

44. NOTICE of the OCCURRENCE of REMAINS of a BRITISH FOSSIL ZEUGLONON (*Z. Wanklyni*, Seeley) in the BARTON CLAY of the HAMPSHIRE COAST. By HARRY GOVIER SEELEY, Esq., F.L.S., F.G.S., &c., Professor of Geography in King's College, London. (Read June 21, 1876.)

IN 1872 my late college friend Dr. Arthur Wanklyn, who had for a long time devoted himself to a study of the Barton Clay, was so fortunate as to obtain, from the Barton Cliff, nearly the whole of the skull of a zeuglodon of moderate size. The skull was extracted entire; but the local collectors, in carrying it up the cliff, had the misfortune to reduce it to fragments. The day before Dr. Wanklyn was leaving London for professional duties, he desired me to draw up some notice of the specimen for publication; but the time at my disposal was too brief for me to attempt a full description of the whole of the remains, and I contented myself with some memoranda on the maxillary bones, teeth, and roof of the brain-case. These I have hitherto kept for myself in the hope that Dr. Wanklyn would be able to bring the fossil to London, in a more perfectly restored condition, for fuller study. But the specimen never came; and since Dr. Wanklyn's death I have been unable to get any tidings concerning it. It has therefore seemed desirable to offer to the Society the notice which I made four years ago; and I do this the more gladly that it enables me to associate with the species the name of its discoverer, of whose enthusiasm for science this may serve as a slight memorial.

Maxillary Bones.

The maxillary bones are imperfectly preserved posteriorly. They show a length of about 8 inches of the bone on the left side, and less than 7 inches on the right side. The anterior termination of the bones is perfect and rounded convexly; and there they measure transversely across the palate $2\frac{1}{4}$ inches from side to side. Each bone in its alveolar surface is about $\frac{7}{8}$ inch thick; and the palatal space between the bones is at present filled with matrix. The external lateral surface of each bone is slightly convex from above downward; but in length the sides of the bones are concave, because they diverge posteriorly. The alveolar border of the bone preserves for some distance backward approximately the same thickness from side to side.

The fragment shows indications of five teeth on the left side. Between the second pair of tooth-sockets the jaw measures $2\frac{1}{2}$ inches from side to side; at the third pair of teeth it is $3\frac{1}{2}$ inches from side to side; and then it widens more rapidly behind. There is a strong oblique inner alveolar thickening of the jaw behind the posterior denticulated teeth. These processes are prolonged inward,

and meet in the mesial line so as to form a flattened slightly convex palate. On the superior surface these bones form a concave channel, which widens behind. The median suture [of the palate] is overlain, for 4 inches, by a fragment of a thin bone $\frac{1}{8}$ inch thick, which appears to have been $1\frac{3}{4}$ inch wide in the middle, and to have narrowed in front and behind. Posteriorly it extends beyond the maxillaries. This bone is presumably the vomer. External to it laterally are the impressions of the premaxillaries, which were about $\frac{5}{8}$ inch wide where they rested on the maxillaries; but behind the third tooth the impressions of these bones widen rapidly and converge towards the median line, as though they met posteriorly.

The Teeth.

The first two teeth in the maxillary bone were presumably simple and conical crowns, with a single fang; from the sockets for these the teeth are gone. The first socket extends to within less than $\frac{1}{4}$ inch of the anterior termination of the jaw; it is $\frac{7}{8}$ inch long and $\frac{5}{8}$ inch broad, is ovate in section, and placed evenly between the inner and outer sides of the jaw. Between this and the second socket is an interspace of $\frac{9}{16}$ inch. This interspace is hollowed out on each maxillary bone into a shallow hemispherical pit outwardly placed on the alveolar margin, caused apparently by absorption due to the pressure from a tooth in the lower jaw. The second socket is more than an inch long, and less than $\frac{5}{8}$ inch wide; so that it is more elongated than the other. On the internal alveolar margin, behind these teeth, runs a narrow elevated marginal ridge of bone.

