

A NEW SALAMANDER FROM THE UPPER MIOCENE BEDS OF SAN JACINTO COUNTY, TEXAS.

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ABSTRACT. A Miocene amphibian skull was recently collected near Cold Spring, San Jacinto County, Texas. The skull elements are described, and the specimen is referred to a new genus and species. The systematic position of the specimen is not clear, but the Tertiary record of the amphibia is so scanty that this is to be expected. The specimen is in the Museum of the Agricultural and Mechanical College of Texas.

KNOWLEDGE concerning the amphibian fauna of the Tertiary is extremely scant, and every bone or fragment found merits careful study. In consequence, a skull discovered in the Upper Miocene of Texas, and acquired by the Texas A and M College Museum is of more than casual interest.

The matrix in which the skull was encased consisted of calcite, partly amorphous, partly crystalline, all very hard, necessitating the most tedious work in excavating the fossil. Lying between the jaws at about their lower level were three fragmentary bones which may or may not belong to the animal to which the skull proper belongs, but which are probably fragments of the hyoid apparatus of an adult salamander. It was thought wise to remove these, and dig away the matrix below them to ascertain if possible the characters presented by the palatal elements. In contact with certain of the skull elements, the matrix had fused solidly in such a manner as to make it impossible to ascertain certainly when matrix ended and fossil began. Occasionally too there were pockets of very soft material, of reddish brown color. The factors causing the softening of the matrix affected likewise the adjoining fossil tooth or bone. This was especially true of the region medial to the maxillary teeth and the medial surfaces of the teeth themselves, most of which were washed away by a water drip, after the very hard adjoining matrix was removed. The remaining portions of the teeth are very hard, but were not discernible until etched with weak acid.

After the greater portion of the matrix had been removed it was found that certain of the skull characters were due to strong compression, which was responsible for narrowing and elevating the braincase. The left maxillary bone had been

pushed back out of its normal position, while that of the right side had retained its normal position. On the left side also the quadrate and associated bones were wanting and the elements forming the left side of the foramen magnum were absent. It was not until the excavation of the condyle revealed that what had appeared to be a single condyle was in reality only the right half of a well-defined double condyle, that we found it imperative to refer the form to the Amphibia.

Believing at first that a single condyle was present, the elevated condition and the almost complete enclosure of the braincase strongly suggested to us that the skull might be that of an amphisbaenid, moreover, numerous fractures made it difficult to ascertain the character of many of the elements present.

? MUTABILIA Merrem 1820
 BATRACHOSAUROIDES gen. nov.

A genus of salamanders doubtfully referable to the MUTABILIA (SALAMANDROIDEA Noble) having an elongated premaxillary spine which separates the nasals; bony pterygoids; the frontals and to a lesser extent, other dorsal anterior cranial elements, sculptured; the occipital condyles with a convex surface apparently somewhat stalked and rather widely separated; premaxilla single, toothed; toothed maxillaries present; vomerine teeth present; mandibular articulation by a ball and socket joint, the ball being the ossified articulare.

Batrachosauroides dissimulans sp. nov.

Holotype:—Museum A & M College of Texas, No. 2234, a skull collected 3 miles northwest Coldspring, San Jacinto County, Texas, by Mrs. Claude Riley, March, 1938.

Description of the type:—The type consists of a skull rather badly fractured and laterally compressed, giving the appearance of a high, narrow, braincase. The posterior part shows a very narrow but distinct parietal crest. The left side of the skull lacks most of the posterior elements, including the left condyle. Some of the elements or fragments present on the left side have been pushed backward. These include the lower jaw and the maxilla.

Locality and stratigraphic position of type:—The locality from which this specimen was collected is in the central part of the east Texas. It was found about one-fourth off of

the Pointblank, Coldspring highway, some three miles north, slightly west, of the latter town. Fossil bearing clays and sands were first discovered here in 1914 by C. L. Baker, and since that time a fairly large, although fragmentary, fauna has been collected.

The beds are a part of the Fleming group, and at this locality have not been sub-divided satisfactorily into definite formations. The fauna, which is largely unpublished, is early Barstovian in age, but is certainly not as advanced as many faunas referred to this age. As the locality stands in the literature today it is definitely Miocene and is referred to the Upper Miocene on the basis of study of the latest discoveries.

DESCRIPTION OF THE INDIVIDUAL CRANIAL ELEMENTS.

