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(Continuation of Contributions from the Museum of Geology)
UNIVERSITY OF MICHIGAN

VOL. III, No. 11, pp. 187–206 (3 pls., 11 text figs.) DECEMBER 18, 1931

DESCRIPTION OF A NEW SPECIES OF *BUETTNERIA*, WITH A DISCUSSION OF THE BRAIN CASE

BY
E. C. CASE

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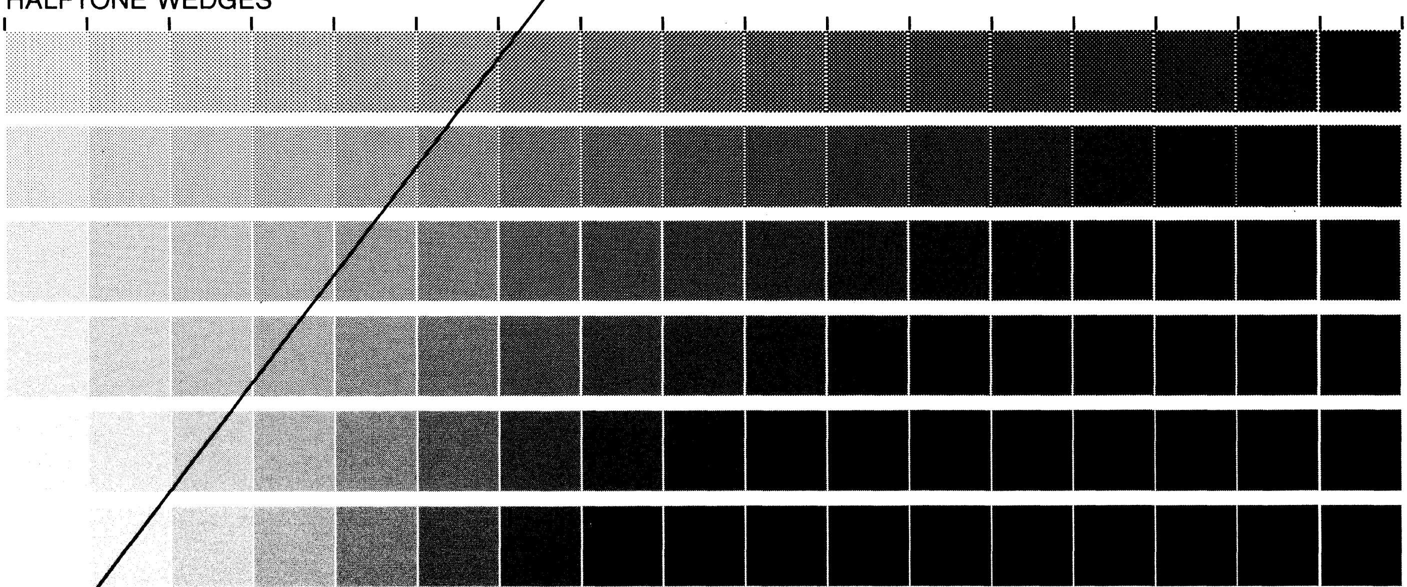

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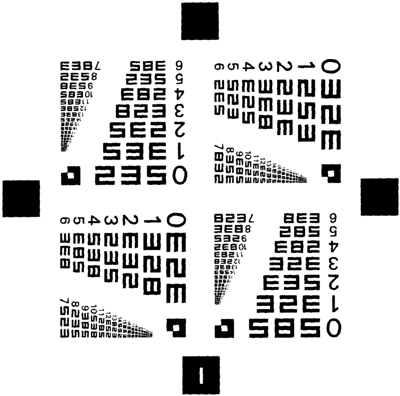

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CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

(*Continuation of Contributions from the Museum of Geology*)

UNIVERSITY OF MICHIGAN

Editor: EUGENE S. MCCARTNEY

The series of contributions from the Museum of Paleontology was inaugurated to provide a medium for the publication of papers based entirely or principally upon the collections in the Museum. When the number of pages issued is sufficient to make a volume, a title-page and a table of contents will be sent to libraries on the mailing list, and also to individuals upon request. Communications with reference to exchange or purchase of copies should be directed to the Librarian, General Library, University of Michigan.

VOLUMES I–II

A list of the papers published in these volumes may be had upon application.

VOLUME III

1. Indications of a Cotylosaur and of a New Form of Fish from the Triassic Beds of Texas, with Remarks on the Shinarump Conglomerate, by E. C. Case. Pages 1–14, with 1 plate. Price, $.25.
2. Fossil Fishes from the Triassic of Texas, by Aldred S. Warthin, Jr. Pages 15–18, with 1 plate. Price, $.20.
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4. Cystoids from the Trenton Rocks of Michigan, by Russell C. Hussey. Pages 77–79, with 1 plate. Price, $.20.
5. Description of a Nearly Complete Skeleton of *Ostodolepis brevispinatus* Williston, by E. C. Case. Pages 81–107, with 3 plates and 12 text figures. Price, $.35.
6. The Color Patterns of Fossil Cephalopods and Brachiopods, with Notes on Gasteropods and Pelecypods, by Aug. F. Foerste. Pages 109–150, with 5 plates. Price, $.50.
7. Additional Notes on Nephriticerina, by Aug. F. Foerste. Pages 151–154, with 1 plate and 1 text figure. Price, $.15.
8. On the Lower Jaw of *Brachysuchus megalodon*, by E. C. Case. Pages 155–161, with 5 plates and 2 text figures. Price, $.30.

