

A NEW SPECIES OF *PALEORHINUS* FROM THE TRIASSIC OF TEXAS¹

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ABSTRACT. A new species of paleorhinid phytosaurs, *Paleorhinus scurriensis*, from the basal Dockum of Scurry County, Texas, is described. The lateral position of the quadrate foramen first reported in *P. bransoni*, is corroborated and is considered characteristic of the genus. The otic opening is present as a deep notch rather than as a completely bounded foramen as described in *P. bransoni*, and there is therefore more reason to suspect misinterpretation of this region in the genotype. A further instance of the presence of a probable persistent parietal foramen in an immature phytosaur is noted. Youthful characters in the genus are discussed and the species is compared with other phytosaurs. Observations are offered on the geologic significance and provisional limitations are placed upon Dockum-Popo Agie correlation.

INTRODUCTION

RECENT examination of the Triassic vertebrate material housed in the West Texas Museum (Texas Technological College) has revealed the presence in that collection of a number of hitherto unrecognized forms from the Dockum group of Western Texas. Among these is a skull of a small phytosaur collected in 1937 by Dr. John Clark on the farm of Mr. H. G. Bryan some two and one half miles northeast of Camp Springs, Scurry County, Texas. The horizon may be referred to the basal Dockum² which in this area is a fine to coarse sandstone and conglomerate which, although white in an unweathered state, appears brownish after prolonged exposure.

The skull when found was enclosed in a concretionary mass of white, fine-grained, calcareous sandstone that has served to protect the bone from rapid disintegration. The greater portion of the snout, the upper and lateral surfaces in the orbital region, and the lateral bones surrounding the temporal fenestrae are lacking. Otherwise the skull is free of distortion and the majority of the sutures are remarkably distinct. Unfortunately the palatal and posterior cranial regions have not been completely freed from the matrix and therefore these areas are only partly available for discussion.

¹ Expenses connected with the preparation of the present paper were defrayed by the Research Council of the Texas Technological College, Lubbock, Texas.

² Beede and Christner (1926) have proposed the name Camp Springs conglomerate for the basal Dockum of this region, but due to the discontinuity inherent in the Dockum sediments it seems best at present to consider the Camp Springs conglomerate as of only local importance.

The skull is of the general phytosaurian form, small in size, longirostrine, and somewhat depressed dorso-ventrally. The extreme anterior position of the external nares suggests a close relationship to the genus *Paleorhinus* Williston. The presence of a lateral quadrate foramen, confirmed by the present specimen, appears now to be characteristic of the genus and offers further evidence of the generic identity of the two specimens. The general proportions of the skull and the unusual construction of the nasal structures is similar to that found in *Paleorhinus parvus* Mehl, and it is therefore assumed that the present specimen is more closely allied to that species than to *P. bransoni*. The relative smallness of the present skull (estimated length 550 mm.), the decidedly uncrowded arrangement of the maxillary teeth, and the apparent presence of a persistent parietal foramen attest the immaturity of the individual.

Unfortunately the type specimens of *Paleorhinus* leave much to be desired from the standpoint of preservation. In many respects the present specimen is in better condition than the other two, but because of this fact comparison with them is rendered extremely difficult. Were all three typical *Paleorhinus* skulls equally well preserved many seeming differences in cranial construction might disappear. The writer, however, is of the opinion that such characters as the dorso-ventral flattening of the skull, the exceptionally large palatine foramina, and the moderately elongate posttemporal fenestrae, are of sufficient importance to separate the present form from the previously described species.

ORDER Thecodontia

SUBORDER Phytosauria

FAMILY Phytosauridae

SUBFAMILY Phytosaurinae Camp

Paleorhinus scurriensis n. sp.

HOLOTYPE: Incomplete skull, W. T. Mus. Pal. Col., No. 539.

HORIZON: Basal Dockum, Triassic (Camp Springs conglomerate).

LOCALITY: Two and one-half miles NE of Camp Springs, Scurry County, Texas.

DIAGNOSIS

Small paleorhinid phytosaur; nares anterior, quadrate

foramen posterior in position, but visible in lateral aspect. Skull flattened dorso-ventrally. Internarial septum composed of premaxillaries and nasals; septomaxillaries not meeting in the median line. Palatine foramina very large; posttemporal fenestrae elongate. Persistent parietal foramen probably present in immature individuals.

