28. *On the* Maxillary Bone *of a* new Dinosaur (Priodontognathus Phillipsii), *contained in the Woodwardian Museum of the University of Cambridge.* By Harry Govier Seeley, Esq., F.L.S., F.G.S., Professor of Physical Geography in Bedford College, London. (Read March 24, 1875.)

[Plate XX.]

Among the few Reptilian fossils collected by the late Dr. Forbes-Young, and presented to the Woodwardian Museum of the University of Cambridge by Sir Charles Young and Henry Young, Esq., was a not very promising specimen showing tooth-sockets, imbedded in a yellow sandstone, containing a variety of *Pecten vagans*. It was in association with bones from the Wealden of Tilgate Forest, but may be of Great Oolite age; though I have collected a similar *Pecten* from a purple clay low down in the Wealden series at Lulworth. In 1869 the matrix of this fossil was removed, so as to expose the external aspect of the jaw; and as in those days I saw no reason for thinking it other than an Iguanodont maxillary bone, the species was briefly described in the 'Index to the Aves, Onithosauria and Reptilia in the Woodwardian Museum' (pp. xix. and 82) as *Iguanodon Phillipsii*. Mentioning to the Woodwardian Professor (Prof. Hughes) my desire to describe this and the other species which are briefly indicated in my published catalogues prepared for the late Prof. Sedgwick, Prof. Hughes met me with great cordiality, and afforded every assistance in examining the specimens. I offer my thanks to Prof. Hughes for this courtesy, which enables me to give effect to a request reiterated by Prof. Sedgwick during the last years of his life.

After cleaning the fossil a little, I found several successional teeth, which closely resembled the teeth of *Scelidosaurus* and the teeth attributed by Prof. Huxley to *Acanthopholis*; so that I have had no doubt of its claim to rank as a distinct genus under the name of *Priodontognathus*, and in nearer association with *Hylæosaurus* than with any Wealden type. The specimen is $4\frac{7}{8}$ inches long, is compressed from side to side, and—since the palatal part of the bone, if it ever existed, is broken away and missing—consists principally of the external and alveolar portion, showing anteriorly its surface for vertical squamous sutural union with the premaxillary bone (Pl. XX. figs. 1–4, *a*), a narrow posterior spur for connexion with the malar bone (*b*), and an ascending nasal process in the middle of the upper margin (*c*), which divided the orbit from the narine. The alveolar part of the bone is $4\frac{1}{4}$ inches long, an inch deep in front from the nasal to the alveolar margin, and rather narrower behind from the orbital region to the alveolar border. The bone terminates posteriorly in a narrow triangular claw-like process (*b*), which is prolonged outward

away from the teeth, backward and somewhat downward, so as to increase the thickness of the bone to $\frac{3}{4}$ of an inch; this claw process is, as preserved, $\frac{5}{8}$ of an inch long, concave in length on the inside, compressed from above downward, so as to form a ridge in front, and seen from above downward narrows very slowly: it may be identified as the jugal process. Something similar in *Hypsilophodon* is represented by Prof. Huxley (Quart. Journ. Geol. Soc. vol. xxvi. pl. 1. fig. 1), and by Mr. Hulke (*ibid.* vol. xxx. pl. 3. fig. 1), though in that genus the process appears to be longer, stronger, and directed upward. This is a point of some importance, since in *Scelidosaurus* no such process is developed. Hence doubt is thrown on the value of Prof. Huxley's classification of the Dinosauria by their teeth; for while this genus by its teeth resembles the Scelidosauridæ, it is shown by this jugal process to have the temporal fossa and associated parts of the skull fashioned on the plan of the Iguanodontidæ (Quart. Journ. Geol. Soc. vol. xxvi. p. 34).

The maxillary bone, which is compressed from side to side, externally is gently convex in length, while internally it is rather more concave in length along the palatal border, so that the inner and outer sides are not quite parallel. The rather oblique line along which the horizontal palatal processes of the maxillary extended is inclined downward and backward; the inner surface of the bone between this line and the alveolar margin is concave in depth. Externally the bone is most convex from above downward, just in front of the jugal process, which is prolonged forward as a convex ridge, making the bone above it seem obliquely flattened and convex, and making the bone below it concave. But a little further forward the bone is steadily convex from above downward, and the convexity grows less till it is obscured in the ridges at the base of the nasal process. The external convexity causes the bone to terminate above and below in a sharp ridge.