The next interspace is about $\frac{9}{16}$ inch long; towards the third tooth it is excavated as though by pressure from a tooth in the lower jaw. The third tooth is $1\frac{3}{4}$ inch long, is compressed from side to side, less than half an inch thick in the middle, and attenuated to a sharp margin in such a way that the angle at which the inner and outer sides of the tooth meet is less than a right angle. The anterior and posterior parts of the crown are moderately serrated, so as to form four small denticles on each side of the larger median denticle which divides them. The denticles are much smaller in front than behind. The cutting-margin of the denticles of the tooth is faintly crenulated. Around the base of the crown runs a narrow elevated cinguloid ridge of enamel, which does not extend mesially above the fangs. The inner surface of the crown above these ridges is marked with vertical striæ on the enamel. The portion of the unenamelled fangs which projects from the sockets is less than $\frac{1}{4}$ inch deep. The height of the crown is less than an inch. The interspace between the third tooth and the fourth is $\frac{1}{4}$ inch. The fourth tooth is also $1\frac{3}{4}$ inch long. Its crown, though equally high, has a different aspect; for the denticles are larger, longer, thicker, and more deeply divided from each other than in the preceding tooth, so that the outline of the crests of the denticles of each side is convex from back to front. As in the third tooth, the posterior denticles are the larger; and the denticles are similarly crenulated. The cingular

ridge is much more developed; the anterior and posterior halves of it do not meet. Above this tooth the outer bone of the jaw thickens into a fold.

The fifth tooth is imperfectly preserved; it appears to be shorter than the others, somewhat thicker, with the denticles a little better marked.

The teeth were inclined towards each other from both sides of the snout, and locked between those of the lower jaw.

There was found with the specimen a remarkable single-fanged tooth, which may be one of those missing from the empty sockets. This tooth resembles the canine tooth of a Carnivore. It is longitudinally ovate in section, and in length recurved, with a tapering crown and a fang which continues to enlarge for some distance below the crown and then contracts somewhat towards the base. The extreme end of the fang is broken away, while its whole lower part has been greatly fractured and somewhat crushed. The extreme length of the portion of the tooth which is preserved is $2\frac{3}{4}$ inches, of which the crown covered with enamel constitutes 1 inch. The base of the crown from back to front, where the enamel terminates, measures $\frac{5}{8}$ inch, and from side to side in the same line it measures less than $\frac{1}{2}$ inch; the crown is more compressed from side to side in front than behind; and while the anterior margin, in common with the outline of the whole tooth, is convex, the posterior margin in the same way is concave, but with a curve which belongs to a much larger circle than that of the anterior margin. Along these anterior and posterior margins on the crown runs an elevated ridge of enamel. The ridges do not extend over the point of the crown, which is blunt, rounded, and unworn. On the sides of the crown and towards its base the enamel, which nowhere has a burnished smoothness, but an exceedingly fine subgranular shining texture, becomes wrinkled into sharp short vertical folds, which are more numerous on the back than on the front aspect, and may number about a dozen on each side of the tooth. They are fine, irregular, not straight; and sometimes two converge and unite into one in passing up the crown. The fang where widest measures $\frac{3}{4}$ inch from front to back. Like the crown, it is more compressed from side to side on its convex than on its concave side. It is marked throughout with exceedingly fine longitudinal striæ; and at intervals among these are faint ridges which are prolongations downward of the chief ridges on the crown. The pulp-cavity is large.

This form of tooth would yield one of the best distinctive characters for the species.

The Parietal Bone.

The parietal bone, which is single, has the form usual in *Zeuglodonts*, as far as can be judged from the fragment preserved, though various small pieces collected with it probably indicate that the parietal region was longer in this animal than in the American *Zeuglodonts*. The anterior suture, with the adjacent part of the

