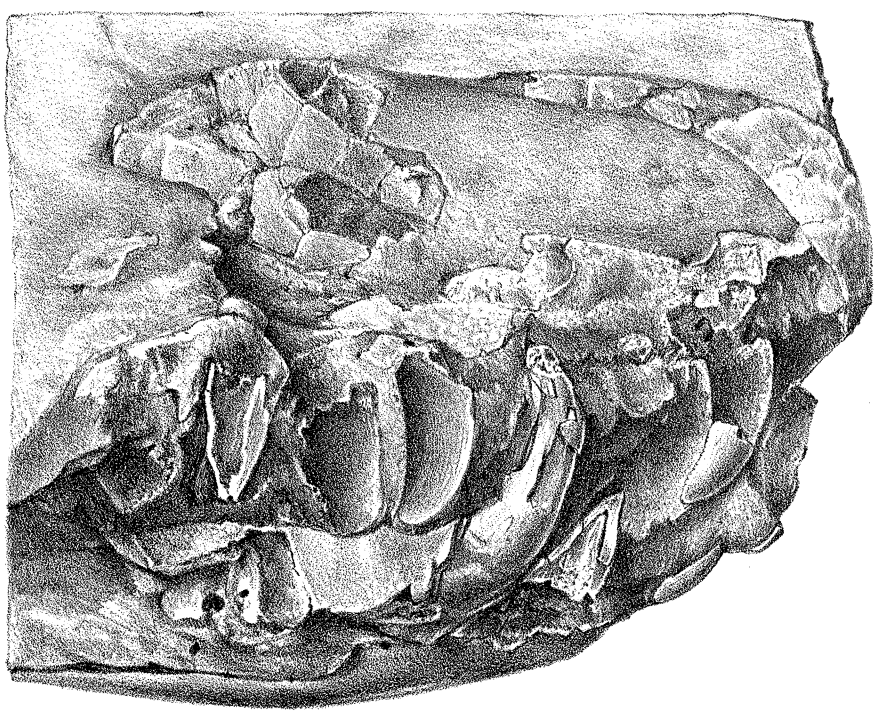

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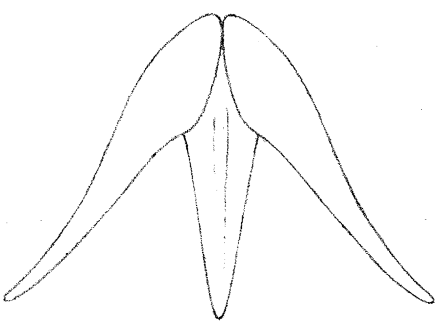

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J. Green del. et lith.

West, Newman imp.

ORNITHOSUCHUS WOODWARDI.

