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FAUNA OF THE VALE AND CHOZA: 8

PELYCOSAURIA: *DIMETRODON*

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Class REPTILIA

Subclass Eureptilia

Infraclass Synapsida

Order Pelycosauria

Suborder Sphenacodontia

Family Sphenacodontidae

Genus *Dimetrodon*

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GENERAL REMARKS

This large, carnivorous pelycosaur is one of the genera frequently encountered in beds of the Vale and Choza formations. Its relative abundance in the faunal records is certainly greater than its actual proportion in the fauna. Not only is it large and readily seen but even small segments of the long neural spines are easily recognized. It was, however, the principal large predator of the fauna and consistently successful from the base of the Vale to the middle Choza, as it had been throughout Wichita and earlier Clear Fork times.

Specimens have been found under a wide variety of circumstances, in shales and sandstones deposited on flood plains, in dipping, coarse deposits marginal to streams, in stream channels proper, and in beds deposited in and around standing bodies of water. The most abundant and best-preserved specimens have come from flood plain deposits of the lower part of the Vale and it seems probable that the flood plains and divides furnished the principal habitats of *Dimetrodon*. There can be little doubt, however, that it preyed not only upon herbivores in this habitat but also found sources of food among the animals that inhabited the margins of the streams and ponds and among some of the slow-moving vertebrates of the ponds as well.

Well over one hundred specimens have been observed in the field but relatively few have been worth taking. The best specimens in the collections from the standpoint of morphological detail are as follows:

C.N.H.M. U.R. 123. Maxillary with teeth, Loc. BZ,¹ lower Vale.

C.N.H.M. U.R. 30. Partial maxillary with teeth, preserved largely as a mold. Loc. KF, middle Vale, Knox County, Texas.

C.N.H.M. U.R. 33. One perfect dorsal vertebra, scraps of others, femur, and skull fragments. Loc. KD, upper Vale, Knox County, Texas.

C.N.H.M. U.R. 34. Partial vertebral column consisting of cervicals 4 and 5 and presacrals 20-27, three sacrals and one caudal in articulation. Loc. KA, upper Vale, Knox County, Texas.

C.N.H.M. U.R. 128. Partial skeleton including 14 vertebrae, with spines and arches variously preserved, apparently 7 to 20 in series; part of skull and lower jaw, well-preserved pelvis, distal end of femur, and various fragments. Loc. FA, *Diplocaulus* site, lower Choza, Foard County, Texas.

C.N.H.M. U.R. 122. Mold of dorsal vertebra. Excellent rubber cast, showing good detail. Loc. FA, *Diplocaulus* site, lower Choza, Foard County, Texas.

In addition to the listed specimens, the collections include limb bones, vertebrae, skull fragments, and parts of girdles from localities ranging from the lowest Vale to the middle Choza.

THE SPECIES

Romer and Price (1940) grouped the pre-Vale species of *Dimetrodon* into two series: Series A, characterized among other things by a short vertebral column, and Series B, characterized by a long column in which the cervical vertebrae in particular are elongated. Relative lengths of vertebrae, especially cervical vertebrae, are considered important for distinguishing the two series and their component species, whereas limb bones and skulls are thought to be of less importance. This renders many of the isolated elements from the Vale and Choza collections specifically indeterminate and directs attention primarily to the vertebrae. It is significant in this regard that

¹ Locality BZ has not been mentioned previously in this series. It is an area on Crooked Creek in western Baylor County, Texas. Aerial photograph location is as follows: CUM 6B 62, 1.9-2.6, along north margin of breaks to road at 3.7-2.6, south along road to 4.4-1.1, along margin of breaks to 2.0-0.9 and north to 1.9-2.6.

all vertebrae that are known from the Vale and Choza conform closely to a single pattern, indicating that but a single species was present.