Running along the lower external alveolar border of the bone, in the usual position of the dental foramina, is a series of unusually large perforations (see figs. 1 & 3), one corresponding to each tooth. They are larger than in the British-Museum specimen of *Teratosaurus*, or the maxillary of *Megalosaurus*, figured by Prof. Huxley (Quart. Journ. Geol. Soc. vol. xxv. pl. 12). The foramen above the last tooth is not preserved; the third foramen is an eighth of an inch from the palatal border, and displays a young successional tooth descending in the socket behind it. The foramina get larger from behind forward; and other teeth are seen behind the sixth, eighth, and eleventh; the twelfth is the largest foramen, resembling a tooth-socket ascending into the jaw. A minute foramen corresponds to the fourteenth socket; but the fifteenth, sixteenth, seventeenth, and eighteenth are in much thinner bone in front of the jaw, and have no corresponding foramina; the sockets of these anterior teeth are smaller than the others, so that they may have presented a difference from the others, like that seen in mammals between the premolar and molar teeth. It may be that, by those anterior teeth having already come down, the foramina

corresponding to them have already been obliterated, owing to absorption of their lower borders; and it seems to me probable that the hinder foramina may have been similarly obliterated with age, the new teeth differing from the usual successional type of Reptiles by being on the outside instead of on the inside of the old tooth.

The tooth-sockets give no other indication of their existence externally; but on the inner side of the jaw are eighteen semiovate sockets, largest in the middle and becoming smaller towards the two ends (fig. 2). The last socket of all displays the basal attachment of a tooth to the socket, and shows the socket of the successional tooth in front of it. The sockets are separated from each other by narrow intervals of bone, indicating that the teeth were scarcely so crowded as in *Iguanodon*, but in this better resembled *Scelidosaurus*. No specimen shows the fang; but the crowns of the teeth are like those of *Echinodon*, *Scelidosaurus*, and *Acanthopholis*. The tooth is more compressed from within outward than in *Echinodon*, and differently implanted; while it appears to differ from that genus and from *Scelidosaurus* in not having large terminal lateral denticles; and the maxillary bone in the two has entirely dissimilar forms.

Of *Acanthopholis* no evidence of jaws is published except the teeth referred to that genus by Prof. Huxley (Geol. Mag. vol. iv. p. 65); but while I have no reason to doubt the excellence of that determination, it may be remembered that no similar teeth have been found in the Cambridge Upper Greensand, in which *Acanthopholis* is far from rare, and in which its jaws occur. On the other hand, no scutes similar to those of *Acanthopholis* are recorded from Wealden beds, or from the Great Oolite. The teeth of *Priodontognathus* resemble those figured by Prof. Huxley so well that the differences are chiefly limited to those of the present fossil being relatively narrower, having only from five to seven denticles on each serrated side of the crown, wanting the thickening at the base of the crown, terminating in a sharp point, and having a greater inflation in the median line of the tooth, more like that seen in *Echinodon* and *Scelidosaurus*. These small points, together with our ignorance of the facial characters of the Greensand and Chalk-marl fossil seem to me to suggest the desirability of the two types being located in separate genera. The only other genus which it resembles is *Hylæosaurus*; but of that genus also the maxillary bone is unknown; and the reference of the teeth named *Hylæosaurus* to that genus is so hypothetical that they may, with almost equal probability, be referred to any other genera of Wealden Dinosaurs of which the dentition is unknown. The crown, moreover, is of different form from that of this fossil; and though *Hylæosaurus* has lateral serrations, they are so fine and numerous as not to be a prominent character.

The maxillary bone terminates anteriorly in a nearly vertical smooth bevelled surface, which is from $\frac{1}{8}$ to $\frac{1}{4}$ inch wide, and looks forward and outward (figs. 1 & 3, *a*); against this surface the premaxillary bone abutted, much after the manner of many mammals and Lizards.