(*Continued on inside of back cover*)

VOL. III, No. 11, pp. 187–206 (3 pls., 11 text figs.) DECEMBER 18, 1931

DESCRIPTION OF A NEW SPECIES OF *BUETTNERIA*, WITH A DISCUSSION OF THE BRAIN CASE

By E. C. CASE

IN THE spring of 1930 Dr. Charles Lawrence Baker of the Rio Bravo Oil Company informed the author of a new locality of Triassic vertebrates in Scurry County, Texas. It had been discovered by Mr. A. N. Huddleston, geologist for the same company, who guided the party from the Museum of Paleontology of the University of Michigan to the locality and rendered all assistance in his power. To both of these gentlemen the director of the Museum of Paleontology wishes to express his appreciation of their disinterested kindness in the matter.

The locality presents a bed of coarse quartz sand of uneven grain, locally very hard and very clean, but with spots of much softer material, including small bits of clay. It is described as "basal" in the Triassic series by the geologists of the oil company.

In the absence of the author, the locality was visited by a party from the Museum of Paleontology to make a reconnaissance. Such material as was available in the brief time at its disposal was collected, and turned out to be entirely the bones of a single species of the genus *Buettneria.* One nearly complete skull, two incomplete skulls showing the basicranial region, isolated clavicles, interclavicles, limb bones and vertebrae were found in close association. The nearly complete skull, number 13055 U.M., is designated as the holotype of a new species, *Buettneria bakeri*, and the two less perfect skulls, numbers 14154 U.M. and 14098 U.M., as the paratypes. The elongation of the pits of the sculpture extending over the frontal and the postorbital regions, the incomplete sensory canal system, the extension of the palatal vacuities anterior to the orbits, the narrower and more elongate skull, and the smaller size distinguish this species from *Buettneria perfecta*, the genotype.

Figures 1 and 2, Plate I, and text Figures 1 and 2 show the

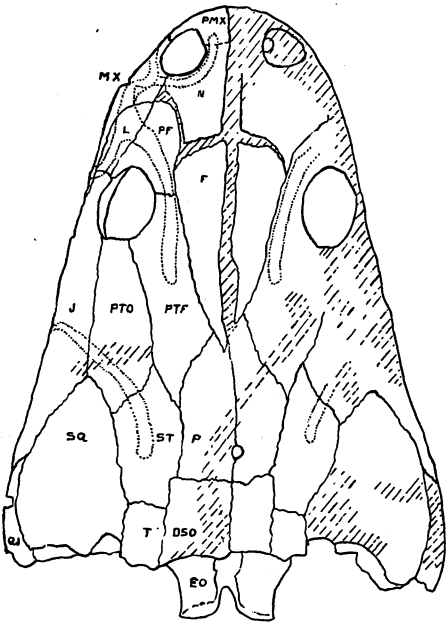

FIG. 1

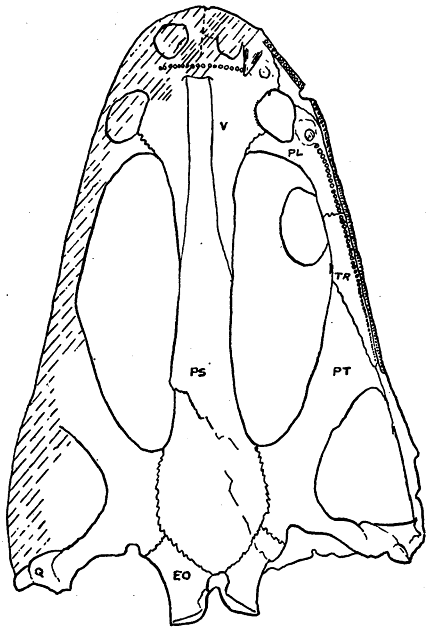

FIG. 2

FIG. 1. Upper surface of skull of *Buettneria bakeri*. Number 13055 U.M. × ¼. The shaded areas show matrix and restored portions. DSO, dermsupraoccipital; EO, exoccipital; F, frontal; J, jugal; L, lachrymal; MX, maxillary; N, nasal; P, parietal; PF, prefrontal; PMX, premaxillary; PTF, postfrontal; PTO, postorbital; QJ, quadratojugal; SQ, squamosal; ST, supratemporal; T, tabulare

FIG. 2. Lower surface of the same skull. × ¼. EO, exoccipital; PL, palatine; PS, parasphenoid; PT, pterygoid; Q, quadrate; TR, transverse; V, vomer

outline of the skull, the character of the sculpture and the course of the sutures and the sensory canals. The restored portions of the skull and the presence of matrix in the cracks are indicated by light cross lines in the text figures and can easily be detected in the photographs. The following table gives exact and comparative measurements.

TABLE SHOWING ACTUAL AND COMPARATIVE MEASUREMENTS OF SKULLS OF *BUETTNERIA*

	B. perfecta	*B. bakeri*
$\frac{\text{Length}}{\text{Breadth}}$	$\frac{443.2}{344.2} = 1:0.8$	$\frac{321}{222} = 1:0.69$
$\frac{\text{Length}}{\text{Postorbital length}}$	$\frac{443.2}{275} = 1:0.62$	$\frac{321}{178} = 1:0.55$
$\frac{\text{Length}}{\text{Length palatal vacuity}}$	$\frac{443.2}{196.8} = 1:0.44$	$\frac{321}{136} = 1:0.42$
$\frac{\text{Length}}{\text{Length posterior to palatal vacuity}}$	$\frac{443.2}{132.3} = 1:0.3$	$\frac{321}{76.5} = 1:0.24$
$\frac{\text{Length}}{\text{Length anterior to palatal vacuity}}$	$\frac{443.2}{128.7} = 1:0.29$	$\frac{321}{68.6} = 1:0.21$
$\frac{\text{Length}}{\text{Breadth at anterior edge orbit}}$	$\frac{443.2}{206.6} = 1:0.47$	$\frac{321}{121} = 1:0.38$
$\frac{\text{Length}}{\text{Length orbit}}$	$\frac{443.2}{47.3} = 1:0.1$	$\frac{321}{36.9} = 1:0.12$
$\frac{\text{Length}}{\text{Postpineal length}}$	$\frac{443.2}{61.8} = 1:0.14$	$\frac{321}{47.5} = 1:0.15$

Specimen number 13055 is nearly complete, but is preserved in such friable sandstone that it has not been deemed wise to excavate deeply into the brain case. It shows, however, the walls of the brain case formed by the plates from the pterygoid and squamosal bones, the stapes of the left side in slightly disturbed position, and the whole of the posterior face of the skull.