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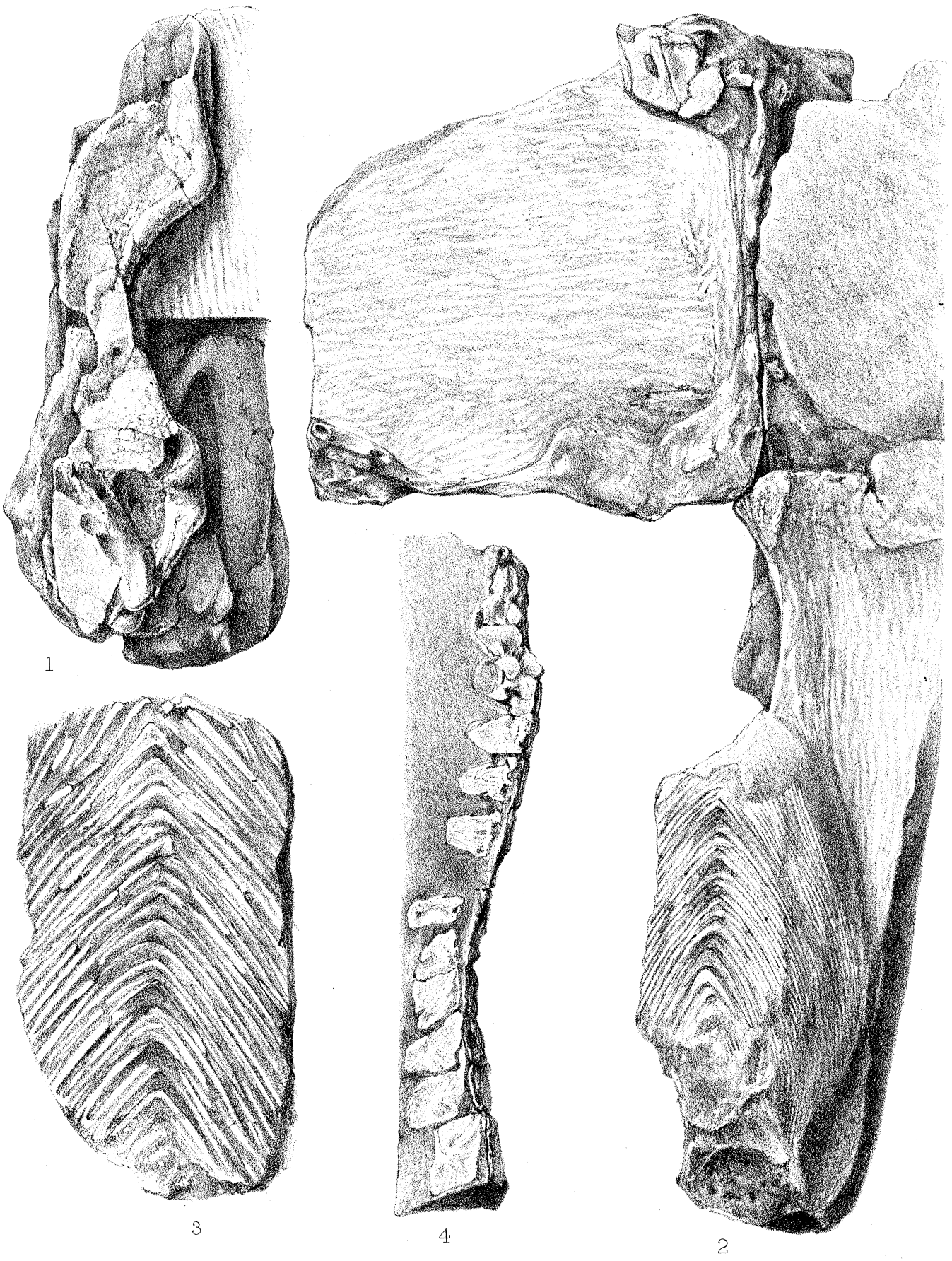

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J. Green del et lith.

West, Newman imp

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PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B BIOLOGICAL SCIENCES