The Vale and Choza dimetrodons belong to Series B, which includes *D. natalis* of the Wichita, *D. macrospondylus* and *D. dollovianus* of the Clyde, and *D. gigashomogenes* and *D. loomisi* of the Arroyo. There is some question concerning the distinction between *D. gigashomogenes* and *D. dollovianus*, as pointed out by Romer and Price (1940). It is evident that *D. gigashomogenes* of the Arroyo was derived from *D. dollovianus* of the Clyde, for there are no clear cut morphological differences. If the two are identical, the specimens now referred to *D. gigashomogenes* Case (1907), must be assigned to *D. dollovianus* Cope (1888). Romer and Price made a thorough study and maintained these species as separate. Their determination will be followed in this paper.

Since all known vertebrae indicate that a single species was present in the Vale and Choza and since this part of the skeleton is the most widely represented, it is a reasonable assumption that less definitive parts of the skeleton also pertain to this species. There is nothing to the contrary in any of the known specimens. Vale and Choza specimens are consistently large, except for occasional immature individuals, and are comparable in their various dimensions to the large Arroyo species, *D. gigashomogenes* and *D. grandis*. These two species may be differentiated by the nature of the cross sections of the neural spines, which in their thicker portions resemble a figure 8 in *D. gigashomogenes* and are quadrate in *D. grandis*. All Vale and Choza specimens resemble *D. gigashomogenes* in this respect. From this evidence there can be little doubt that the Vale and Choza specimens of *Dimetrodon* belong to a species that is closer to *D. gigashomogenes* than to any other that is known. Whether or not they represent *D. gigashomogenes* is less easily determined.

Any morphological differences that might exist in the skeleton would be finely drawn and probably detectable only through statistical analyses. Specimens from the Arroyo yield very small samples for any particular measurement, generally with $N=4, 5, \text{ or } 6$, and, as a rule, Vale and Choza samples consist of only one or two specimens. Thus, statistical treatment is reduced essentially to a comparison of a single specimen with an Arroyo sample of 4 or 5. Results cannot be expected to be definitive. Tests have been carried out in the course of this investigation and results are for the most part inconclusive. By use of the expression $\frac{X_1 - X_2}{\sigma_1} = t$ (where $X_1 =$

sample mean, σ_1 =standard deviation of the sample, X_2 =value in a single specimen, and t =Student's t), it was found that the probability of the fourth cervical vertebra of C.N.H.M. U.R. 34 being drawn from the population of the Arroyo was only 0.003 on the basis of the length of the centrum and 0.002 on the basis of the ratio of central length to the height from the base of the centrum to the postzygapophyses. Since, in the first instance, the lengths of the centra of the lumbar vertebrae of C.N.H.M. U.R. 34 fall near the means of samples of comparable vertebrae of Arroyo samples, there is a suggestion of actual elongation of the cervical vertebrae with respect to body length. The second probability cited suggests a proportional difference. Tests on the seventh cervical vertebra of C.N.H.M. U.R. 128, from the Choza, do not show these differences. Tests on the femora, both statistical and using the unit system of Romer and Price (1940), were inconclusive, suggesting affinities with *D. gigashomogenes*, *D. loomisi* and *D. dollovisianus* in various cases. None of the differences found between one specimen or another and Arroyo samples is consistent, and no trends of change throughout the Vale and Choza emerge from the studies.

In view of the qualitative morphological similarities of all known specimens of *Dimetrodon* from the Vale and Choza to *D. gigashomogenes* and the failure to find consistent quantitative differences, there seems no alternative to an assignment of the Vale and Choza specimens to the species *D. gigashomogenes*. This is in agreement with the determination for lower Vale specimens from Taylor County, made by Wilson (1948). The known range of this species thus extends from the base of the Arroyo to the middle Choza.