Specimen number 14154 shows the middle of the posterior face and the whole cranial region. The quadrates are missing. Both stapes are in place, the left in undisturbed position. The rising plates of the pterygoids forming the walls of the brain case are complete, that of the left side uncrushed and unbroken, that of the right side slightly crushed. The epipterygoids are preserved in position, that of the right side complete, that of the left side with the posterior edge injured. Portions of the roof and of the parasphenoid have been removed to permit access to the brain case.

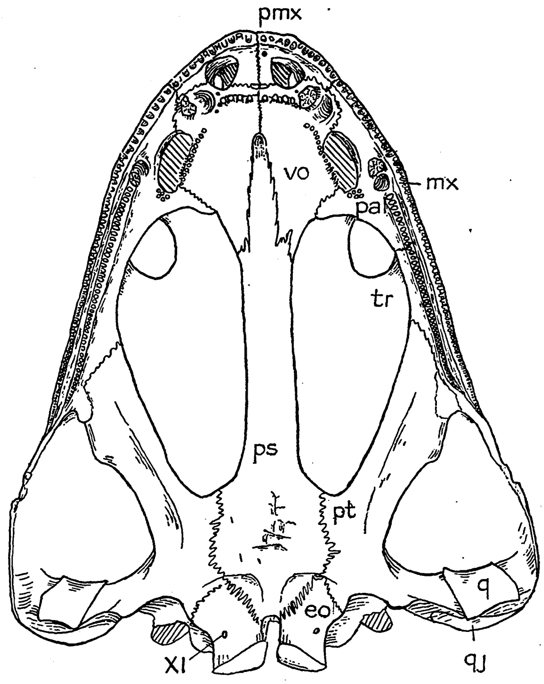

FIG. 3. Lower surface of skull of *B. perfecta*, with the transverse correctly indicated. × $\frac{1}{4}$. EO, exoccipital; MX, maxillary; PAL, palatine; PMX, premaxillary; PS, parasphenoid; PT, pterygoid; Q, quadrate; QJ, quadratojugal; TR, transverse; VO, vomer

Specimen number 14098 shows the left side of the cranial region complete, with the stapes in undisturbed position. This specimen has been taken apart, so that the details of the brain case can be clearly seen.

External characters of the skull. — The skull, number 13055, is very little crushed, as is shown by the undisturbed plates of the pterygoids and squamosals, but has been somewhat macerated and the bones of the anterior portion have been slightly separated, and there is an oblique crack and slight separation across the postorbital region, so that in the photographs and figures it appears somewhat broader than it was in life. It has the characteristic flat dorsal and palatine surfaces of the genus. The sutures can be traced on one side or the other and are indicated with confidence, except the lachrymal-prefrontal. The pattern is that common to all of the capitosaurian stegocephalians. The sculpture is notably different from that of all described Upper Triassic stegocephalians from North America; the elongation of the sculpture pits, not only on the squamosals, but on the frontal and postorbital regions, approaches in this character the genus *Cyclotosaurus*.

The course of the sensory grooves is indicated in the text figures and can be followed in the photographs. They are exceptionally broad and well marked. The interorbital grooves terminate sharply at about the center of the postfrontals and the temporal grooves terminate equally sharply at the center of the supratemporals. There are no connecting grooves between these two sets.

On the palatine surface the space anterior to the palatine vacuities is proportionately short, permitting the vacuities to extend anterior to the orbits. The vomerine teeth extend transversely in an almost straight line and there are indications of very fine teeth on the inner edges of the choanae. There were strong vomerine tusks; that of the left side is preserved, slanting strongly to the rear. It is probable that the inclination is due to the accidents of preservation. The cultriform process of the parasphenoid is broad and extends as far forward as the transverse row of vomerine teeth, where it rises with the appearance of an opening between it and the vomerine teeth below.

In general arrangement the bones are as in the genotype. The ectopterygoid is clearly outlined and the author takes occasion here to correct the original figure in which he was in doubt concerning this bone. The probable error was pointed out to him some years ago by Dr. D. M. S. Watson and the present specimen confirms the error and permits correction. (See Fig. 3.)

The posterior face of the skull closely resembles that of *B. perfecta,* but the posttemporal openings are present. They are very small, but in specimen number 14098, which has been taken apart, the presence of a perforation is evident.

Cranial region. — The three specimens reveal in undisturbed detail the features of the cranial region. The evidence from the three is mutually confirmatory. In none of the specimens has the author been able to find any evidence of the presence of ossified basioccipital, presphenoid, proötic or epiotic, such as have been reported or suggested by authors in descriptions of similar forms. The advanced degree of secondary chondrification of the walls of the brain case attained in these forms is responsible for the absence of ossified elements which would naturally be looked for.

Descriptions and figures of the cranial region of the Triassic stegocephalians have been given by Fraas (1890), Wiman (1913), Watson (1919), Huene (1922), Case (1922), Wepfer (1923), Hofker (1927), and Branson and Mehl (1929). The very perfect material upon which this paper is based permits a fuller understanding of the less well preserved material described in previous papers. The following detailed description is based largely upon the paratypes of the species. Throughout the study the author has carefully compared the specimens with the specimen of *B. perfecta* and with his original description and finds little to correct; the present description is largely additional matter and explanation of points obscure in the specimen of the genotype.