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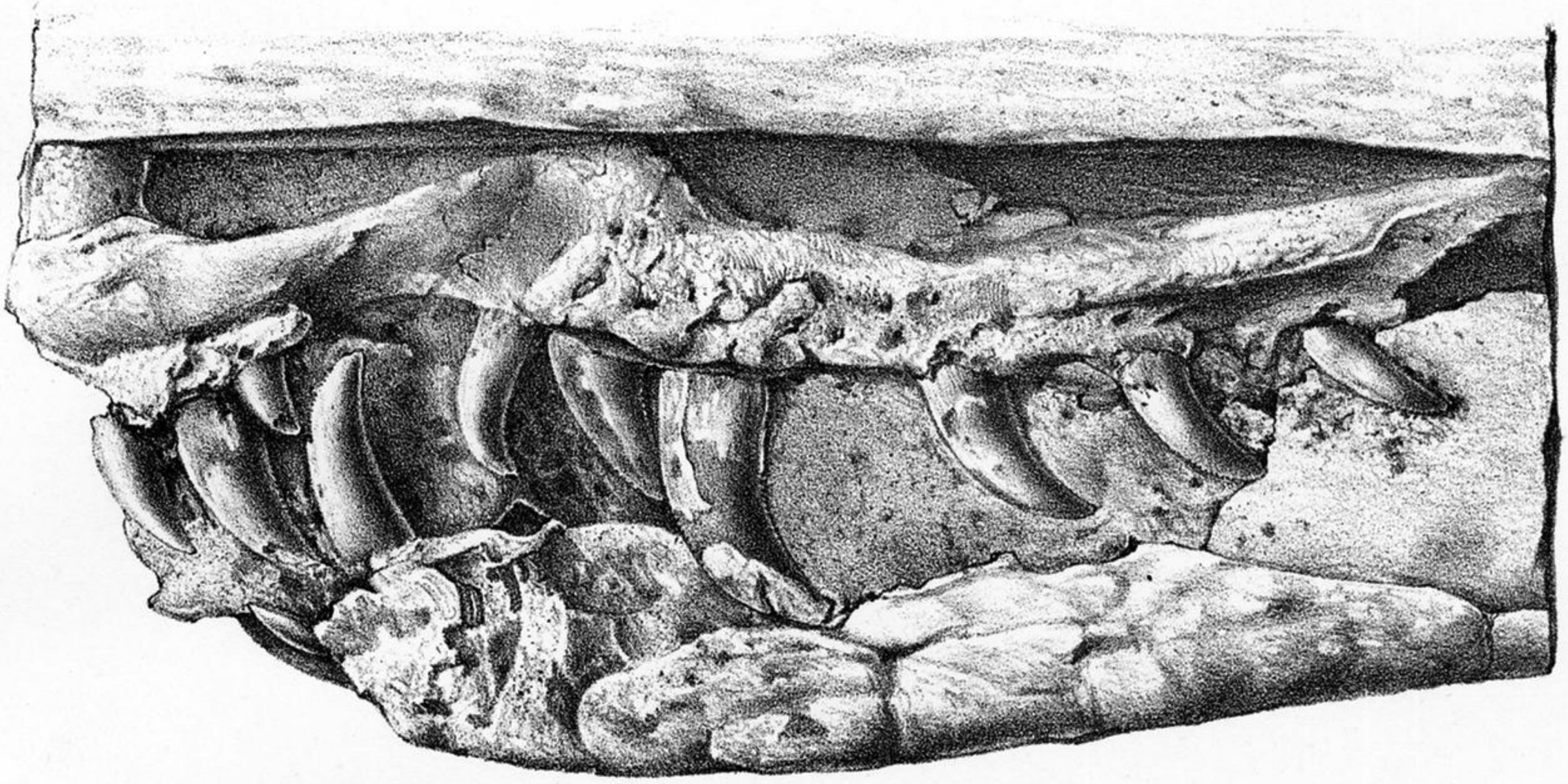

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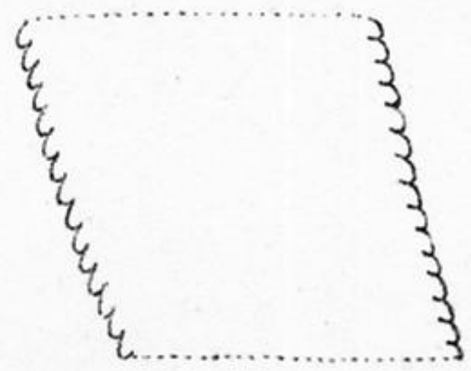