OPENINGS IN THE SKULL

The pronounced anterior position of the narrow and elongate external nares in *Paleorhinus scurriensis* is even more striking than in the previously described species of *Paleorhinus*. They look upward and slightly forward, the posterior borders being somewhat more elevated than the anterior rims. They are transversely wide behind, but become progressively narrow in the anterior direction and finally disappear in narrow slots on the upper surfaces of the septomaxillaries.

The choanae are elongate, narrow openings situated in the palatal vault on either side of a thin but vertically broad median septum. They are situated some distance behind the posterior limits of the external narial openings.

The relatively small antorbital fenestrae are oval in outline. The left opening is slightly larger than the right, the former measuring some 64 mm. by 32 mm. along the extreme axes. They extend forward to a point some 36 mm. behind the posterior limits of the external nares. The openings are only partially visible in lateral aspect although they may be seen in their entirety from above. The lateral areas of the skull immediately surrounding the antero-superior and posterior margins of the fenestrae are sharply depressed in a manner similar to that seen in *P. bransoni*.

The median and posterior rims of the superior temporal fenestrae are preserved on both sides of the skull and indicate that these openings were broadly oval in outline.

The boundaries of the lateral temporal fenestrae are completely lacking, but the extreme thinness of certain portions of the right jugal and squamosal indicate that these areas were not far removed from the borders of the openings on that side of the skull.

A small portion of the frontal rim of the right orbit is preserved. Apparently the orbits were directed upward and

outward. The transverse diameter of the frontals between them seems to have been somewhat less than in *P. bransoni*.

Unfortunately the various foramina situated in the cranial region have not been freed from the matrix. Numerous fossae can be seen leading into the general vicinity of them, but their actual positions cannot be determined.

The quadrate foramina, represented by a small portion of the right opening, were visible in lateral aspect although their position was somewhat more posterior than in *P. bransoni*.

The foramen magnum is nearly round in outline.

The posttemporal fenestrae are elongate and vertically narrow. They are larger than in the skull of *P. bransoni*, but are, nevertheless, relatively smaller than in the majority of the larger phytosaur species.

The palatine foramina in *P. scurriensis* are large, elongate openings bounded medially by the palatines and laterally by the ectopterygoids and maxillaries. The total area of each opening appears greater than in any other genus with the possible exception of *Angistorhinus*.

INDIVIDUAL SKULL ELEMENTS

PREMAXILLARIES: Only the posterior portion of the premaxillaries is available for discussion. When seen from above the bones are relatively smooth, strongly rounded transversely on the upper surface, and meet each other in the median line. They are not separated posteriorly by interjection of the septomaxillaries, but, as described in the following paragraphs, continue into the narial opening forming the greater part of the internarial septum. Elsewhere the premaxillaries are excluded from the narial rim by the septomaxillaries and the nasals. They terminate laterally some 40 mm. anterior to the antorbital fenestrae, in a sharp tapering process which separates the nasals and the maxillaries in this region of the skull. Ventrally the premaxillaries are strongly vaulted forming the roof of the anterior portion of the palate. On either side of the median line there is a strong, sharp ridge running longitudinally on the inside of the alveolar trough. Similar alveolar ridges, although reported in the majority of the phytosaurs including *Paleorhinus bransoni*, are, however, described as being "little developed" in *P. parvus* (Mehl, 1928). This ridge dies out posteriorly on the palatal surface of the