Exoccipitals. — On the lower surface the exoccipitals are separated by the parasphenoid, which extends to the posterior edge of the floor of the brain case. There is no evidence of an ossified basioccipital, but the two bones have broad inner processes with rough faces which were evidently attached to a cartilage which partially filled the space between them. From the upper surfaces a broad pillar rises to connect with the descending processes of the dermsupraoccipital and the tabulare, and forms the wall of the foramen magnum. This pillar is triangular in section with one, median, face looking into the foramen magnum, one, anterior, looking forward into the brain cavity and one, posterior, looking backward. On the median face, near the base, are two foramina.

(In specimen 14098 there is a third, smaller, one posterior to the other two.) It has been possible to clean out the larger, more posterior, of the foramina in two specimens and to demonstrate that the canal passes directly through the condyle to open on the outer side. The smaller, anterior, foramen leads downward and outward. It has not been possible to clean out the canal, since all the smaller passages are filled with calcite instead of sand grains after a short distance, and the hardness of the calcite is so close to that of the bone substance that it is impossible to distinguish between them with the probe. The canal has been followed to the center of the condylar portion of the bone.

On the anterior face there are two foramina, the lateral much larger than the mesial. The larger canal has been traced downward and a little backward to the center of the bone; from the direction of this canal and that of the anterior foramen on the median face it seems impossible that they could have united. The smaller, mesial canal opens after a short distance into the larger one.

On the lower face there is a large foramen about the center of the condylar portion. The canal rises almost directly into the bone for a short distance and then turns forward in the exoccipital portion of the floor of the brain case just outside of the suture between the exoccipital and the parasphenoid. A fortunate break through the neck of the condyle revealed the calcite filling of this canal, which was cleared out to connect with the foramen, but could not be removed anterior to the break.

Of eight exoccipital bones from six different specimens no two agree exactly in either the number or the position of the main foramina, and there are numerous minute irregularly placed foramina. There was evidently a rather wide range of individual variation. Of all described forms the nearest in agreement with these specimens is that of an isolated exoccipital of ? *Metoposaurus stuttgartiensis*, figured and described by Huene (1922), with considerable reservation in his assignment of the nerves and blood vessels to the various canals. So divergent have been the opinions of the various writers regarding the nerves or vessels which occupied the different canals and so inconclusive has been the evidence given in support of the divergent opinions that it seems of little value to recapitulate or discuss them.

There is fairly definite agreement that in the Upper Triassic stegocephalians the hypoglossal nerve was not a cranial nerve, and that the large canal which passes directly outward through the condyle transmitted the IX, X and XI nerves and the jugular vein. This canal has been reported as bifurcate at either the mesial or lateral ends or at both, and as double throughout its extent, but its position is fixed and its function fairly certain. Huene tentatively attributes the anterior foramen of the median face and the mesial foramen of the anterior face (which is much larger in his specimen than in those here described) to the acoustic nerve, and the lateral foramen of the anterior face to a semicircular canal. In view of the course of the canals, as demonstrated in these specimens, and of the practical certainty that the otic capsule was entirely cartilaginous, and not inclosed in bone, these assignments seem less probable.

Various breaks across the exoccipital, the pterygoid and the parasphenoid show that there was a considerable plexus of canals within these bones, a fact recognized by Huene for the exoccipital, and it seems probable that these foramina permitted the passage of the blood vessels which occupied the plexus of canals.

Huene (1922) suggested that the foramen on the under side of the condylar neck may have been for the entrance of the internal carotid artery. The locus of entry of this vessel into the brain case is so variously placed by different writers that the assignment of one or another foramen to its passage is most uncertain.

The fact that the canal from the lower foramen leads forward in the body of the exoccipital would support Huene's suggestion, if any connection with the brain cavity could be shown, but its canal seems to be but a part of the plexus within the parasphenoid and adjacent bones.

The internal carotid arteries have a fixed position for their entry into the skull in most classes of the vertebrates, near the hypophysial region. From the origin of the arteries and their importance the fixity of position is most natural and probable. In the forms of Amphibia with a large parasphenoid bone, there is some departure from the general rule, but, as Watson (1919 and 1926) has demonstrated, the more primitive stegocephalians have a foramen in this region which it is rational to assign to the internal carotids. Even in the highly specialized Anura the entrance is approximately in the normal position. Watson (1919) has figured and described a basisphenoid bone in *Capitosaurus* which he says "is perforated vertically by a foramen, from which a groove on the ventral surface leads to the posterior edge of the bone." Elsewhere in the same paper he refers to the basisphenoid of *Capitosaurus* as "perforated by an obvious carotid."

In the living urodeles the carotids have been described as entering through the parasphenoid at various places, some fairly far back. Sollas (1920), in describing *Lysorophus,* which Williston considered as a Permian urodele, says that "two openings (0.3 mm. in diameter) are visible on the ventral surface of the parasphenoid just in front of the greatest breadth, one on each side and not far from the margin. Their course as they traverse the bone is slightly forwards and a little inwards and they reach the dorsal surface close to the sides of the median trough. These are evidently foramina for the internal carotid arteries.

"In Anura and the Frog they occupy much the same position but lie outside the parasphenoid, just in front of the 'guard' of the dagger-shaped bone."

While it is unwarranted to assume that the condition in such aberrant forms as the urodeles can be taken as a guide to the condition in the Upper Triassic stegocephalians, suggestions have been made of similar conditions. Altogether it seems probable that the internal carotids entered the skull of *Buettneria* in the position previously suggested by the author, anterior to the quadrate ramus of the pterygoid, and passed backward through the canals in the parasphenoid.

The rising process of the exoccipital is bifurcate as in other forms, and is connected by suture with the descending processes of the dermsupraoccipital and the tabulare. There is no perforation in this region in *Buettneria perfecta,* but in *B. bakeri* there is a small opening. The opening is scarcely apparent in the skulls which have been slightly crushed, but in specimen 14098, which has been taken apart, the opening is shown to be larger than would be expected, though still small. The sutures between the exoccipital and the bones above are clearly marked.

