Vertebrate fauna of the Dockum Group, Triassic, eastern New Mexico and West Texas

Joseph P. Gregory
1972, pp. 120-123. https://doi.org/10.56577/FFC-23.120

in:

East-Central New Mexico, Kelley, V. C.; Trauger, F. D.; [eds.], New Mexico Geological Society 23 rd Annual Fall Field Conference Guidebook, 236 p. https://doi.org/10.56577/FFC-23

This page is intentionally left blank to maintain order of facing pages.

VERTEBRATE FAUNAS OF THE DOCKUM GROUP, TRIASSIC, EASTERN NEW MEXICO AND WEST TEXAS

by

JOSEPH T. GREGORY
Department of Paleontology
University of California
Berkeley, California

DISCOVERY AND COLLECTION OF TRIASSIC VERTEBRATE FOSSILS

Redbeds along the Canadian River valley containing petrified logs were first described in 1853 by Jules Marcou who regarded them as Triassic in age. Bones of large reptiles were discovered near Dockum, northwest of Spur, Dickens County, Texas, in 1890 by W. F. Cummins, and identified as Triassic by E. D. Cope. Cope accompanied Cummins on a collecting trip along the east side of the Llano Estacado in 1892 and secured additional Triassic vertebrates as well as fossils from the late Tertiary and Pleistocene deposits.

The major portion of our knowledge of the Dockum vertebrates comes from the work of E. C. Case of the University of Michigan who began describing fossils from Crosby County, Texas, in 1920, in part material found by G. D. Doughty of Post, and William J. Eliot of Spur, Texas. Dr. Case returned to these localities repeatedly during the next 20 years and was assisted in his fieldwork by William Buettner. In 1927 he collected well-preserved reptiles near Otis Chalk, Howard County, Texas, and in 1930 he obtained an important concentration of amphibians in northern Scurry County, Texas. The prolific site on Sierrita de la Cruz Creek northwest of Amarillo in Potter County, was discovered by Floyd V. Studer of Amarillo in 1926; Case described material that he collected here in 1931; extensive collections were made around 1940 by the Panhandle-Plains Museum at Canyon, Texas.

Further collections in the Otis Chalk region were made by J. W. Stovall for the University of Oklahoma in 1931, and by Grayson Meade for the University of Texas Bureau of Economic Geology in 193901940. An important fish bed not far from the reptile quarries in Howard County, was collected by Bobb Schaeffer for the American Museum of Natural History in 1954 and 1963. Another locality near Camp Springs in Scurry County was found in 1937 (Langston, 1949). The University of Texas (Works Progress Administration) parties also collected from a site in southern Borden County, Texas, about 1940 and made additional collections from the well-known Crosby County localities, some of which have also been worked by Earl Green for Texas Technological College in Lubbock.

In New Mexico, M. G. Mehl collected near Fort Wingate, McKinley County, in 1916, and in 1919 he described a phytosaur skull from near Santa Rosa, Guadalupe County. A party from the University of Oklahoma under J. W. Stovall obtained a phytosaur from the Sloan Canyon Formation in the Cimarron River valley, Union County, 1939. Fossil trackways from the same beds at nearby localities have been described by Baird (1964). Case and T. E. White prospected exposures south of San Jon and around Tucumcari in the early 1930's. Robert Abercrombie of Norton, Quay County, New Mexico, collected in this area for many years, sending specimens to Case and other paleontologists. He discovered the extensive reptile trackways in the Redonda Formation on Mesa Redonda. In 1947 J. T. Gregory began collecting in the Tucumcari area for Yale Peabody Museum, and later for the University of California.

R. V. Witter of Harvard University discovered the "Amphibian Graveyard" south of Lamy, Santa Fe County, in 1936; collections were made here for Harvard by Witter and T. E. White in 1938 and for the U.S. National Museum by David H. Dunkle, Franklin Pearce, and George Sternberg in 1947.