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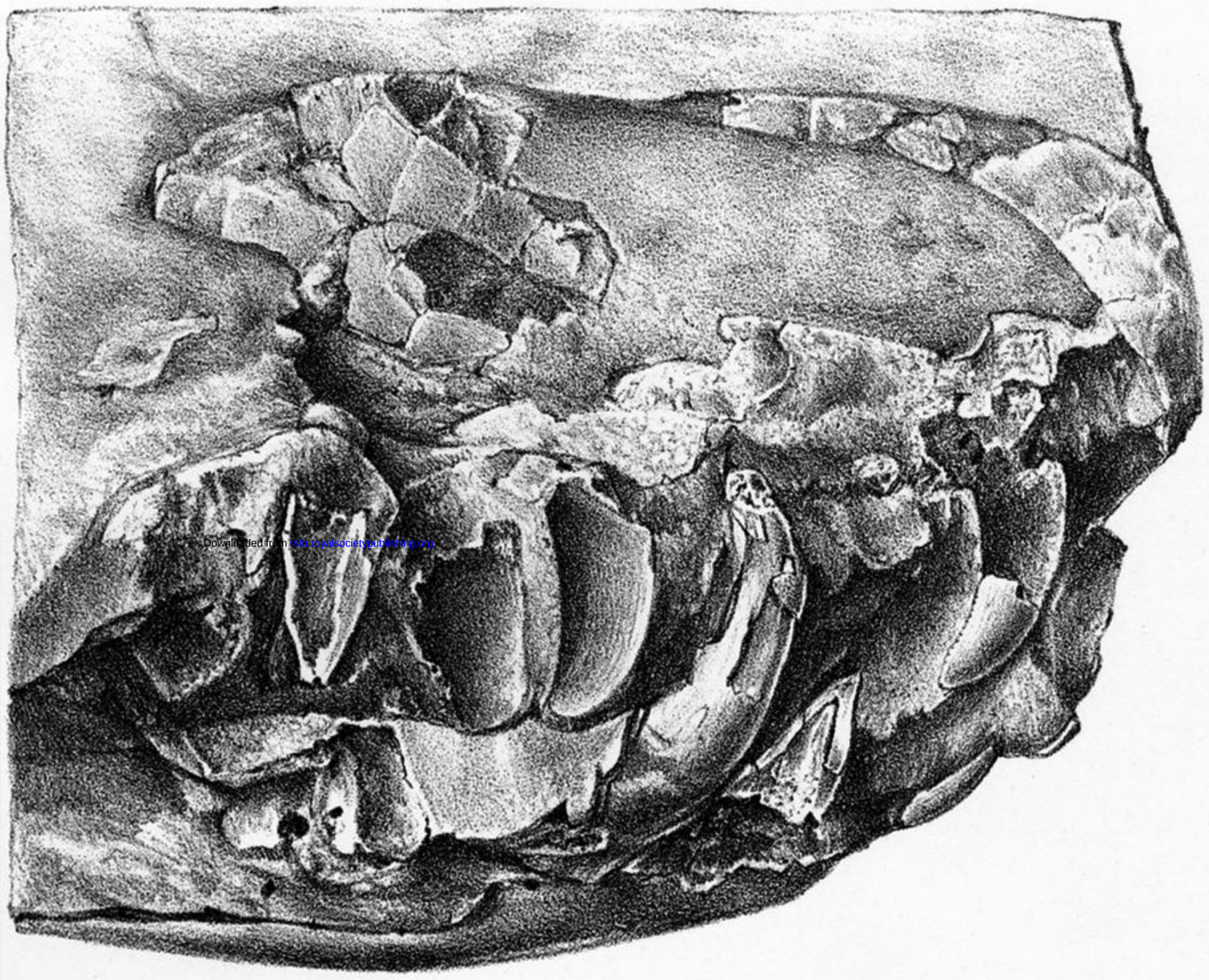

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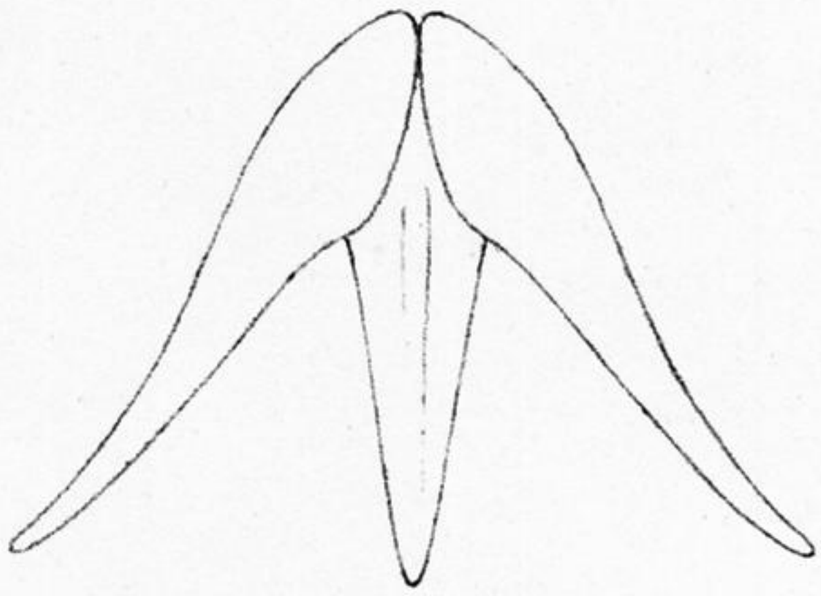