Opisthotic. — As in the genotype, there is no distinct opisthotic. In the description of the genus the suggestion was made that a thin plate apparently distinct on the anterior face of the descending process from the tabulare might be the much reduced opisthotic; no indication of such a plate occurs in the present

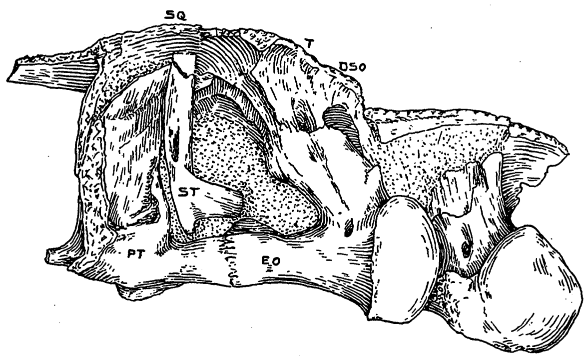

FIG. 4. Oblique view into the left otic opening of number 14154 U.M., showing the position of the stapes and adjacent bones. × $\frac{2}{3}$. DSO, dermsupraoccipital; EO, exoccipital; PT, pterygoid; SQ, squamosal; ST, stapes; T, tabulare.

specimens, nor can the author detect where such a plate might have been attached or been fused with the tabulare.

Posterior otic opening. — The great posterior opening leading to the otic region is bordered by the exoccipital, pterygoid and tabulare. The squamosal may take a very small part in the upper border; but is apparently excluded from it by the meeting of the tabulare and the rising process of the pterygoid. The relation of the bones in this region is shown in text Figure 4. There is no suggestion of the presence of either a separate proötic or epiotic in the very perfectly preserved material. On the left side of specimen 14154 and on the right side of specimen 14098 the wall of the brain case formed by the meeting of the processes from the squamosal and the pterygoid are preserved complete and uncrushed; both have been examined with minute care and no trace of separate elements can be detected. It is the conviction of the author that the otic capsule was entirely cartilaginous and that the bones usually taking part in the capsule were either absent or reduced to cartilage. The capsule lay in a space partly surrounded by other bones.

The anterior face of the descending portion of the tabulare shows clearly the imprint of a portion of the capsule, and it is this part, if any, which must represent the opisthotic. Seen from the front and below, the face is divided into three areas by two sharp, nearly vertical ridges. The outer area is a concave space on the under side of the process which forms the mesial border of the otic notch. The median area is a depression between two ridges; its upper, anterior, portion is deep and corresponds to the pit in the lower surface of the tabulare described in the genotype. The third, inner, depression is marked off from the median one by the second ridge, which runs vertically on the process and then curves inward on the lower surface of the tabulare. The depression is shaped as if made by the impression of the segment of an ovoid body, i.e. the otic capsule; its inner edge is formed by the border of the opening between the descending processes of the tabulare and the dermsupraoccipital. The surface of the depression is pierced by two foramina which lead into the body of the bone. These are too far posterior and too remote from the median line to be regarded as the openings for the endo- and perilymphatic ducts, but no other openings for these ducts, probably present, have been found. Similar foramina occur in specimen 14098. The anterior wall of the space formed by the processes from the pterygoid and squamosal shows no impression from the capsule.

Stapes. — The stapes is preserved in three specimens, in number 13055 on the right side; in number 14154 on both sides, the left in undisturbed position; in number 14098 on the right side in undisturbed position. The position and form of the stapes are shown in text Figures 4 and 5. The upper end is drawn to a blunt point and lies directly in the otic notch, where it was attached to a tympanic membrane or an area of modified skin. The main shaft of the stapes is broadly elliptical and extends downward and forward. Near the center of the posterior face there is, in specimen 14154, a deep, narrow depression ending sharply below; in the other specimens this depression is less sharply marked. The lower end expands and is separated by a notch on the lower end into two processes. The outer process is smaller and is a direct continuation of the outer edge; it ends within a millimeter of the outer end of the arch covering the canal in the parasphenoid bone described below. This relation was found in both specimens in which the stapes were undisturbed and is very similar to that described by Watson (1919) in *Lydekkerina* and *Laccocephalus* where he says that a lappet from the parasphenoid bone overlies the lower surface of the stapes. The inner process is directed toward the brain cavity at an angle of about 45° to the axis of the shaft and is much heavier than the outer process. The inner end is rough and broadly oval; it was apparently applied to the fenestra ovalis in the cartilaginous otic capsule. There are various small foramina in the bones, but none that could be called the stapedial foramen; perhaps this is represented by the notch in the lower end.

FIG. 5. Stapes of the right side from number 14098 U.M. $\times \frac{2}{3}$

Rising plate of the pterygoid. — This plate is preserved undistorted and complete on the right side of specimen 14098 and the anterior portion is undistorted and complete in specimen 14154. The plate is confined to the quadrate ramus of the pterygoid, rising near the mesial origin of the ramus and running obliquely backward to the outer edge of the otic notch and then turning more sharply outward to the quadrate. The plate is supplemented in the formation of the lateral wall of the brain case by the descending plate from the squamosal described below.

Seen from the posterior view, the plate rises sharply from a point just outside the pterygoid-exoccipital suture forming the outer edge of the great otic opening. The plate is heavy at its origin, but is excavated by the irregular depression described by Wiman as the place of attachment of the pterygoideus muscle.