NATURE OF THE FAUNA

The Dockum fauna is typical of late Triassic continental assemblages not only of the western United States, but of most of the northern hemisphere. Many closely related or identical genera of fishes, amphibians, and reptiles are known from the Newark Group of the eastern United States, the Keuper Formation of Germany, the Maleri Formation of India, and recently discovered deposits in Morocco and the Sahara of Africa. Fragments of phytosaurs have been found in Madagascar and China, and armored pseudosuchians are prominent in recently discovered late Triassic deposits of Argentina.

Dinosaurs are represented by infrequent and incomplete fragments of at least two types; the slender, bipedal, predatory *Coelophysis*, and the more probably quadrupedal prosauropod *Poposaurus*, presumably an omnivore or even an herbivore.

Pseudosuchians or "false crocodiles" were short-headed animals of crocodile-like proportions, protected by rings of bony armor plates from which short spikes projected. In *Desmatosuchus* a pair of these spikes was enlarged into long curved horns above the shoulders. Their dentition was feeble, and conjectures as to their food range from plants to carrion.

Phytosaurs are by far the most abundant of the reptiles. They were of the size and proportions of large crocodiles and probably of similar, mainly aquatic, habits. *Paleorhinus* and *Angistorhinus* resembled the gavials of India in their very slender jaws, and probably fed chiefly on fishes. The more massive *Nicrosaurus* (= *Phytosaurus*) could have preyed on larger land reptiles which ventured near the water, and on the large labyrinthodont amphibians of the streams and ponds. *Rutiodon* was intermediate in skull proportions but probably replaced *Paleorhinus* as a fish-eater in later Dockum time.

Trilophosaurus had the proportions of a lizard, about 10 feet long, with a short, deep head. Its jaws held a series of chisel-like teeth, and terminated in a toothless, turtle-like beak. Apparently it chopped or tenderized its food before

swallowing it, but whether it fed on plants or insects has not been determined. Its remains are known only from Howard and Crosby Counties, Texas, but closely similar forms have been found in England.

Metoposaurs are the last survivors of the labyrinthodont amphibians which were the dominant animals of the Carboniferous coal swamps. *Buettneria* (also called *Eupelor*) had a flat, wide body with disproportionately small legs and an extremely large, flattened, wide head. These big amphibians, whose skulls may reach a meter in length, probably lay on the bottoms of shallow ponds or sluggish streams and engulfed fishes by suddenly opening their cavernous mouths. Their remains share top place in abundance with phytosaurs. *Anaschisma* is a related genus; *Latiscopus* a much smaller labyrinthodont.

Ceratodus teeth are fairly common and closely resemble those of the living Australian lung fish which inhabits pools of seasonal streams but does not aestivate. Their food consists mostly of worms, insects, and other small invertebrates.

The coelacanth fish *Chinlea* is sparsely represented at several localities; its only surviving relative is marine, but many Triassic and earlier coelacanths occur in freshwater associations. It was probably the largest fish of these waters, and a predator.

Several "ganoid" fishes (with heavily enameled rhombic scales)—*Cionichthys*, *Lasalichthys*, and *Synorichthys*—have been found in Howard County, Texas, and ganoid scales are common in many places. These fish are also known in the Chinle Formation in southeastern Colorado, and have relatives in the eastern U.S.A. They probably fed upon small invertebrates.

Still another fish, *Colognathus*, had strange, bladelike teeth at the rear of slender, pointed jaws. The rest of its anatomy, and its relationships and behavior are as yet unknown.

A few fin spines of large sharks have been found in Crosby County, Texas.

Two important members of other late Triassic faunas of North America have not yet been discovered in the Dockum beds: the large, herbivorous anomodont reptile, *Placerias*, and semionotid fishes.

ENVIRONMENTAL IMPLICATIONS

The common and widespread members of these faunas all show marked aquatic adaptations; scales or other indications of fishes are frequent; the fossils are closely associated with stream-channel deposits or occur in clay lenses representing old pond fillings. Some beds contain freshwater clams. An aquatic, floodplain or deltaic environment is suggested. The rarity of dinosaurs and other strictly terrestrial animals, and the fragmentary condition of such remains of these as do occur, suggests that they inhabited higher terrane away from the streams and ponds in which the deposits and fossils were accumulating.