frontal bone, is well seen, and on the inferior margins are two small bones which are in the position of alisphenoids; posteriorly the bone is very imperfect; on the under side it is traversed by a groove which widens posteriorly and becomes part of the cerebral cavity. The parietal rests upon and encases the frontal bone, much in the way seen among Ichthyosaurs; so that while in the fragment measuring $6\frac{1}{2}$ inches in length $4\frac{1}{2}$ inches are occupied externally by the parietal, on the cerebral surface only $2\frac{1}{2}$ inches are occupied by that bone. The sides of the parietal bone are nearly vertical, and nearly parallel, measuring 2 inches from side to side in front, where they are about $1\frac{1}{4}$ inch high. Above this height the sides become rounded, and converge towards the middle line into an elevated mesial keel, which rises higher the further it is prolonged backward; so that while the bone as it stands on its sutural base is but little over 2 inches high in front, it becomes, where fractured behind, nearly $3\frac{1}{2}$ inches high. In front the ridge is rounded; but the last $1\frac{1}{2}$ inch of it preserved becomes flattened horizontally and widens posteriorly, being at the fracture $\frac{3}{8}$ inch wide. Concomitantly with the formation of this ridge the bone appears to widen out from side to side behind, and the lateral inclined halves of the upper surface exchange their rounded outlines for a sloping flattened surface. In front the ridge dies away just behind the suture. The suture is deep and well marked; it is somewhat irregular, and penetrates back into the parietal in the form of an inverted W with long outer arms, which on the shoulder of the side of the bone contribute to form a similar uninverted figure, the outer arm of which, in an irregular line, is prolonged downward and backward at an angle of about 45° with the basal outline of the bone; so that the parietal extends a less distance along the side than along the superior surface, where its termination is bifid.

The Frontal Bone.

The sutural end of the frontal necessarily corresponds closely with the parietal; but as the sides of the bone are similarly flat and vertical, and the superior surface is horizontal, it results that the section of the bone at the fracture is nearly quadrate, being rather higher than wide. The frontal bone is also notched on the under-side with a nearly quadrate olfactory canal about half an inch in section. The angles between the lateral surfaces and superior surface become elevated; and where it is fractured anteriorly the bone appears to be widening outward from side to side. The horizontal surface of the frontal continues forward the anterior depression in height of the parietal, and at its anterior termination the frontal is but $1\frac{1}{2}$ inch high.

Thus the portion of the frontal preserved has extremely thick walls. The walls of the skull scarcely become thinner in the parietal region; for the groove which traverses the bones only slowly widens and deepens. Its surfaces are nearly flat, and, except that it is relatively deeper, it corresponds closely in form with the external

ridge already described; and under the region where the ridge becomes flattened, the middle of the enlarging cerebral cavity becomes flattened, though there are concave excavations on each side. The suture between the parietal and frontal is deeply impressed on the cerebral surface. Behind its inferior termination is, on each side, another suture $1\frac{3}{8}$ inch long and about $\frac{3}{8}$ inch above the flat irregular basal surface of the specimen. The small bone thus indicated is not quite perfect behind, where it is shown by a fracture to be imbedded between the outer and inner walls of the parietal. These bones have none of the usual characteristics of the alisphenoids, and are probably to be regarded as orbito-sphenoids. They are about $\frac{1}{2}$ inch wide; and the film of parietal external to them is about $\frac{1}{8}$ inch thick. In front of these bones and internal to them are concave grooves, which widen in passing forward to more than $\frac{3}{4}$ inch, which is the width of the frontal bone on each side of the groove.

Almost the whole of the skull could be reconstructed from the materials preserved by Dr. Wanklyn. Among other parts I noticed the two egg-shaped tympanic bones, remarkable for their regular form.

In no respect does it approach *Squalodon*, which not only has the parietal region constructed on a different pattern, but also has the teeth of different form.

It differs from all known species of *Zeuglodon* in the shortness of the interspaces between the teeth, and apparently in the characters of the premolar teeth, as well as in the shorter form of the skull. But in the absence of the specimen any detailed comparison with other species must be deferred.

The parietal and frontal fragment is about the same size as in *Zeuglodon brachyspondylus* of Müller, which similarly has the frontal region flattened, with a sharp crest along the parietal region—which, however, does not become flattened posteriorly into a narrow table as in the species described; nor has the parietal in the foreign species the folded sutural junction with the frontal of our English specimen.

I would express my thanks to Mr. W. Davis for assistance in examining the *Zeuglodonts* in the British Museum, and a hope that Dr. Wanklyn's *Zeuglodon* may eventually be deposited in one of our National collections.