The superior limit of the maxillary bone in its anterior inch is

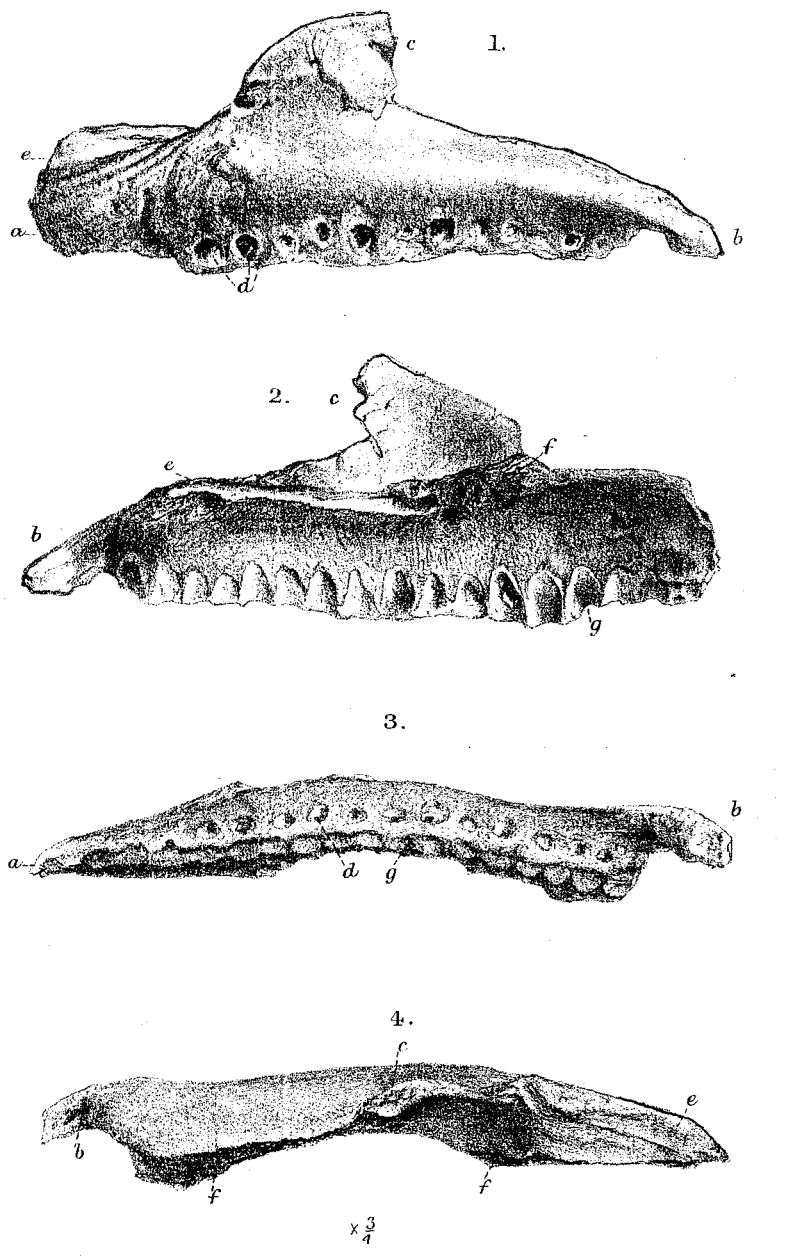
parallel to the alveolar border; it is horizontal and somewhat expanded. Passing backward, this surface becomes concave in length by ascending a little way up the nasal process. It is divided by a remarkable longitudinal groove (which originates within half an inch of the anterior end of the bone) into two unequal parts (figs. 1 & 4, *e*). The larger inner part widens considerably in front, and is nearly enclosed a little further backward, where it terminates $1\frac{1}{8}$ inch from the palate and $1\frac{3}{4}$ inch from the anterior end of the bone in a smaller canal directed backward, upward, and outward.