The widespread ripple-marked layers in the base of the Redonda Formation, and the striking change to relatively thin, uniform, widespread layers in that formation form a marked contrast to the underlying stream-channel sandstones and floodplain clays of the Chinle Formation. This suggests that extensive shallow and perhaps ephemeral lakes covered much of the region during Redonda time. The greater abundance of fishes in these beds is consonant with such a change.

BIOSTRATIGRAPHY

The implications of vertebrate fossils for correlation of Triassic continental deposits of North America with those of Europe have been summarized by Colbert and Gregory (1957, p. 1456-1457). The position of the Triassic-Jurassic boundary in the Colorado Plateau is disputed currently (Welles, 1970, p. 989; Galton, 1971, p. 781), but the beds in question lie above equivalents of the Dockum, whose faunas correspond in age to the middle Keuper of Germany.

Detailed correlations within the Dockum are hindered by incomplete knowledge of the assemblages from many localities, and by nomenclatorial problems which obscure statements about such relationships as are understood. At least three distinct faunal zones may be recognized on the basis of evolutionary changes in the skulls of phytosaurs; these are supported to a slight extent by the associated fauna. No stratigraphically significant variations have been discovered in the pseudosuchians, and the stratigraphic sequence of variations in the metoposaurs is inadequately established at the best, and implicitly denied by the detailed analysis of these fossils by Colbert and Imbrie (1956, p. 399-452). Other groups are of too restricted occurrence to be useful in correlation.

The most primitive and presumably earliest fauna is found in Howard and Borden Counties, at Camp Springs in Scurry County, and probably at Walker Tank north of Kalgary, Crosby County, Texas. It is correlative with the Popo Agie fauna of Wyoming. The phytosaurs *Paleorhinus* and *Angistohinus*, *Trilophosaurus*, and the dinosaur *Poposaurus* are confined to these localities. *Buettneria howardensis* Sawin, which was included with metoposaurs from all other Texas localities in *Eupelor fraasi jonesi* (Case) by Colbert and Imbrie, differs from *B. perfecta* of the *Rutiodon*-bearing assemblages in its distinctly larger and deeper otic notch. *Typothorax meadei* Sawin is not certainly distinguishable from the widespread *T. coccinarum* Cope. Several fishes and *Latiscopus* have been found only in Howard County and are of unknown stratigraphic range.

The localities containing this primitive *Paleorhinus* fauna are, with one exception, geographically distant from exposures of the more widespread *Rutiodon* fauna, and superpositional relationships of the two assemblages have never been observed. The marked morphological modification of *Rutiodon* and *Nicrosaurus* skulls compared to those of *Paleorhinus* and *Angistorhinus*, and the clear stratigraphic separation to these genera or their morphological equivalents in the German sequence, support the inference of a temporal separation of the American faunas.

The Walker Tank locality north of Kalgary in Crosby County, Texas, may also belong to this fauna as *Paleorhinus* and *Trilophosaurus* occur here. Case described *Paleorhinus [Promystriosuchus] ehlersi* from the head of Home Creek, about two miles from Walker Tank. Subsequent collecting in the Home Creek badlands has produced only advanced phytosaurs, and it is possible that this specimen actually came from the Walker Tank exposure, which Case might not have separated from other Home Creek sites in his earlier collecting. The species is more advanced than *Paleorhinus scurriensis* in the greater elongation of its rostrum, and the possibility that it is a late survivor of the genus cannot be excluded.

The most widespread assemblage, characterized by the phytosaurs *Rutiodon* and *Nicrosaurus* [*Phytosaurus*], by *Buettneria perfecta*, and possibly *Desmatosuchus*, is known

from Home Creek, Sand Creek, and Cedar Mountain, Crosby County, adjacent areas in Dickens County, Palo Duro Canyon, and the rich deposit on Sierrita de la Cruz in Potter and Oldham Counties, Texas. The *"Buettneria bakeri"* concentration in northwestern Scurry County, Texas, may well be of the same age. The fauna is almost identical to that of the Petrified Forest Member of the Chinle Formation from St. Johns, Apache County, to Cameron, Coconino County, Arizona.