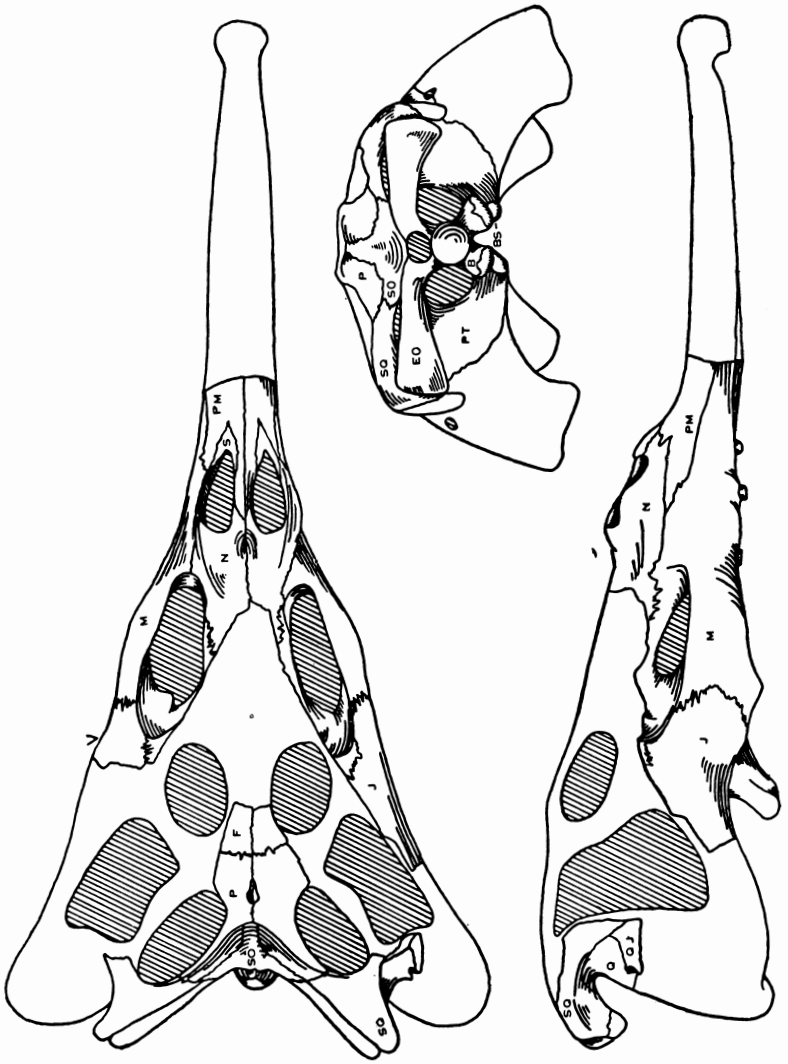


Fig. 1. *Paleorhinus scurriensis*, new species; W. T. M. Pal. Col., No. 539. Dorsal, lateral, and posterior aspects of skull. Approximately $\frac{1}{4}$ nat. size. Abbreviations: B, basioccipital; BS, basisphenoid; EC, ectopterygoid; EO, exoccipital; F, frontal; J, jugal; M, maxillary; N, nasal; P, parietal; PA palatine; PM, premaxillary; PT, pterygoid; Q, quadrate; QJ, quadratojugal; S, septomaxillary; SO, supraoccipital; SQ, squamosal. V indicates area through which section (Figure 3) was taken.

maxillary. Only one possible premaxillary alveolus is preserved in each bone. Posteriorly the premaxillary-maxillary sutures converge on the median line causing the premaxillaries to become narrow in this direction. They project into the choanae for a distance of 10 mm. at which point they have been destroyed by a transverse fracture through the skull. There is no contact with the palatines on the palatal surface.

As in *P. parvus* the relatively thick internarial septum rises somewhat above the level of the elevated narial rim. It is composed principally of the postero-mesial extensions of the premaxillaries which are overlapped laterally by the thin mesial wings of the septomaxillaries. The nasals project between the nares for a distance approximately one-fourth of the length of the septum.

In the majority of the phytosaurs this septum is formed by the septomaxillaries and the nasals. The premaxillaries are usually excluded from it by the juncture of the septomaxillaries in the median line. The preservation of the present specimen is such that when two adjacent bones have been damaged by weathering, a thin lamina of concretionary matrix remains standing to mark the position of the suture. These concretionary partitions are clearly seen in the region of the nares, and there can be little doubt that the condition exists as figured.

In his restoration of the skull, Lees (1907) indicates that the internarial septum in *P. bransoni* is composed altogether of the nasals which extend well forward anterior to the external nares and bound those openings completely. No septomaxillary elements are shown in the figures. Mehl (1928), however, has demonstrated the presence of these bones in the skull of *P. parvus* and their position in *P. scurriensis* cannot be questioned. Insofar as can be determined the relationship of the septomaxillaries to the premaxillaries and the nasals and the general construction of the internarial septum is similar if not identical in the two latter species, and there is, therefore, strong reason to expect similar conditions in *P. bransoni*.

SEPTOMAXILLARIES: The septomaxillaries are relatively small V-shaped elements that form the anterior rims of the external nares. They project forward between the posterior wings of the premaxillaries for a distance of only 18 mm. The posteriorly directed mesial process of each bone extends well

into the naris where it laps against the septal portion of the premaxillary. Insofar as the writer is aware, a similar relationship is to be seen elsewhere only in *Paleorhinus parvus*. Mehl (1928), however, was unable to determine the posterior extent of the septomaxillaries in *P. parvus*, and therefore it is not known whether these elements joined each other in the median line in that form. In the present specimen, however, it is certain that they do not.