Premaxilla:—This single element is fractured and incomplete. The anterior dentigerous portion is separated from the spine and broken into at least three fragments, two of which remain in place. A portion from the right side is missing. A longitudinal fracture severs the spine into two somewhat unequal moieties. The fracture, on superficial observation, suggests that it is a suture, and further suggests the possibility that the dentigerous portion may likewise have been in two parts originally. Closer scrutiny, however, points to the greater probability that it is a fractured single element. It is presumed that it curved down at the anterior end, although this is not certain.

It is not possible to ascertain beyond question the character and number of the premaxillary teeth. Basal portions of five teeth can be seen and judging by their position it is estimated that originally there were nine teeth. It seems almost certain that an uneven number of teeth was present, since a tooth somewhat larger than the others occupies a medial position.

The surface of the spine is smooth save for a very few pits or grooves.

Maxillae:—The maxilla on the right side seems to be complete, or nearly so, and in its normal position. However, it is possible that a small anterior portion is missing, together with the contiguous part of the premaxilla. From an external lateral view, its lower edge and the teeth are hidden by the dentary and its teeth. Viewed from the medial side parts of 18 or 19 pleurodont teeth can be counted. There is evidence of some pitting although the surface is relatively smooth. On

the left side the small part of the maxilla which remains has been shifted back much beyond its normal position.

Prefrontals:—The prefrontal remaining on the right side, presumably in its normal position, is a small, roughly sculptured element lying between the upper edge of the maxilla and the frontal. Anteriorly the element is thin, while posteriorly it is thickened and bent down with a broad, posterior face. On the right side the maxilla has been displaced backward and a fragment of the prefrontal is attached to the upper edge of the maxilla but separated from the frontal. On the posterior face there is a faint suggestion of a suture as if a lacrymal element may have been present. We consider this possibility unlikely.

Nasals:—Apparently all trace of the nasals is missing save for a small posterior fragment cemented to the prefrontal by calcite. It is believed that the nasals originally lay loosely upon the nasal cartilages without sutures or at least with only very insecure sutures against the adjoining elements. The nasal opening is directed forward.

Frontals:—The paired frontals extend anteriorly about as far as the maxillae, terminating in a sharp point, somewhat concealed anteriorly by the premaxillary spine when seen from above, and presumably concealed by the nasals when these are present. Posterior to the premaxillary spine the frontals have a common median suture, and extend back to the level of the posterior end of the lower jaw. The sutures of the frontals with the surrounding elements are very difficult to follow with certainty, due to numerous fractures, but these apparently are as is indicated in Fig. 1. The dorsal surfaces of the anterior and medial parts are deeply sculptured as far back as the distinct temporal ridge. Force applied laterally has brought the sides of the frontals rather close together (about 9 mm.) while the elevation of the summit is about 11.5 mm. above the exposed part of the parasphenoid.

Parietals:—The parietals meet on the median line forming a very narrow, low crest. The posterior parts of these elements are shattered and much is missing on the right side and the greater part of that on the left. There appears to be a forward and downward projecting arm, bordered anterodorsally by the frontal and posteriorly by the otic elements (probably) or the squamosal.