Exposures in the upper part of the "Chinle" claystone member of the Dockum in the vicinity of Revuelto Creek, at various sites around the foot of the plains escarpment from San Jon to Plaza Larga Creek and Luciano Mesa, at the base of Mesa Redonda, and in Bull Canyon, Quay and Guadalupe Counties, New Mexico, have yielded phytosaurs, metoposaurs, *Typothorax*, and rare fragments of dinosaurs which represent the same or a closely similar fauna. *Nicrosaurus* [*"Phytosaurus"*] is more abundant here than in other localities. The fossiliferous levels are from 30 to 300 feet below the base of the Redonda Formation, and may be younger than the Texas sites mentioned above although there is neither stratigraphic nor paleontologic evidence to demonstrate this.

The Sloan Canyon Formation along the Cimarron River in northeasternmost New Mexico has yielded a skull of *Rutiodon* [*Machaeroprosopus*] *tenuis* (Camp), a species characteristic of higher levels of the Chinle Formation in the Petrified Forest area of Arizona, and abundant at the Ghost Ranch on the Chama River in northwestern New Mexico. This species suggests a somewhat later age than the better known *Rutiodon* fauna of Texas.

The youngest of the Dockum faunas is found in the Redonda Formation at several localities southeast of Tucumcari, New Mexico, where it clearly overlies the *Rutiodon-Nicrosaurus* fauna. The phytosaur in these uppermost beds is an advanced species of *Rutiodon* with an extremely specialized temporal and occipital region of its skull. It is accompanied by *Anaschisma*, a metoposaur known elsewhere only from the Popo Agie of Wyoming, and by fragments of armored pseudosuchians and various fishes. Massive siltstone layers in the Redonda contain poorly preserved ganoid fishes; shales carry abundant ostracods; ripple-marked calcareous sandstone near the base of the member in places has abundant reptile footprints.

TRIASSIC VERTEBRATE LOCALITIES OF EASTERN NEW MEXICO

Fossil bones may be encountered on any exposure of the Dockum beds, more especially in pebbly sandstone or clay-pellet conglomerate, or in fine claystone adjacent to channel deposits. The principal areas from which vertebrate material has been described are as follows:

Lamy, Santa Fe County, New Mexico (sec. 29, T. 12 N., R. 11 E.)

About 16 miles south of Lamy just east of U.S. Highway 285. The spectacular "amphibian graveyard" contains almost exclusively remains of the large labyrinthodont *Buettneria* [or *Eupelor*, or *Metoposaurus*], and appears to represent a pond which dried out causing the death of these aquatic animals. The large otic notches of these skulls resemble those of *B. howardensis* from the Howard County, Texas localities, and it is possible that this deposit is earlier than other Dockum

DISTRIBUTION OF VERTEBRATE TAXA AT LOCALITIES IN DOCKUM BEDS.

	Texas								New Mexico						
	Paleorhinus fauna				Rutiodon fauna								Advanced fauna		
	Howard Co.	Scurry Co.	Borden Co.	Crosby Co. Walker Tank	Crosby Co.	Dickens Co.	Palo Duro Canyon	Potter Co.	Tucumcari Wash	Bull Canyon	Lamy, Santa Fe Co.	Sloan Canyon, Union Co.	San Jon	Apache Canyon	Mesa Redonda
Fishes															
Hybodont Shark				X	X										
Cionichthys	X														
Lasalichthys	X														
Synorichthys	X														
Ganoid indet.										X			X	X	
Chinlea				X	X		X								
Ceratodus	X			X	X									X	
Colognathus				X	X		X	X							
Amphibians															
Buettneria	X	X		X	X	X		X	X	X	X				
Anaschisma														X	
Latiscopus	X														
Reptiles															
Trilophosaurus	X			X											
Typothorax	X				X	X		?	X					?	
Desmatosuchus			X		X	X									
Paleorhinus	X	X	X	?	?										
Angistorhinus	X														
Rutiodon					X	X	X	X		X	?	X	X	X	
Nicrosaurus							X	X	X						
Coelophysis	X		X		X			X							
Poposaurus	X														
Dinosaur indet.					X		X	X	X					X	
Trackways												X		X	X

localities in New Mexico. The highly faulted structure in the vicinity of the fossil site has prevented determination of its position in the local stratigraphic section (Romer, 1939, p. 337-339).