MAXILLARIES: The maxillaries are rather massive and elongate. Their maximum anterior extension on the lateral surfaces of the skull cannot be determined. In palatal aspect they form most of the anterior borders and part of the lateral margins of the choanae. They do not meet in the median line of the palate, being everywhere separated by the posterior continuation of the premaxillaries. Laterally the maxillaries occupy large areas on the sides of the skull and contribute greatly to the borders of the antorbital fenestrae. In fact, from the preservation of the specimen, it would appear that the maxillaries completely surround these openings. It seems probable, however, that at least a small part of the upper margins of the fenestrae would be contributed by the lacrimals. Beneath this opening the maxillaries are vertically thickened and become somewhat convex downward. The maxillaries contain 16-17 rounded alveoli of which the anterior five or six are decidedly the smallest. They are separated by transverse partitions and it appears that the teeth were not greatly crowded, a feature which has been interpreted as a youthful character in *Machaeroprotopus* (Colbert, 1947).

JUGALS: The jugals are poorly preserved and can be only partially described. They articulate anteriorly with the maxillaries by means of angular interdigitating sutures. These sutures run upward and backward along the ridges created by the depression of the lateral skull surfaces just posterior to the antorbital fenestrae. In lateral aspect the ventral outline of the jugals is strongly arched permitting a wide view of the postero-ventral processes of the ectopterygoids. The relationships of the jugals to the orbits and lateral temporal openings cannot be accurately determined.

No recognizable portion of either lacrimal is preserved.

NASALS: The nasals are massive bones surrounding the external nares laterally and posteriorly. They are rugosely

sculptured dorsally, but are relatively smooth on the lateral surfaces. They project slightly between the narial openings, forming not more than one-fourth of the internal septum. Posterior to the nares the nasals are depressed and transversally constricted. Below the narial rim there is a moderate depression of the lateral skull surfaces which together with the constriction of the dorsal surface posterior to the nares lends a rather bulbous appearance to the nasal prominence. In lateral aspect the bones become wedge-shaped anteriorly where they separate the premaxillaries from the septomaxillaries for a short distance. They terminate laterally slightly in advance of the external nares. The nasals do not contribute to the borders of the antorbital fenestrae, but are separated from those openings by thin, backwardly directed processes of the maxillaries. Due to the loss of the dorsal region of the skull posterior to the nasal prominence the relationships of the nasals to the other bones of the skull cannot be determined.

FRONTALS: The frontals are poorly preserved and little can be said of them. The transverse diameter between the orbits appear to have been slightly less than in *P. bransoni*, and as a result the orbits probably looked more directly upward than in that form. The frontals meet the parietals along an almost straight transverse interdigitating suture.

PARIETALS: The parietals are proportionately of about the same size as in the type of *P. bransoni* although the maximum transverse diameter appears somewhat less than in that form. The sutural contacts are largely obscured in the present specimen, but the median and frontal sutures can be delimited to some extent. When seen from above the parietals appear as postero-median elements of roughly Y-shaped outline, the upper surfaces of which are rugosely sculptured. They are deeply excavated on either side by the superior temporal fenestrae. Posteriorly the parietals separate, each bone sending backward a wing-like process which lies above the supra-occipital and meets the antero-mesial branch of the squamosal. As a result of destruction of the upper surface of the post-temporal arcade on either side of the skull, the exact point at which this latter juncture occurs cannot be determined. It is the opinion of the writer that the suture must lie at about mid-length of the posttemporal bar. It is certain that it does not occur mesial to that point.

Some 12 mm. from the fronto-parietal suture an abnormally deep pit of roughly ovate outline excavates the parietals in the median line. It is certain that this pit, although much deeper than the adjacent sculpture, does not extend into the cranial cavity. Its relations to the internal structure