Beyond this depression the plate is much thinner. It was this portion of the plate which was described in the genotype as bifurcate and as receiving, between an anterior and a posterior portion, the descending plate from the squamosal. Though the condition is still somewhat obscure, there is much in these specimens to confirm the original description. An isolated squamosal bone, number 14099, shows the complete descending plate. The sutural surface on the exposed posterior face shows an overlap downward on the anterior face of the pterygoid at about two thirds of the height of the wall. This suture is hardly to be detected on the other specimens. The descending plate of the isolated squamosal is notched on its outer edge by the large quadrate foramen. Below the notch a long process runs outward toward the quadrate. In specimen 14154 the plate is broken across vertically in its median portion and shows a distinct calcite filling between an anterior and a posterior wall. At the point where the pterygoid plate joins the quadrate there is a thin tongue of bone extending down between the two bones for about half the distance of the contact; this is evidently the extension of the squamosal plate below the quadrate foramen.

The descending plate of the squamosal originates at the posterior end of the squamosal, at the outer portion of the otic notch, and runs outward toward the quadrate; it does not extend forward.

Anterior portion of the pterygoid plate. — This portion of the plate rises to, but does not fuse with, the bones above it; in all the specimens there is a thin line of matrix separating the parts. It has a short contact with the squamosal and the supratemporal; the line of cartilaginous attachment is indicated by the roughened area marked XI in Figure 3 of the description of the genotype. Anterior to the roughened area the upper edge of the plate is parallel to, but free from, the supratemporal for a short distance and then descends sharply to the pterygoid. Just below the upper end of the anterior edge there is a strong process tending directly inward; this is notched on both the upper and lower edges for the passage of nerves or vessels, perhaps for branches of the V or VII nerves. This process, shown in Figure 6, is perhaps the remnant of the proötic, but there is no evidence of even an initial separation from the pterygoid plate.

At the lower end of the anterior edge there is a deep notch; this is in the position described by Watson (1919) in *Capitosaurus* as the place of escape of the vena capitis lateralis and the VII nerve, but in his figure the nerve is marked as passing in front of the epipterygoid. This can be seen on the left side of Figure 6.

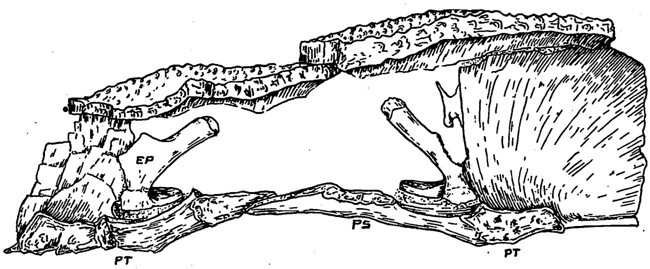

FIG. 6. Anterior view of the brain case of number 14154 U.M., showing epipterygoids and pterygoid plates. $\times \frac{2}{3}$. EP, epipterygoid; PS, parasphenoid; PT, pterygoid

Epipterygoid. — Just in front of the ascending plate of the pterygoid stands the epipterygoid. This is very peculiar in its form and relation to the adjacent structures. The bones of both sides are present in almost undisturbed position in specimen 14154 as shown in their symmetrical positions. (See Plate II, Fig. 2, and text Fig. 6.) In specimen 14098 the bone of the left side is in undisturbed position. Seen from the side, the bone has a rod-like ascending process which nearly reaches, but does not touch, the parietal. The posterior portion of the lower end is extended backward in a broad process which is closely applied to the edge of the rising plate of the pterygoid just above the notch, but in both specimens the epipterygoid is a separate element. This posterior process is the otic process of the epipterygoid, as described by Watson (1919), but has no such elevation as in his specimen of *Trematosaurus*. Seen from the front, text Figure 6, the lower end of the rising process is shown to originate from a broad, flat, disc-shaped base. In both specimens this base is separated from the pterygoid below by a layer of matrix; evidently it was attached by a fairly thick cartilage. This is the element which was found in a fragmentary state in the genotype skull and tentatively regarded as a proötic. It is the element which puzzled Branson and Mehl (1929) in their description of *Koskinodon.* It is obvious from their description and from their Figure 5 that the plate labeled L and called "epipterygoid" is the basal plate of the epipterygoid; that the part labeled U, "unnamed bone," is the rising process of the epipterygoid; that the part labeled T, "unit imperfectly fused with the 'epipterygoid,'" is a part of the rising plate of the pterygoid. The part labeled S, "stapes," is probably a splinter of the rising plate of the pterygoid or a displaced fragment of the stapes. The recognition of the true form of the epipterygoid and the stapes explains their less well-preserved material and relieves them from the necessity of their rather forced conclusions concerning any relation between the epipterygoid and the auditory apparatus and function.

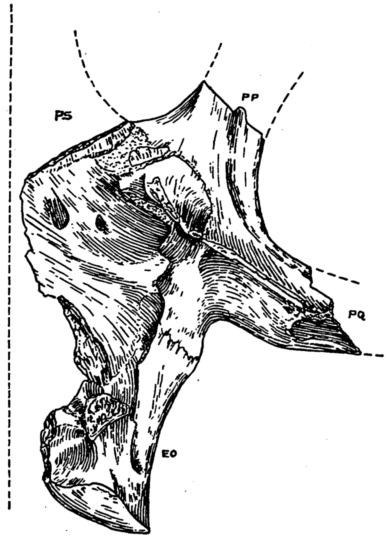

FIG. 7. Right side of the floor of the brain case shown in number 14098 U.M.; EO, exoccipital; PP, palatine ramus of pterygoid; PQ, quadrate ramus of pterygoid; PS, parasphenoid. × $\frac{2}{3}$

Floor of the brain case (text Figure 7). — The floor of the brain case is very similar to that of the genotype, but shows some additional and clarifying details. The description is drawn very largely from specimen 14098. The exoccipital portion is thickened on its outer border and is continued forward as far as the suture with the pterygoid as a raised edge, forming the side of this portion of the brain cavity. This border forms the major portion of the lower edge of the otic opening. There are no foramina in this part of the exoccipital, but the floor is penetrated by the canal which has its outer opening on the lower surface of the condyle. The anterior end of the canal cannot be determined, but it is possible that it communicates with the foramina at the base of the anterior end of the rising plate of the pterygoid, described below.

