ART. XL.—*New Genera of Permian Reptiles*; by S. W. WILLISTON.

AMONG the new genera of Permian vertebrates represented by material in the collections of Yale and Chicago Universities there are two presenting such peculiar characters as to justify their present description. A third new genus of reptiles from New Mexico is represented by parts of two skulls and will be described later. Two distinctive genera of small amphibians from New Mexico, of new and peculiar types, are also represented in the Chicago collections by skull and limb bones.

Glaucosaurus megalops, gen. sp. nov.

The type and only known specimen of the present genus and species is an incomplete skull of small size discovered by Mr. Paul Miller on Mitchell Creek, Texas, in the same horizon as that of the type of *Broiliellus*, that is, from the lower part of the Texas beds. The same horizon has also yielded five specimens of *Pantylus*, numerous specimens of different species of *Captorhinus*, *Theropleura*, etc., none of which has ever been detected in the uppermost deposits.

The skull (fig. 1) had been fossilized complete, but, when found, the lower posterior part and much of the roof of the occipital and parietal region were gone. Enough remains, however, to indicate approximately the contour of the quadrate region.

The skull is remarkably narrow and high, reminding one of the general shape of the chameleons. It has a high, thin, nose-like face, very much like that of *Edaphosaurus*, with the external nares near the pointed end, and separated by a narrow bar of bone. There are two teeth on each premaxilla, of small size, and fifteen on each maxilla, the latter increasing a little in size as far as the twelfth; the last two are smaller. Some of the teeth have been injured on the outer side in preparation, showing a hollow cavity, but their outlines are visible in nearly all. They are rather obtusely rounded at the extremity, the front ones more acute. They appear to be acrodont, but are, in all probability, protothecodont. They are not cuspidate.

The most peculiar character of the skull, one that distinguished it from the skulls of other known genera, is the relatively enormous size of the orbits, their greater diameter being nearly equal to one-half the whole length of the skull, and considerably more than the length of the face in front of them. In life they looked nearly directly outward, with a

slight inclination forward. The mandibles have a considerable depth posteriorly, but are thin, and can have only a single row of teeth. Back of the orbits the thickened, smooth border of the anterior inferior angle of the temporal opening is apparent. The structure here was probably much like that of *Edaphosaurus*, the lower bar broader and the quadrate in all probability not descending so low. Above, posteriorly, only the impressions of the roof bones with clinging fragments are preserved. The region here is similar to that of *Edaphosaurus*.

FIG. 1.

FIG. 1. Skull of *Glaucosaurus megalops*, from side and from above. Natural size. No. 603, University of Chicago.

The orbital margins are rather prominent, and the frontal region between them is concave. The sutures, so far as they have been made out, are shown in the drawings.

In the general shape of the skull *Glaucosaurus* seems to resemble *Tetraceratops* Matthew, from the Permian of Texas, but the genus differs markedly in the absence of rugosities for nasal and frontal horns, and especially in the teeth. Moreover, the orbits are much larger. Two or three genera of Permian reptiles from Texas are yet known only from skeleton bones, and there is a possibility that some one may eventually be found to be identical with the present, but, upon mature consideration, I believe that the probability is very slight.

One wonders what the habits of this creature, with such extraordinary eyes, could have been. Possibly it was crepuscular in habit, and probably a rock climber. That the genus must be classed with the so-called "Pelycosauria" or Theromorphia is evident, but closer relationships among the extraordinary diversity of the American reptiles can at present be but a mere speculation.

Chamasaurus dolichognathus gen. sp. nov.

Although the type and only known specimen of the present genus consists of the left mandible, lacking its posterior end, the characters it presents are so peculiar that they will justify its description.

The specimen was accidentally discovered in the matrix of dark reddish brown sandstone enclosing a type specimen of *Limnoscelus*, from the Permian or Permo-Carboniferous of New Mexico. The type specimen is No. 827 of the Yale Museum collections. The mandible (fig. 2) is especially note-

FIG. 2.