Exoccipital:—Only the right exoccipital is present. Appar-

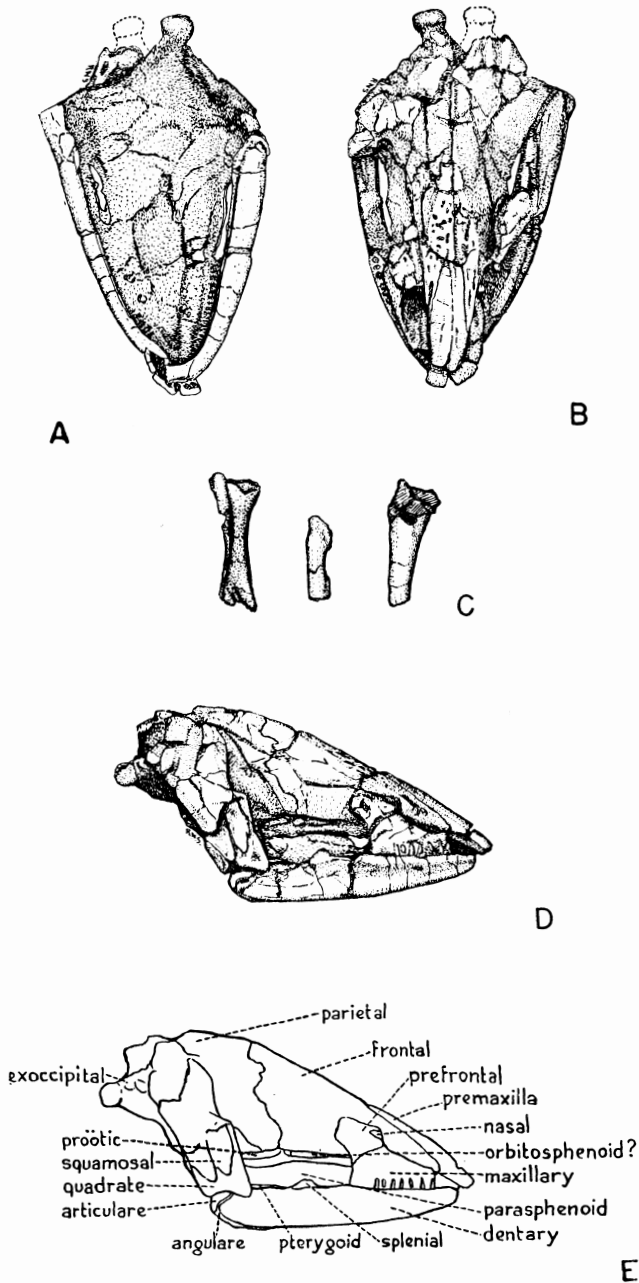


FIG. 1. A. Inferior view of skull with lower jaws in place. B. Superior view of skull. C. Small elements removed from matrix in clearing the palate, may be hyoid bones. D. Side view of skull and lower jaw. E. Outline of skull and lower jaw with those elements determined indicated. All figures somewhat diagrammatic. $\times 1\frac{1}{2}$.

ently it is nearly in its normal position. It possesses a short posterior stalk which terminates in the occipital condyle. The latter is transversely placed, somewhat ovate, the posterior articular surface, however, being somewhat flattened. The two edges of the exoccipital which form the upper and lower borders of the right side of the foramen magnum are indistinguishable from the matrix. Ventrally too, its borders are lost, and we cannot state whether the exoccipital elements remain separated or fuse with the parasphenoid as occurs in certain Caudata.

Quadrate:—This bone is much thickened, especially its lower parts. The inferior face is concave, forming a fossa (cotylus). From a lateral view the quadrate is hidden by the squamosal save for the lower end. Its anterior face is exposed, more extensive and distinctly concave; a notch in the upper border is due to a fracture.

Squamosal:—The squamosal is now broken into a number of parts and its upper extension cannot be determined. However, the anterior part of the suture with the parietal is indicated by a blackish line. It appears that the upper posterior part of the bone is broken. The severed portion now lies above the exoccipital.

Otic bones:—The operculum cannot be found nor can the extent of the other otic elements be ascertained. We interpret a fragment lying between the parietals and the pterygoid as representing a part of a proötic.

Orbitosphenoid:—It is uncertain whether this element is present or not. We interpret some fragments lying between the lower edge of the frontal and the parasphenoid (in lateral view) as belonging to that element. However, there is no certainty that this is the case.

Parasphenoid:—This element is of large area, but its posterior extension seems to be indistinguishable from the matrix. It is fractured in numerous places and in other places sections of the bone seem to have been replaced with crystalline calcite. Both lateral edges apparently are fractured and the broken posterior surface is strongly concave. Anteriorly the element becomes indistinguishable from the matrix and its sutures with the prevomers cannot be made out.

Anterior palatal region:—In the anterior palatal region somewhat posterior to the premaxillaries and on the right side there is a short series of teeth. These are out of line with

the maxillary series and we believe them to be the right vomerine teeth. Parts of four teeth can be counted here, and two other fragments are visible between the ends of the dentaries at the point of the symphysis. The entire (double) series probably consisted of 8 or 10 teeth. It is improbable but not impossible that these are teeth broken away from the dentary or mandible. The lower jaws, now fused to the cranium terminate just at the point where the presumed vomerine series lie. Hence there is some uncertainty as to whether these teeth are properly interpreted.

Pterygoids:—The right pterygoid is rather wide. It extends forward from the quadrate and is in contact with the parasphenoid at least a part of its length. Its anterior end is probably free, (save for matrix). That on the left side has apparently been fractured and only a part of the bone can be found. We find no evidence of teeth on this element.