The parasphenoid forms the main portion of the floor of the brain cavity. It is thin in its median portion, but thickens where it joins the pterygoid and the exoccipital. Just anterior to the exoccipital-pterygoid suture is the oblique canal which was tentatively assigned to the internal carotid in the description of the genotype. The upper border of the outer opening of this canal is elevated and extended into a small process which is directly opposite to, and almost in contact with, the lesser process of the lower end of the stapes, as described above. The canal with its arched covering has the same course as in the genotype.

A similar condition is described by Watson (1919) in *Laccocephalus:*

> Very nearly or quite in the posterior end of the suture between the pterygoid and the parasphenoid a medium-sized foramen enters the latter bone and travels forward and inwards in its substance until it turns upwards towards the brain cavity. Comparison with the skull of *Capitosaurus* . . . shows that this canal must be for the internal carotid artery, for in the latter type the basisphenoid is perforated by obvious carotid foramina, and there is a small foramen at the junction of the exoccipital, pterygoid, and parasphenoid which is the only possible entrance of the carotid, and agrees with the posterior end of the canal in *Laccocephalus*.

Wepfer (1923), in his account of the skull of *Mastodonsaurus cappelensis*, describes (p. 62) and figures (Fig. 10) two grooves on the floor of the brain case in the exact position of these two canals which he suggests may be the impressions marking the course of nerves, the facialis-acusticus.

Just in front of the arch the floor is sharply depressed and forms a groove which leads into a similar groove on the pterygoid and finally into the foramina on the pterygoid just within the epipterygoid. This is the groove which Watson (1919) ascribes to the vena capitis lateralis in *Capitosaurus*.

The pterygoid portion of the floor lies within the rising plate and the epipterygoid. The lower end of the anterior edge of the rising plate is notched, as described above, and from the upper edge of the notch a shelf runs inward toward the opening of the internal carotid artery. This shelf is perforated by a foramen which opens into a much larger one below the shelf. The common

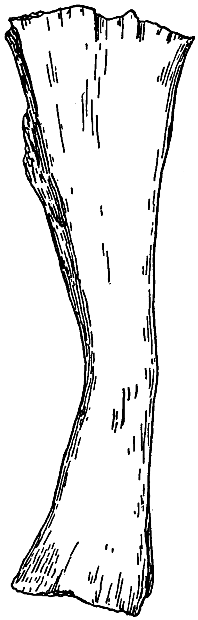

FIG. 8. Lateral view of right femur. Number 12946 U.M. × ½

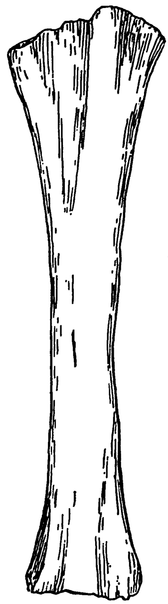

FIG. 9. Anterior view of right femur. Number 12946 U.M. × ½

canal leads into the body of the bone and may communicate with the canal in the exoccipital.

It is apparent that, though the skull of *Buettneria* is similar to Capitosauridae in form, in the position of the orbits and in the general relations of the bones, it is very much more advanced in the secondary chondrification of the brain case, approaching in this respect the *Metoposauridae* and the *Mastodonsauridae*. The same thing may be said for all other forms of stegocephalians described from the Triassic of North America; this is as would be expected from the Upper Triassic age of the beds.

Two nearly complete interclavicles, numbers 13027 U.M. and 13029 U.M., and a complete clavicle, number 13028 U.M., were found associated with the skulls. The interclavicles, Plate III, Figures 1 and 2, are notable for the greater extent and sharper contour of the portion anterior to the faces for the clavicles than

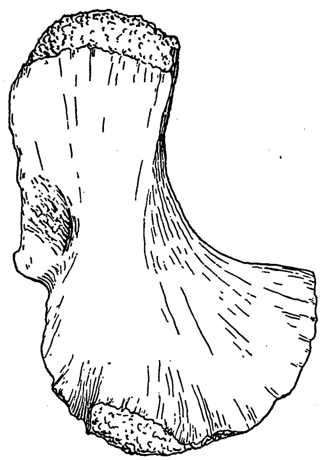

FIG. 10. Anterior face of humerus. Number 12940 U.M. × $\frac{2}{3}$

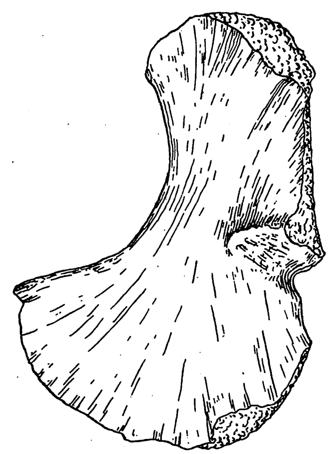

FIG. 11. Posterior face of humerus. Number 12940 U.M. × $\frac{2}{3}$

in other interclavicles found, and for the more restricted area of reticulate sculpture. A much larger portion of the surface of the bone is marked by linear sculpture than in *B. perfecta.* In this regard it corresponds to the sculpture of the skulls.

The clavicle shows a similar restriction of the area of reticulate sculpture.

Several femora were found with the skulls. These show few distinctive characters beyond the presence of a strong adductor ridge. The articular faces were evidently, even in the largest specimens, largely cartilaginous. Figures 8 and 9 show the form of specimen number 12946 U.M., which is one of the largest. It is uncrushed and undistorted. The major axes of the articular faces are nearly at right angles to each other.