The larger anterior groove appears to correspond with the infra-orbital canal of the second division of the fifth nerve, which seems to reappear on the inner side of the bone and to be prolonged backward in a groove parallel to the alveolar border (fig. 2, *e*). The external border of the groove forms a strong oblique ridge, which ends behind in a tubercle.

The nasal or frontal process of the bone rises over the middle of the bone to a height of $1\frac{7}{8}$ inch from the alveolar border (figs. 1, 2, & 4, *c*). It is very thin, and extended posteriorly a little further than is indicated by its preservation; it is directed upward, backward, and a little outward; its front border is straight, entire, concave from before backward, and rounded from within outward, and looks obliquely upward and forward. The inner triangular or subtrapezoidal surface of the process is smooth, concave from above downward, and slightly concave from before backward. It forms $1\frac{1}{4}$ inch of the external border of a large anterior vacuity in the skull, which looked forward and upward, and was presumably the left narine. The outer side of the process is convex in length, with a slight oblique ridge running below its superior border, while below this ridge the process is convex from above downward.

The extraordinary form of this bone is no way paralleled in the maxillary bone of birds, and lends no manner of countenance to Prof. Huxley's morphological hypothesis of the Avian affinities of Dinosaurs. It differs from *Hypsilophodon*, as figured by Mr. Hulke and Prof. Huxley, in the remarkable extension of the bone anterior to the nasal process, and in forming the posterior narial wall, after the manner of Chelonians, Lizards, and many mammals. This process is, among reptiles, Lacertian; and is also closely paralleled in the maxillary bone of *Hatteria*, which develops a corresponding, though relatively thicker, malar process posteriorly, which is similarly directed backward and downward. *Hatteria* has a similar ascending nasal process, and similarly has conspicuous dental foramina, though they are differently placed. This close correspondence becomes the more important when we remember how close are the resemblances to *Hatteria* offered by some Dinosaurs in the base of the cranium (*Craterosaurus*), in the pterygoid and quadrate bones (*Scelidosaurus*), and other parts of the skull. So that we may be sure that in some Dinosaurs, at least, the predominant cranial affinities are Rhynchocephalian.

There are, however, interesting resemblances among mammals, even, to the form of this maxillary bone. Thus a similar external



G. H. Ford. Mintern Bros. imp.

PRIODONTOGNATHUS.

shape is seen in the Rhinoceros, in which the premaxillary similarly joins a narrow anterior border of the maxillary, and the relations of the bone are such as might occur in a Dinosaur.

EXPLANATION OF PLATE XX.

Maxillary bone of *Priodontognathus*. Three fourths natural size.

Fig. 1. External aspect.
2. Internal aspect.
3. Alveolar aspect of the same bone, showing the tooth-sockets and the dental foramina.
4. Superior aspect of same bone, showing the semicircular outer nasal wall.

a, bevelled margin articulating with the premaxillary bone; *b*, posterior zygomatic process; *c*, ascending nasal process dividing the nostril in front from the orbit of the eye behind; *d*, dental foramina showing several successional teeth; *e*, canal for blood-vessel and nerve; *f*, fractured surface from which the palatal portion of the bone is broken away; *g*, sockets for the teeth; *h*, matrix.

Discussion.

Mr. Etheridge expressed his regret that the locality of this interesting fossil was unknown. The *Pecten* was not *P. vagans*, but *P. fibrosus*. He thought that the block containing the fossil was either Calcareous Grit or Coral Rag, and that it had probably been obtained as a fragment on the sea-shore. If so, it would be salt to the taste. In this case there were only two points from which it could have come, namely, the Yorkshire coast and Hastings.

Mr. Judd remarked that Mr. Sorby had made a microscopic investigation of the structure of the Calcareous Grit of the Yorkshire coast, and suggested the possibility of ascertaining the locality from which this specimen had been derived by an examination of the microscopic characters of its matrix.

Mr. Seeley, in reply, said that he did not detect the presence of salt in the stone. The *Pecten* probably was the form described as *P. fibrosus*: but he regarded *P. fibrosus* and *P. vagans* as identical.