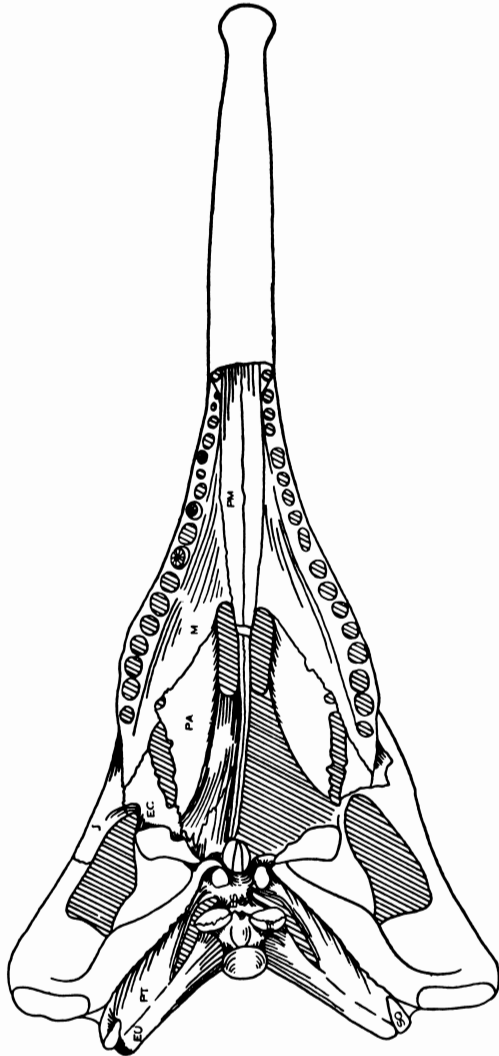


Fig. 2. *Paleorhinus scurriensis*, new species; W. T. M. Pal. Col., No. 539. Palatal aspect of skull. Approximately $\frac{1}{4}$ nat. size. For abbreviations see Figure 1.

of the cranium cannot be observed. The writer, therefore, cannot state definitely that this pit represents a pineal foramen, but its position is strongly suggestive. A pineal foramen is reported in *Mesorhinus* and Camp (1930) has demonstrated its presence in a juvenile specimen of *Machaeropsopus lithodendrorum*. In view of this evidence and the fact that the epiphysis is strongly developed in adult individuals of *Machaeropsopus* (Camp, 1930), vestiges of the pineal opening might be expected in immature members of the Phytosauria.

SQUAMOSALS: The squamosals are poorly preserved. It can be seen, however, that they are overlapped posteriorly by the paraoccipital processes of the exoccipitals. They articulate laterally in diagonal sutures with the quadrates. Apparently they form about one-third of the postero-mesial borders of the superior temporal fenestrae, but as pointed out above, the exact position of the parieto-squamosal sutures cannot be determined. The squamosals and quadrates are deeply excavated in the vicinity of the otic foramen. Lees (1907) described this area as containing an otic foramen in *P. bransoni*. In the present specimen, however, this area is well preserved and there is no indication of any structure that might have bounded the opening on the ventral side. It is, therefore, concluded that while the otic opening is deeply excavated in *P. scurriensis* it was present as a deep notch rather than as a completely bounded foramen, and the writer is inclined to agree with Mehl (1928) and others in questioning the accuracy of Lees' interpretation of this region in the genotype.

QUADRATES AND QUADRATOJUGALS: Only a small portion of the quadrate and quadratojugal from the right side of the skull is available for discussion. Strong indications of a quadrate foramen as shown by Lees in *P. bransoni* are to be seen on the postero-lateral surface of the quadrate. The opening is clearly visible in lateral aspect, but it is situated somewhat nearer the posterior edge of the quadrate than in that species.

PALATINES AND PTERYGOIDS. The palatal vault with its extremely thin and delicate bones is by no means well preserved in the present specimen. In fact, it has been deemed inadvisable to attempt the removal of the matrix from this region on the left side of the skull. A longitudinal fracture has, however, caused the exposure of the sides and roof of the palatal vault

on the right side and, although badly broken, the palatine and pterygoid can thus be delimited with some degree of certainty. The posterior limits of the choanae cannot be determined in the specimen.

The palatines and pterygoids form the greater portion of the high steeply vaulted palate posterior to the choanae. The former elements are of the characteristic phytosaurian construction with the usual horizontal and vertical plates set off from each other at angles approaching 90 degrees. Laterally and anteriorly the palatines are in sutural contact with the maxillaries; postero-superiorly they are overlapped by the pterygoids, whereas postero-laterally they meet the ectopterygoids. When seen from below, the horizontal plate of each pterygoid is broadly triangular in outline. The base of this triangle is somewhat rounded and thickened whereas the posterior leg forms the internal boundary of the palatine foramen, which in *P. scurriensis* is slightly less than one-half (60 mm.) of the total length of the palatine. Anteriorly the mesial border of the horizontal plate forms the postero-lateral rim of the choana, but other relationships of the vertical plate in this region cannot be determined. Each palatine terminates anteriorly, on the lingual surface, in a sharp pointed process which wedges out in the maxillary at a point just behind the anterior borders of the choanae.