Bull Canyon, Guadalupe County, New Mexico (center W½ sec. 28, T. 9 N., R. 26 E.)

A large skull and other bones of *Rutiodon* sp. and fragments of metoposaurs were collected from a clay-pebble conglomerate and claystone near the top of the Chinle beds, about 30 feet below the base of the Redonda Formation. Bones occur at about this stratigraphic level at various points about the escarpment of Luciana Mesa south of Montoya and northeast of Ima. Presumably the skull of *Rutiodon* [*Machaeroprosopus*] *andersoni* (Mehl) came from this region.

The Redonda Formation is well exposed around Bull Canyon, but with relatively steep outcrop; it has yielded only fish scales and coprolites in this area. Still higher in the section, around Bull Canyon and Luciana Mesa south of Montoya, a white, thinly laminated, calcareous shale, possibly a lens in the Exeter, contains fairly well preserved remains of fishes, especially *Pholidophorus americanus* Eastman (Koerner, 1930, p. 463).

Mesa Redonda, Quay County, New Mexico (sec. 24 T. 9 N., R. 30 E. and secs. 27, 28, T. 9 N., R. 31 E.)

Scattered teeth and bones of phytosaurs and possibly dinosaurs are found in beds of clay and sandstone in the upper part of the Chinle around the foot of Mesa Redonda, and elsewhere

in the Plaza Larga Creek and Revuelto Creek drainages south and southeast of Tucumcari. This level seems to be about the same as that in Bull Canyon and the more prolific exposure on Revuelto Creek noted below.

On the northeastern point of Mesa Redonda, in the lower part of the Redonda, calcareous sandstone contains abundant reptile trackways. This locality has been collected by R. Abercrombie for the University of Michigan, Royal Ontario Museum, and other institutions.

Apache Canyon, Quay County, New Mexico (secs. 3, 9, T. 8 N., R. 33 E.)

On the north and east sides of Apache Canyon, where the road from Norton to Grady climbs the high plains escarpment, a rather massive sandstone in the Redonda Formation forms a conspicuous ledge. Reptile footprints are present on the lower surface of the ledge at various localities. In the north fork of the canyon, about 21 feet above the top of this ledge, a channel fill of clay-pellet gravel contains numerous teeth, skin plates, and other bones of phytosaurs, pseudosuchians, *Typothorax*, and especially broken skulls and shoulder girdles of a small metoposaur. Bones of a large fish, a dipnoan tooth, many ganoid fish scales, and waterworn bone fragments are abundant. The labyrinthodonts are all small and have the shallow otic notch characteristic of *Anaschisma*. Impressions of *Neocalamites* and other plants occur in shale underlying the bone bed. Remains of a large phytosaur were obtained in a brownish siltstone just below the channel level, and poorly preserved ganoid fishes are present in pink claystone in a nearby stream bed at a level about 4 feet below the fossiliferous channel. The deposit is about 55 feet below the lowest of the massive, white to buff sandstone of the Exeter-type (which still has phytosaur remains above it, however).

Red Peak, Quay County, New Mexico (secs. 28, 29, T. 9 N., R. 33 E.)

The conspicuous conical red hill at the edge of the escarpment east of Norton rises from badlands in the upper part of the Chinle in which scattered fragments of phytosaurs and *Typothorax* occur. Just above the prominent shelf-forming ledge in the lower part of the Redonda Formation are dull reddish shale beds containing ostracods, *Unio*, and fish scales. Slightly above these—perhaps at the same level as the fish-bearing siltstones in Apache Canyon—an indurated siltstone containing poorly preserved ganoid fishes is exposed on the northern slope.

Revuelto Creek, Quay County, New Mexico (secs. 10, 14, 15, T. 10 N., R. 33 E.)