Dentary:—This element is present on each side. That on the right side is moved slightly forward, the curved anterior end is fractured and reaches somewhat beyond the median line. That on the left side is pushed back and the posterior part can with difficulty be distinguished from the matrix. The right dentary has a length of 27 millimeters, measured along the curve. Although fractured in a number of places it remains practically in its normal position. The tips of seven teeth are visible above its upper edge. Behind these, posterior to a short space two more teeth can be discerned, where they have been broken off at the jaw level; while anteriorly four others are discernible where they also have been broken off at about the level of the jaw. The posterior teeth are circular or somewhat oval in cross section while the anterior teeth are much larger, oblong or triangular in cross section and have a much greater width. On the left lower jaw only three teeth are present above the edge of the jaw. From a median view, about 15 teeth can be counted, none complete. The outer face of the dentary is traversed by a broad, relatively deep, longitudinal groove, narrower and deeper anteriorly, becoming shallower and finally disappearing towards the posterior part of the bone. A foramen is discernible below the 11th (?) tooth. There is little or no pitting apparent such as occurs on certain of the dorsal skull elements.

Angularis:—This bone lies on the inner face of the dentary. When the jaw is viewed laterally the suture can be seen only at

the extreme posterior part of the jaw. Viewed from below the suture can be traced nearly its entire length. Anteriorly it terminates in a splint-like point. Posteriorly the angulare is concave. We find no trace of a prearticulare and presume that this is fused with the angulare into a single element. The upper edges of both angulare and dentary are broken off. There is evidence of a deep groove between the two bones on the upper surface of the jaw.

Articulare:—The postero-dorsal surface of the articulare forms the ball of the jaw articulation. This surface is irregularly rounded. The total extent of this element cannot be determined.

Splénial:—The outlines of a splénial bone cannot positively be discerned, but it is believed that one is present because on the inner face of the left jaw the basal parts of five or six teeth are visible at the most elevated part of the jaw. These are apparently out of line with the other mandibular teeth. This part of the jaw is missing on the right side.

Measurements in millimeters:—These measurements are actual (or estimated if a fragment is missing).

Skull, premaxillary to occipital condyle	36
Width of skull with jaws	22.5
Length of premaxilla	13
Length of frontal	17
Length of dentary	27
Length of maxilla	12.5
Width between quadrates	20 ?
Estimated width (normal)	25

Relationship:—The systematic position of *Batrachosauroides* is not wholly clear. However, based on the characters afforded by the type, we believe the genus should be referred to the suborder MUTABILLA? (SALAMANDROIDEA) at least until further specimens shall have provided better criteria for assigning it to a more certain position in the system. We find that other subordinal groups of Caudata differ as follows:

Meantes. Members of this order have groups of teeth lying above the parasphenoid and lack maxillaries. Teeth are wanting on the dentary and premaxilla.

Proteida. Maxillaries absent; palatine and pterygoid contiguous; nasals and prefrontals wanting; pterygoid teeth present.

Cryptobranchoidea. Angulare and prearticulare separate:

nasals meet in mid-dorsal line not separated by the spines of the premaxilla.

Ambystomoidea. Premaxillae divided, with spines close together. Splenial teeth not present in adult.

Of the three families belonging to the SALAMANDROIDEA the relationship appears to be closer to the AMPHIUMIDAE than to either the PLETHODONTIDAE or the SALAMANDRIDAE. Thus the latter family is separated on the character of oposthocoelous vertebrae, and paired premaxillaries. The PLETHODONTIDAE differ in the absence of splenial teeth in adults and teeth are present, on the parasphenoid. Maxillary teeth are occasionally absent, but normally present.

Batrachosaurides is a large species, presumably comparable to the size of the living species of *Amphiuma*. The sculpturing of the anterior skull bones, the presence of a temporal ridge, as well as the general alignment of the cranial elements as far as can be determined point to a relationship with the Amphiumidae. The genus, however, differs from *Amphiuma*, in having a well-developed series of splenial teeth on the posterior part of the lower jaw, occupying a position similar to those in the adult of *Necturus*.

Remarks:—The three unattached fragments found in the matrix between, but on a level with the jaws are presumed to be fragments of the hyoid apparatus, but an attempt to place them more specifically would be largely conjecture. None is complete (*See Fig. 1 C*).

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