The badly broken right pterygoid only is preserved in the palatal region. It forms part of the vertical sides of the palate and enters into the palatal roof to an undetermined extent. Along the median line of the palate there is a rather sharp, ventrally directed carina which is formed, at least in part, by the joining of the downward turned mesial edges of the pterygoids. This carina continues forward into the choanae and there probably meets the septal portion of the premaxillaries although the imperfection of the specimen in this region makes it impossible to state the exact position of the juncture. When seen from behind both pterygoids appear as broad-wing-like plates of bone. There is no indication of the presence of the quadrate suture on the preserved surfaces of either bone. Below, downwardly and anteriorly directed flange-like processes fold around the anterior and lateral surfaces of the basiptyergoid processes.

There is no evidence of vomerine sutures and the writer is

inclined to believe that these elements did not appear in the palatal aspect in *P. scurriensis*.

ECTOPTERYGOIDS: The right ectopterygoid is partially preserved. The antero-lateral process articulates with the maxillary and jugal and surrounds the postero-lateral half of the palatine vacuity. In lateral aspect the bone projects

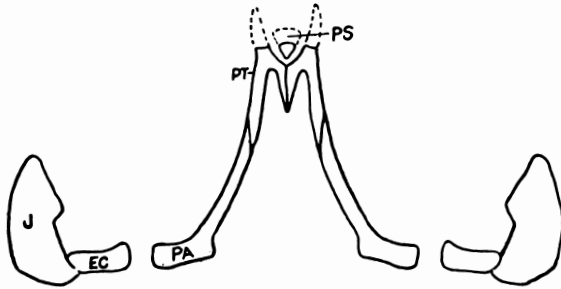


Fig. 3. *Paleorhinus scurriensis*, new species; W. T. M. Pal. Col., No. 539. Transverse section through skull (V, Figure 1), somewhat diagrammatic. PS, parasphenoid process. $\frac{1}{2}$ nat. size.

downward well below the lower border of the upwardly arched jugal. It underlies the outer process of the pterygoid.

SUPRAOCCIPITAL: The supraoccipital is a relatively large triangular element situated in the postero-mesial notch of the skull. From above it is more completely visible than in *Paleorhinus bransoni*, approaching in this respect, the condition found in *Promystriosuchus ehlersi*. It forms only a small part of the upper boundary of the foramen magnum and extends upward terminating against the posterior eave-like extension of the parietals just below the level of the skull roof. Laterally the bone extends outward on either side in narrowing wing-like processes to articulate with the squamosals on the posterior face of the skull about mid-length of the post-temporal arcade. Supero-laterally it is bounded by the parietals whereas ventrally it unites with the exoccipitals along horizontal sutures.

EXOCCIPITALS: The exoccipitals are of the characteristic phytosaurian form although the paroccipital processes appear to be somewhat more elongate than in the majority of the genera. Except for the small mesial portion, contributed by the supraoccipital, they bound the foramen magnum completely and extend downward onto the occipital condyle form-

ing a major part of the neural surface of that process. The paroccipital processes are relatively straight, extending strongly backward and outward to terminate in rather broadly expanded buttresses against the squamosals. The elongate but vertically narrow posttemporal fenestrae are situated at about mid-length of this process.

BASIOCCIPITAL: The basioccipital comprises the greater part of the rounded knob-like occipital condyle which is set off from the remainder of the bone by a strong but relatively short neck. It is excluded from the floor of the foramen magnum by the junction of the exoccipitals in the median line. Ventrally the basioccipital is divided along the median line by a deep groove thereby forming the posterior halves of the strongly developed roughened tubera. Supero-laterally it is in contact with the exoccipitals whereas antero-ventrally it joins the basisphenoid.

BASISPHENOID: The basisphenoid is a large, irregular median element situated just anterior to the basioccipital with which it is cojoined along a very tenuous suture. The connection between the two bones is much less stout than in the larger phytosaurs. Postero-ventrally this suture runs transversely across the large downwardly and anteriorly projecting tubera of which the basisphenoid forms the anterior one-half. Antero-ventrally the bone is again expanded on either side of a deep median pit into two strong, downwardly and laterally projecting basisphenoid processes which are enclosed anteriorly by the median, recurved flanges of the pterygoids. Much of the matrix still remains in this region of the skull and other features of the basisphenoid and adjacent elements are therefore obscured from view.

LATEROSPHEOID: Insofar as they can be seen the laterosphenoids underlie the frontals and parietals medially. They are broken on either side of the skull, but it is apparent that they also underlie the postfrontals to some extent. Posteriorly they meet the proötics, but are excluded from contact with the supraoccipital by the junction of proötics and the parietals in front of those bones. The bones are rather bulbous in appearance beneath the parietals, but taper gently inward anteriorly beneath the frontals.