There are two humeri in the collection, numbers 12940 U.M. and 12941 U.M., both from the left side. Figures 10 and 11 show the form of number 12940, which is undistorted; it is about two thirds of the size of the other specimen. These humeri were collected at a different locality, some miles north and west of Amarillo, Texas, but evidently belong to the genus *Buettneria,* the only large stegocephalian which has been found in Texas, and are, so far as the author knows, the only humeri of stegocephalians recovered from the Triassic beds of North America. The figures give a good idea of the form. The articular ends are rough, but convex instead of concave, as in the femora. The head is well developed, with a rough surface which extends down the outer side to the triangular face of the lower end of the deltoid ridge. The posterior face of the lower end of the ridge is convex and rugose and the anterior face is flat and equally rugose. The distal end of the humerus is expanded into a strong entepicondylar process, but, as is characteristic of all stegocephalians, there is no foramen. The radial tuberosity is prominent, but is not distinct from the region of the articulation of the ulna. On the outer side of the radial tuberosity there is a slight prominence in the position of the ectepicondylar process.

SUPPLEMENTARY NOTE

(September 11, 1931)

In the summer of 1931 the author was permitted to excavate the deposit near Snyder, Texas, through the courtesy of the owner, Mr. P. L. Fuller. Four very perfect skulls and a large amount of other material, almost entirely of *Buettneria bakeri,* were recovered. A description of the deposit and the specimens found will be prepared and published as soon as possible. The author desires in this note to express publicly his appreciation of the kindness of Mr. Fuller in permitting and helping the work of the Museum of Paleontology of the University of Michigan.

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PLATE I

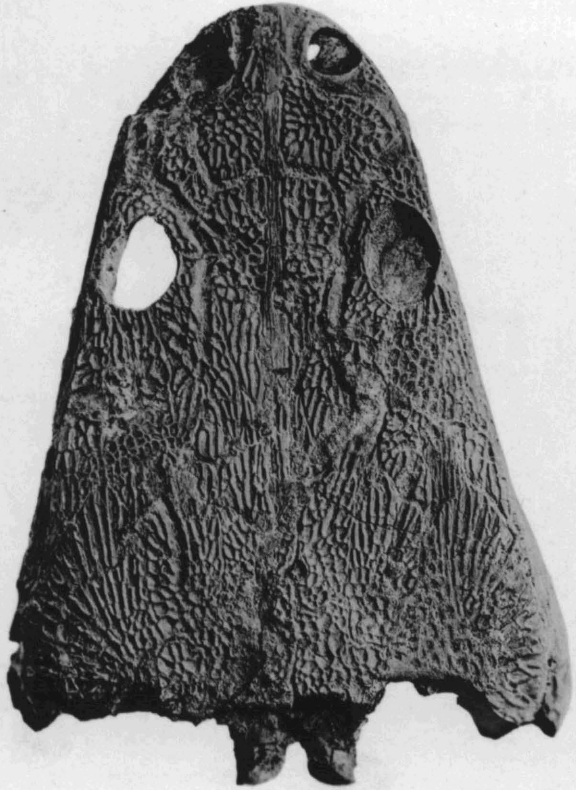

FIG. 1. Upper surface of skull of *Buettneria bakeri*, number 13055 U. M. × about ⅓

FIG. 2. Lower surface of skull shown in Figure 1. × about ⅓

PLATE II

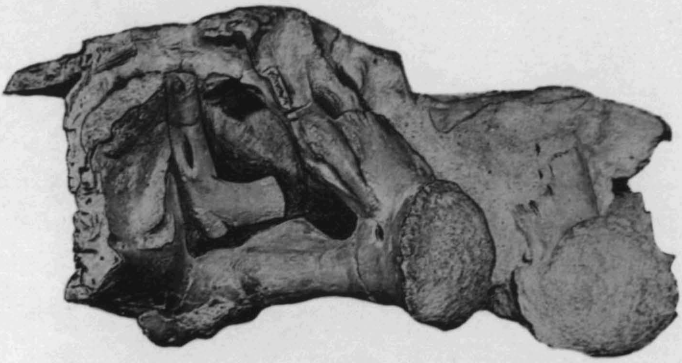

FIG. 1. Photograph of otic region in number 14154. Compare text Figure 5. × about ⅓

FIG. 2. Photograph of brain case of number 14154 from the front. Compare text Figure 6. × about ⅓

PLATE III

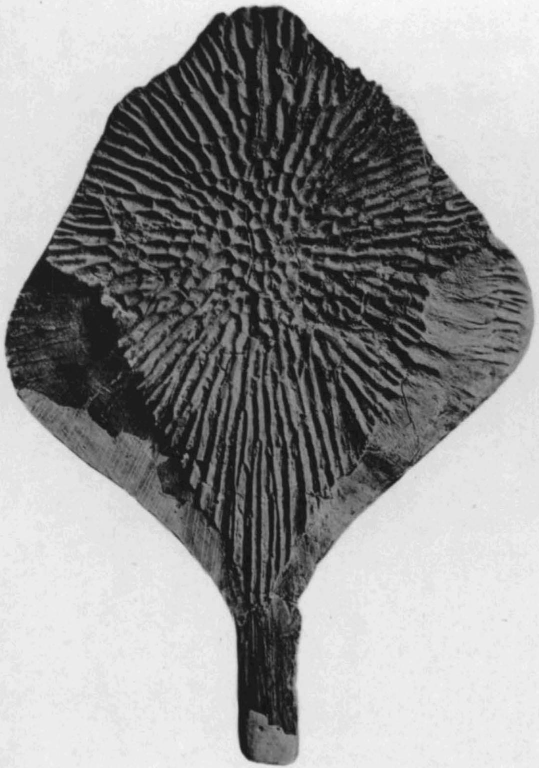

Fig. 1. Interclavicle, number 13027 U. M. × about $\frac{2}{3}$

Fig. 2. Interclavicle, number 13029 U. M. × about $\frac{2}{3}$

(Continued from inside of front cover)