THE MOUNTED SKELETON OF Edaphosaurus boanerges Romer AT SOUTHERN METHODIST UNIVERSITY

Ellis W. Shuler and Robert V. Witter

This paper is written primarily for visitors to the Geological Museum of Southern Methodist University. Mr. Robert V. Witter of the Museum of Comparative Zoology at Harvard University is the collector and preparator of this newly added specimen of *Edaphosaurus boanerges*. He has contributed his knowledge of the conditions under which the specimen was found and to the count and arrangements of the skeletal parts. We have freely drawn from the writings of Dr. A. S. Romer, who described this species and discussed its family relationships in his monograph, "Review of the Pelycosauria" (Geological Society of America, Special Paper 28), and in *Natural History,* vol. 48 no. 4 of the American Museum.

Through the generosity of Mr. John Kay, a geologist of Wichita Falls and a former student of Southern Methodist University, and his friends, Mr. Tom B. Medders, Mr. T. J. Waggoner, Jr., Mr. Jack Martin, Mr. Jasper B. Ferguson, Mrs. N. H. Martin, and Mr. L. C. Harper, of Wichita Falls and vicinity, the Geological Museum has been presented with this finely mounted specimen. It is the first of its kind from the Permian Red Beds to be adequately mounted in Texas.

The specimen belongs to the Pelycosauria or Theromorpha, reptiles especially noteworthy in the Upper Carboniferous and Permian Red Beds of Texas. They play an important part in the history of Vertebrates. The group was first recognized by Cope from material collected in 1878 by Jacob Boll, a Swiss botanist from Dallas, Texas. While apparently they represent an early stage in the beginnings of mammal-like forms, they possess many archaic features.

The pelycosaurs were essentially a terrestial group.

They could enter water upon occasion. Their legs were widely sprawled out from the body, the trackway wide and the stride short, indicating a rather slow rate of travel.

The members of the group laid typical shelled amniote eggs. A large oval egg about 59 mm. long, found in the Admiral formation by L. I. Price of Harvard University some seven years ago, could have been laid by either of the four large reptiles, the cotylosaur, *Diadectes;* or the pelycosaurs, *Dimetrodon, Edaphosaurus* or *Ophiacodon.*

The specimen mounted was collected from Archer County, Texas, about ten miles south of Holliday and twenty-five miles southwest of Wichita Falls. The fossil quarry is located near Geraldine. This locality is sometimes called the "Edaphosaurus flats," and is in the Admiral formation of the Wichita group, a disputable border formation between the Permian and Pennsylvanian. The quarry has produced several specimens of *Edaphosaurus.* From it has been collected also a small specimen of *Dimetrodon,* as well as the amphibians *Cricotus* and *Eryops.*

Habitat

All these animals met their death and were buried in the muds of a small intermittent stream or floodplain pools of a large river. The clay beds below and above the bones indicate successive flood periods, which not only embedded these animals but also preserved abundant plant remains. Four species of *Pecopteris,* specimens of *Callipteridium, Odontopteris, Sphenophyllum* and *Pinnularia, Tingia, Dorycordaites* and *Sigillaria* are found. The plant collections indicate a florule composed of lush plants with luxuriant growth, similar to that found in coal bearing formations.

Taken as a whole, the sedimentary facies in which the fossils were found indicates bog conditions. In fact, logs lying lengthwise as if in a former stream bed are found throughout the deposit. They have coalized and their fine granular condition often interferes in taking up specimens of bone.

The great amount of plant material present also accounts for the fact that the bones are black. About ten years or more of sun and rain are required to bleach these out to

a pink to bluish color. Copper and iron played their part in "mineralizing" the bones. Gypsum and calcite infiltrated into the pores of the bone structure give a hard and brittle quality.

Although the deposits in North Texas are called "Red Beds," most of the fossiliferous deposits are variegated clays, and in the case of the Geraldine locality, the whole deposit is a gray and yellow color. Since marine limestone extends into the collecting region from the south, a deltaic condition is presumed. Fishes, such as sharks, lung fish, and some ganoids are found in almost all deposits. The amphibians *Cricotus* and *Eryops*, as well as pleuracanth shark teeth, are, with few exceptions, found in association with Edaphosaurus material from Cisco up into the Clear Fork.

Edaphosaurs

Edaphosaurs are found not only in Texas but also in New Mexico, Oklahoma, Kansas, West Virginia, and Pennsylvania—also in Czechoslovakia and Russia. However, the bulk of material (about 90%) has come from Archer, Baylor, and adjacent counties of North Central Texas and has been found in seven formations, classified by Dr. Romer as follows:

Permian	Clear Fork group	VII	Arroyo formation
		VI	Clyde formation
Permian or Pennsylvanian	Wichita group	V	Belle Plains formation
		IV	Admiral formation
		III	Putman formation
		II	Moran formation
Pennsylvanian	Cisco group	I	Pueblo formation

The lower beds are poorly known, and being for the most part marine, exposures are widely scattered. The Admiral and Belle Plains produce an abundance of material owing to the fact that they were deposited during a period of changing lakes and streams. The Clear Fork gives evidence of a more arid climate and a drying up of many pools and streams. This resulted in the congregation of many small animals about and in the depressions, so that their bones accumulated in limited areas. They were buried and later cemented with either hematite, lime, silicates, or any com-

bination of these. This makes the preparation of the specimens very difficult.

The mounted specimen of *Edaphosaurus boanerges* Romer at Southern Methodist University is probably that of a female, since the skull, limbs, and vertebrae are smaller in proportion to the long spines which protrude from the backbone than is found in other specimens from the same deposit. The estimated weight of this animal is about 200 lbs. and it is 6 ft. 10 in. from the tip of its nose to the end of the tail.

The specimen has a short low skull six inches long. It has 23 presacral vertebrae, 3 sacrals and 60 caudals or tail vertebrae.

The skull is short. It has well developed tooth plates on the palate of the mouth and corresponding ones on the lower jaw, obviously used to crush food as it passed on down into the cavernous belly. It had a pineal opening or so-called "third" eye on the top of the skull between the orbits.

The first *Edaphosaurus* was called *Naosaurus* ("Ship Lizard") by Cope in 1886 because of the elongated presacral neural spines of the vertebrae which carry for most of their length lateral tubercles or cross bones like cross spars on a ship.

Just what this "sail" frame was for is a debatable subject. That it was used to enable the animal to sail the seven seas, as has been suggested by some, is doubtful. Since it is firmly attached to the body, it could not be raised or lowered or flapped about in the breeze. Neither is it a wing which might give it a bird-like quality. It probably was more of a handicap than a valued possession, since many specimens have been found with evidences of collisions, possibly with low hung branches. In fights with other beasts it may have served as a warning or as a protective adaptation since it would look as big as did its cousin *Dimetrodon,* which was about the same size and also had a huge fin along its back. Dimetrodons, however, were fierce carnivorous brutes and possessed huge canine teeth. The solution as to the use of the huge fin along the spine is still left unsolved. The tubercles or outgrowths found along the spines of the *Edaphosaurus* are not present on *Dimetrodon.*