PROÖTICS: The proötics are inadequately exposed, but it can be seen that they are relatively large. They are bounded

above by the supraoccipital and antero-posteriorly by the parietals.

GROWTH FACTORS IN THE GENUS *Paleorhinus*

The size and robustness of the type skull of *Paleorhinus bransoni* indicate that the individual was adult or nearly so whereas there can be little doubt as to the immaturity of the present specimen. The question of growth factors in the genus *Paleorhinus* may therefore be examined.

Colbert (1947) has attributed certain variable characters in *Machaeroprotopus* to factors of growth. The extent to which these criteria (robustness, prenarial crest, posterior expansion of premaxillaries, spacing of teeth, and proportion of prenarial length to skull length) can be applied to the genus *Paleorhinus* is not completely clear, but most of them appear to be of at least minor importance.

Differences in robustness are clearly evident in skulls of *P. bransoni* and *P. scurriensis*; the latter is more lightly constructed in every detail. The presence of prenarial crests within the Phytosaurinae appears to be peculiar to *Machaeroprotopus*, *Phytosaurus*, and in somewhat less degree to *Leptosuchus*. The rostrum in *Paleorhinus* apparently underwent some increase in overall massiveness during growth, but nothing resembling the crests of the above named genera is evident. A posterior expansion of the premaxillaries is present in *P. bransoni*, but is of less magnitude than in *Machaeroprotopus*. This region is missing in the present specimen. The teeth in *P. bransoni*, while not approaching the crowded condition found in the adult *Machaeroprotopus* skull are, nevertheless, more closely spaced in the Texas specimen. The changes in proportion of the prenarial length to skull length cannot be established on the basis of available material. The presence of a parietal foramen has been discussed above.

Two features observed in the study of the skull of *P. scurriensis* are perhaps significant although their variability is perhaps most important from the phylogenetic standpoint. The condition of the septomaxillary as described in the foregoing discussion is not seen in the more advanced forms. Two small bones in the same relative positions as in *P. scurriensis* are figured in *Mesorhinus* (Jaekel, 1910) and there is reason to believe that these elements represent the septo-

maxillaries in a much reduced and primitive condition. If *Mesorhinus* is accepted as a primitive structural type, and *Paleorhinus* is considered as an intermediate stage, the proportional changes occurring in the phytosaur skull during the Triassic will clearly demonstrate the development of the remarkably large median septal elements of such advanced American forms as *Machaeroprotopus*.

The second feature, the large size of the palatine foramen, is a feature which appears to be peculiar to the more primitive Phytosauria (with the possible exception of *Promystriosuchus*). It is therefore assumed that immature skulls in which a parietal foramen still persists might still reflect this primitive condition of the palatine foramen. It is certain that the openings are larger in *P. scurriensis* than in *P. bransoni*.

The effect of sexual dimorphism upon the variability of these characters is at present unknown. They may be summarized as follows:

CHARACTER	YOUTHFUL CONDITION	ADULT CONDITION
Robustness	general trend toward	increase in massiveness
Prenarial crest	absent	absent
Posterior expansion of Pmx	not observed	present, but of small magnitude
Spacing of teeth	wide	narrow
Prenarial length/skull length		undetermined
Size of septomaxillaries	small	larger?
Palatine foramen	large	smaller
Pineal foramen	persistent	obliterated

COMPARISONS WITH OTHER FORMS

A comparison of the skull of *Paleorhinus scurriensis* with the two previously described *Paleorhinus* species is tabulated below:

CHARACTER ³	<i>P. bransoni</i>	<i>P. parvus</i>	<i>P. scurriensis</i>
Nares anterior	3	2	1
Squamosal short, heavy	1	—	2
Quadrate foramen visible in lateral view ..	1	—	2
Otic opening a notch	1	—	2
Skull flattened dorso-ventrally	2	—	1
Internarial septum composed of Pmx. and Na.	—	0	1
Septomaxillaries not meeting in median line	—	0	1
Palatine foramina large	2	—	1
Posttemporal fenestra elongate	2	—	1
Number of maxillary teeth	16	17	16-17

³ 1-3 indicates degree of development; No. 1 indicates maximum development. 0 indicates a probable difference, but degree not completely observed.