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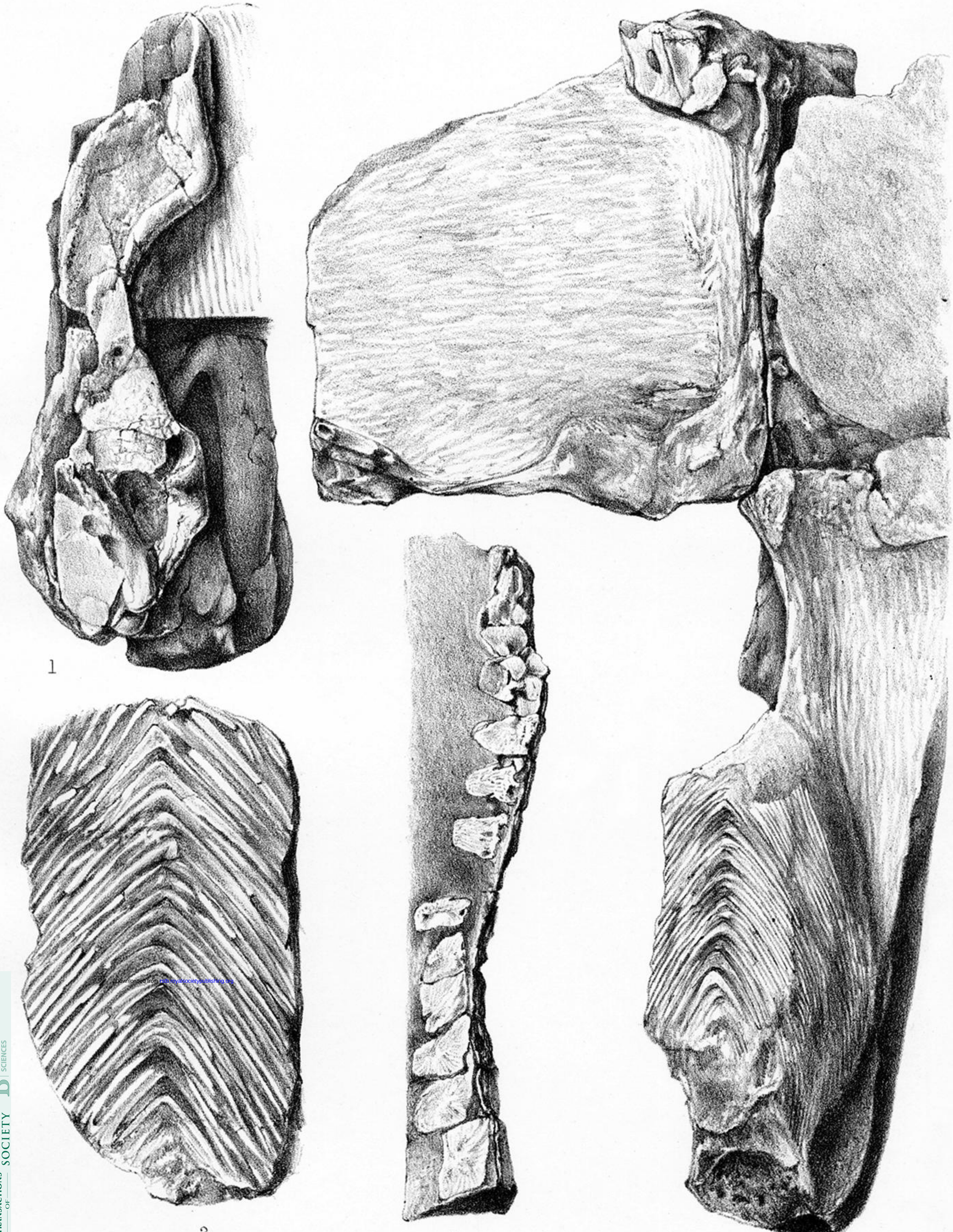

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