Extensive badlands occur along Revuelto Creek south of the highway and railroad crossings five miles west of San Jon. A large skull of the phytosaur *Nicrosaurus* was collected in 1947 from the upper edge of the badland breaks and two other skulls near the east end of the hills formed by irregular channel sandstone about a mile south of the highway. Numerous teeth, bone fragments, and coprolites occur in the badlands just south of these hills. Metoposaur fragments and typothorax scutes occur in the eastward extension of the badlands north of the ranch house.

These fossils are from extremely irregular channel deposits which appear to be about 310 feet below the base of the Redonda Formation on the escarpment of Red Hill 4 miles south.

South of San Jon, Quay County New Mexico (east side sec. 28, T. 9 N., R. 34 E.)

At the top of a low flat-topped promontory projecting north from the plains escarpment immediately east of Sand Canyon Arroyo, known locally as "Shark Tooth Hill," 7½ miles south of San Jon, clayey siltstone overlying a hard, calcareous sandstone ledge contains abundant bones of phytosaurs. A little above these a bed of red gravel is filled with phytosaur teeth, and scales and teeth of ganoid fishes. No metoposaur material has been observed at this site. The phytosaur skull collected here by the Yale party in 1947 is the most specialized known in the structure of its temporal region. The bone layer is at approximately the same level as that in Apache Canyon.

Sloan Creek, Union County, New Mexico (NW¼ sec. 12, T. 31 N., R. 35 E.; SE cor. sec. 31, T. 32 N., R. 36 E., NW¼ sec. 30, T. 31 N., R. 34 E.)

A phytosaur skull was collected on Sloan Creek in the Cimarron River valley near U.S. Highway 64, 11 miles west of Kenton, Oklahoma, about 100 feet below the top of the Sloan Canyon Formation (Stovall and Savage, 1939, p. 759-766). Its identification as *Rutiodon validus* (Camp) suggests correlation with the upper part of the Petrified Forest Member of the Chinle in Arizona, and perhaps slightly younger age than the Dockum deposits along Canadian River near Amarillo, Texas. Other phytosaur remains have been reported from the same area. In nearby Peacock Canyon, footprints attributed to rhynchocephalians by Baird (1964, 118-125) occur together with more usual three-toed dinosaur trails.

Further information is available in an excellent open-file report of the United States Geological Survey (James C. Wright and Warren I. Finch, 1971).

REFERENCES

Baird, Donald E. 1964, Dockum (late Triassic) reptile footprints from New Mexico: J. Paleont. v. 38, p. 118-125.

Colbert, E. H., and J. T. Gregory, 1957, Correlation of continental Triassic sediments by vertebrate fossils: Geol. Soc. America, Bull. v. 68, p. 1456-1467.

Colbert, E. H., and J. Imbrie, 1956, Triassic metoposaurid amphibians: American Museum of Natural History, Bull. v. 110, p. 399-452.

Galton, Peter M., 1971, The prosauropod dinosaur *Ammosaurus*, the crocodile *Protosuchus*, and their bearing on the age of the Navajo Sandstone of northeastern Arizona: J. Paleont. v. 45, p. 781-795.

Koerner, H. E., 1930, Jurassic fishes from New Mexico: Amer. J. Sci. (5) v. 19, p. 463.

Langston, Wann, Jr., 1949, A new species of *Paleorhinus* from the Triassic of Texas: Amer. J. Sci. v. 247, p. 324-341.

Romer, A. S., 1939, An amphibian graveyard: Scientific Monthly, v. 49, p. 337-339.

Stovall, J. W., and Savage, D. E. 1939, A phytosaur in Union County, New Mexico, with notes on the stratigraphy: J. Geology, v. 47, p. 759-766.

Welles, S. P., 1970, *Dilophosaurus* (Reptilia, Saurischia), a new name for a dinosaur: J. Paleont. v. 44, p. 989.

Wright, James C. and Warren I. Finch, 1971, An annotated bibliography of fauna and flora described from the Dockum Group of Triassic Age in eastern New Mexico and western Texas: U.S. Geological Survey, Open File R port (Denver, Salt Lake City, Dallas), 26 p.