Differences between the present specimen and skulls of *Lep-tosuchus*, *Brachysuchus*, and *Machaeroprotopus* are to be found most abundantly in the above table. In fact, no points of complete agreement with the listed characters are to be found except in the open otic notch. *Mystriosuchus* and *Rutiodon* are completely different in appearance and general proportions. *Angistorhinus* is a relatively primitive genus that exhibits many similarities to the present skull. Most of these may be considered as of only superficial importance and the characters of the subfamilies are adequate for definitive purposes.

There is much similarity between the skull of *Paleorhinus scurriensis* and that of the nearly contemporaneous Texas form *Promystriosuchus ehlersi* Case. Both are of relatively small size with slender rostrae. The nares are anterior in each, but they are somewhat more elevated in the latter. The depression of the facial and posterior cranial portions is more pronounced in *Promystriosuchus*. The posttemporal arcade is apparently in about the same stage of development in both skulls although the squamosals are more strongly developed posteriorly in *Paleorhinus scurriensis*. The number of teeth is approximately the same. The elongate and broadly exposed parasphenoid process of *Promystriosuchus ehlersi* is remarkably different from that in all other phytosaurs, including *Paleorhinus*. The palate is more steeply vaulted and the palatine foramina are much larger in *Paleorhinus scurriensis*.

SYSTEMATIC POSITION

The present specimen is in complete agreement with the characters listed by Camp (1930) as typical of the subfamily Phytosaurinae and is obviously primitive within that group. Its similarity to the paleorhinid skull as exemplified in *P. bransoni* is obvious, but its position within the genus is obscured by the fact that it pertains to an immature individual in which important comparative features are not fully developed. For this reason it seems advisable to defer further decisions on the systematic position of *P. scurriensis* in the hope that future discoveries in the Dockum group may provide an adult individual.

GEOLOGICAL IMPORTANCE

Recognition of the genus *Paleorhinus* in Texas again raises

the question of terrestrial Triassic correlation in western North America. Detailed correlation, however, is hazardous even within the relatively small areas of continuous Dockum exposures. In many instances it is impossible to prove the age equivalence of exposures that are separated by only short distances. It is not surprising, therefore, that attempts to integrate the present stratigraphic information concerning the Dockum and other Triassic deposits have met with little success.

In view of the paucity of identifiable invertebrate fossils in the continental Triassic redbeds and the extreme degree of lithologic facies variation within the sediments, the evidence afforded by vertebrate remains becomes of great stratigraphic importance. Numerous discoveries of these remains have provided surprisingly few instances of genera common to two or more areas. Several supposed occurrences of faunal duplication have been reported, but in most cases the identifications have been based upon inadequate material. The validity of such occurrences must, therefore, be accepted with scepticism.

Two phytosaur genera, *Angistorhinus* and *Paleorhinus*, originally described from the Popo Agie⁴ of Wyoming, are known to be present in the Dockum of Texas; the former through at least two occurrences in the Big Spring area (Stovall and Whorton, 1936; Gregory, 1944) and the latter through the present specimen. Neither of these forms has yet been reported from Dockum deposits farther to the north which are presumably somewhat higher stratigraphically than the exposures in Scurry and Howard counties. In fact, the skull of *Paleorhinus scurriensis*, coming from a level just above what is considered as the Permian-Triassic boundary in Scurry County, may represent the oldest phytosaur yet reported from the Dockum. Exact information regarding the stratigraphic position of the Texas *Angistorhinus* specimens

⁴ Reeside (1929) proposed that the name Jelm formation be substituted for the Popo Agie formation, basing his argument upon structural, stratigraphic, and lithologic considerations. Others later concurred in this opinion. Without regard to the apparent desirability of such a substitution, however, it must be stated that the term Popo Agie formation has found wide usage as a vertebrate horizon within a section of beds relatively barren of identifiable vertebrate remains and as such still possesses considerable value for purposes of vertebrate paleontologic correlation. The term as here employed refers only to that portion of the Jelm formation from which diagnostic vertebrate remains have been described.

is not available, but they must have come from a level somewhat higher than that which yielded the present specimen. Information concerning the relative positions of the two genera in the Popo Agie is likewise lacking, but insofar as the writer can determine, the two forms were never found in association.

In general, proposed correlations between the Dockum and Popo Agie have been couched in rather general terms, but the trend has been to indicate an *in toto* age equivalence for the two. The writer is of the opinion that the equivalence of the Popo Agie and the lower part of the Dockum group can now be demonstrated within acceptable limits of error. However, this equivalence which is most accurate in the Howard and Scurry County area must become less distinct laterally. The vertical limits of equivalence cannot be accurately determined, although it is apparent that the Popo Agie sediments represent a much shorter period of deposition than do those of the Dockum group.

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