EVOLUTION OF DIMETRODON IN THE CLEAR FORK

Dimetrodon thrived during the time represented by deposition of the Arroyo, Vale and the lower and middle parts of the Choza formations of the Clear Fork. This period of time, however, witnessed a reduction in the number of species, so that only one existed after the Arroyo. This change probably was associated with a reduction in numbers and types of large herbivores. Two major lines of *Dimetrodon* are present in the Arroyo, one represented by *D. grandis* and the other by *D. gigashomogenes* and *D. loomisi*. At the end of the Arroyo both *D. grandis* and *D. loomisi* appear to have become extinct and only *D. gigashomogenes* survived. There was a marked change in sedimentation near the end of the Arroyo, in which the earlier varied shales, sandstones, grits and fine conglomerates were replaced

by even red shales and thin beds of dipping sandstone. This presumably reflects a marked change in environment. Many Arroyo species failed to survive this change, among them several of the large herbivores. *Dimetrodon* has not been found in the red shale beds of the uppermost Arroyo, but it appears immediately upon the resumption of the more typical deltaic sedimentation that marks the beginning of the Vale. Presumably it existed during this interval in areas adjacent to the delta. This is borne out to some degree by the specimens of Arroyo age in deposits in Oklahoma. Both *D. gigashomogenes* and *D. grandis* have been identified from Oklahoma, but in neither case does the assignment to species seem certain. In any event, when *Dimetrodon* reappeared in the Vale, only a single species, *D. gigashomogenes*, was present. This is a large representative of the rather lightly built series B of Romer and Price. Thus, of the seven or eight species that had existed during the Wichita and the early part of the Clear Fork on the delta, all but one had become extinct.

It is highly probable that the foodstuffs of *D. gigashomogenes* changed rather markedly from the Arroyo to the Choza, for the principal large herbivores that were characteristic of the Arroyo were either no longer present or greatly reduced in numbers. *Eryops* persisted and probably was a source of food, and recent evidence indicates the presence of *Diadectes* in the basal beds of the Vale. *Casea*, a genus new to the delta, almost certainly furnished prey. Slow-moving pond types, such as *Diplocaulus*, formed a part of the diet as indicated by coprolites both from the Arroyo and the Vale. The inferred modifications of diet appear to have had no effect upon *D. gigashomogenes* in so far as dentition and skeleton are concerned, for no well-defined changes occurred in morphology up to the time of disappearance of the species in the middle Choza.

Dimetrodon is not known from beds younger than middle Choza. No traces of the genus have been found in the upper Choza or in the overlying beds of the San Angelo. Conditions of deposition of the latter suggest that the environment was much the same as that which pertained during parts of the Clear Fork and that *Dimetrodon* would have found suitable habitat. Recently a carnivorous reptile, *Steppe-saurus* (Olson and Beerbower, 1953), that resembles *Dimetrodon* superficially in dentition has been found in the San Angelo. It appears to be an adaptive counterpart of *Dimetrodon*, derived from the sphenacodont stock. So far as the record is now known, *Dimetrodon* became extinct during the later stages of the Choza. Addi-

tional exploration may, of course, reveal its presence in younger beds, but the nature of the fauna of the San Angelo suggests that this will not be the case.

REFERENCES

CASE, E. C.

1907. Revision of the Pelycosauria of North America. Carnegie Inst., Washington, Publ. 55, 176 pp., pl.

COPE, E. D.

1888. Systematic catalogue of the species of Vertebrata found in the beds of the Permian epoch in North America, with notes and descriptions. Amer. Phil. Soc., Trans., **16**, pp. 285-297.

OLSON, E. C. and BEERBOWER, J. R.

1953. The San Angelo Formation, Permian of Texas, and its vertebrates. Jour. Geol., **61**, pp. 389-423, 10 figs.

ROMER, A. S. and PRICE, L. I.

1940. Review of the Pelycosauria. Geol. Soc. Amer., Special Paper no. 28, 528 pp., 46 pls., 71 figs.

WILSON, J. A.

1948. Vertebrate fauna of a Permian locality in Taylor County, Texas. Abs. Bull. Geol. Soc. Amer., **59**, p. 1363.

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