FIG. 2. Left mandible of *Chamasaurus dolichognathus*. Twice natural size. No. 827, Yale University.

worthy because of its slenderness. That it does not belong to an amphibian is evident from the teeth, which are closely set, flattened, and thecodont or protothecodont, characters unknown among the amphibians. The slight but distinct rugosities of the mandible are cotylosaurian rather than pelycosaurian, though this character is not unknown among the zygocrotaphous reptiles. Twenty-five teeth are preserved, the most of them perfectly. The first four or five, the sixteenth and the twenty-third are injured on their outer sides, but show for the most part their shapes. In front of these teeth there are alveolar emarginations for two more, which have been represented in the drawing by dotted outlines, making twenty-seven as the entire number. The teeth are very closely placed, almost touching each other at their bases. They are smoothly and gently convex on the outer side, from one and a half to more than two times as long as wide. They are rather acute and longer anteriorly; more obtusely pointed posteriorly. They are evidently inserted in a single row.

Sixty-two described genera of American Permian or Permo-Carboniferous amphibians and reptiles are at the present time recognized as presumably valid. A few of these are yet known only from incomplete or fragmentary material, and will not be securely established until more is known of them. About fifteen genera are now known from practically complete skeletons. In the Chicago collections forty-four distinct genera have been recognized, with two or three additional, more or less doubtful, described ones.

Omitting the few doubtful genera there are to-day in the collections not less than sixty distinctly differentiated genera from the Permian deposits of Texas, Oklahoma, Kansas, New Mexico, Illinois and Pennsylvania, distributed about equally among the Amphibia, Cotylosauria and Theromorpha. They have been classified under at least twenty-three families, and ten larger groups.

As regards the distribution of these genera, twelve are known only from New Mexico, two from Oklahoma, two from Illinois, and two from Pennsylvania. Four genera are more or less doubtfully common to New Mexico and Texas, and four to Illinois and Texas. The four genera supposed to be common to New Mexico and Texas are *Eryops*, *Aspidosaurus*, *Edaphosaurus* and *Diadectes*, but it is probable that some of these, if not all, will be found to be distinct when more thoroughly known. The four genera common to Illinois and Texas are *Lysorophus*, *Diplocaulus*, *Cricotus* and *Clepsydropus*, the first three almost certainly; the last doubtfully the same. Not a trace of any one of these has been detected in New Mexico, of the first three not even their families, though it is possible that *Chenoprosopus* may be allied to *Cricotus*. Some of the most common genera in Texas are utterly unknown in New Mexico, notably *Dimetrodon*, *Captorhinus*, *Labidosaurus*, *Diplocaulus*, *Lysorophus* and *Trimerorhachis*, and only the first of these is replaced by an allied form, *Sphenacodon*, so far as we know; while *Theropleura* of Texas is represented by the closely allied but distinct *Ophiacodon*; *Diadectes*, *Diadectoiles* and *Chilonyx* by *Nothodon*, *Animasaurus* and *Diasparactus*; *Zatrachys* by *Platyhystrix*, etc. The genus *Limnoscelis* has no known allied form. Not a single one of all these American genera has been recognized elsewhere, though I am convinced from the examination of European specimens, as also from Huene's studies, that some of the known European forms are allied, possibly belonging in identical genera. Especially have I seen a part of a spine in the museum at Halle which I could not distinguish from the peculiar ones of *Edaphosaurus*; and long-spined, dimetrodont forms seem also to occur there. Broom and Watson have urged the relationships of some of the south African types with certain ones of America, and their arguments are persuasive; nevertheless, the relationships of the South African forms do not seem to be as close as do some of the European Permian genera. Perhaps, after all, as Case has urged, we are dealing chiefly with generalized rather than genetic characters.

That deposits no thicker than those of Texas and New Mexico should have already yielded so extraordinarily rich a

fauna of amphibians and reptiles—and the end is not yet; that the local faunas of regions so little remote as those of Texas and New Mexico, though closely allied, should show such distinct generic differences, suggest that the world's fauna of reptiles at least, in early Permian times was richer in genera and species than it has been at any succeeding epoch in geological history. Divergence was limited by primitive characters, for evolution had not gone far enough to affect the more fundamental ones, but no other known epoch of approximately equal duration has yielded so extensive a fauna of cold-blooded air-breathing animals as has the Lower Permian of America. Of the genotypes, or specimens upon which the accepted described genera have been based, thirty are preserved in the collections of the American Museum, eighteen in the collections of the University of Chicago, six in those of Yale, four at Munich, and the remainder at the universities of Oklahoma, Kansas, Michigan and the Carnegie Institute.