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Longiscitula Houghae,
A New Genus of Dissorophid Amphibian from the Permian of Texas[1]

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This is the first of several papers to be published on the dissorophid amphibians from the Clear Fork, Permian, of Texas. The specimens of this new genus came from a locality in the Arroyo Formation discovered by Dr. E. C. Olson of the University of Chicago. From this locality a new species of *Broiliellus* (yet to be named) was collected, and as a result, the locality has been called "Olson's *Broiliellus* pocket."

I am grateful to Dr. E. C. Olson for suggesting this project to me. The illustrations were made by Mrs. Jane Hubby.

Longiscitula houghae, new genus and species

Genotype and only species.—*Longiscitula houghae,* new species.

Holotype.—CNHM No. UR 430, a skull (figs. 1, A and B, and 2, A and B).

Referred specimen.—CNHM No. UR 807, a posterior part of a skull.

Locality and Horizon.—Known only from Olson's *Broiliellus* pocket, Coffee Creek, Arroyo Formation, Clear Fork Group, Permian of Baylor County, Texas.

Description.—The two known specimens give information on the skull solely from the dorsal and lateral aspects, and on part of the ar-

[1] While this paper was in press, Chicago Natural History Museum adopted the name Field Museum of Natural History. In this paper the catalog designations remain CNHM.

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mor of the animal. The posterior, dorsal part of the skull and the otic notch are well preserved, allowing reliable description. Anterior to the orbits, considerable fragmentation and crushing limit accurate description. Nothing can be said about the palate, except by analogy with related genera, because a mass of extraneous bones fills the skull. Nothing is known of the post cranial skeleton, except for part of a piece of dorsal armor, unless some of the multitude of loose bones from the *Broiliellus* pocket can be shown to belong to this species. Unfortunately, *Dissorophus*, *Trematops*, and a new species of *Broiliellus* are known from the pocket, and as a result this would be a fruitless endeavor without articulated specimens.

The dorsal aspect of the skull of the holotype of this genus, particularly with reference to the proportions, is very much like that of *Trematops*. The skull is about 12.5 cm. long, with a preorbital length of about 5.5 cm. The skull is notably narrow in proportion to its length. Because of crushing, measurements are somewhat inaccurate, but the greatest width, which is at the posteriormost part of the skull, appears to be about 7.5 to 8 cm. Anterior to the orbits, the skull is very narrow, and tapers to a sharply rounded tip. The skull apparently widens posteriorly, to a point just behind the orbits. Posterior to this point the widening is imperceptible.

It is not possible to get an entirely clear concept of the relative depth of the skull, but the well preserved posterior portion of the skull shows that it is very deep for a dissorophid, with nearly vertically oriented margins.

Measurements and proportions of *Longiscitula* are listed (p. 52), along with comparative information on *Dissorophus* and *Cacops*, which can be considered to be typical dissorophids. Note particularly the information concerning the comparative length and depth of the skulls.

The nares are not well preserved, but fortunately both are present, however deformed, and this affords some control over distortion. They are marginal and face mostly laterally. They extend anteriorly to within 2 or 3 cm. of the sharply rounded snout, and posteriorly for about 2.5 cm., nearly to the orbits. The external nares are divided into two parts. The anterior portion is a rounded hole, followed posteriorly by a restriction, and then an elongate fenestra (fig. 2), as in the case of *Trematops*. Continuous with, and posterior to the external nares, or fenestra, is a deep groove running posteriorly and laterally, and terminating just anterior to the orbits.

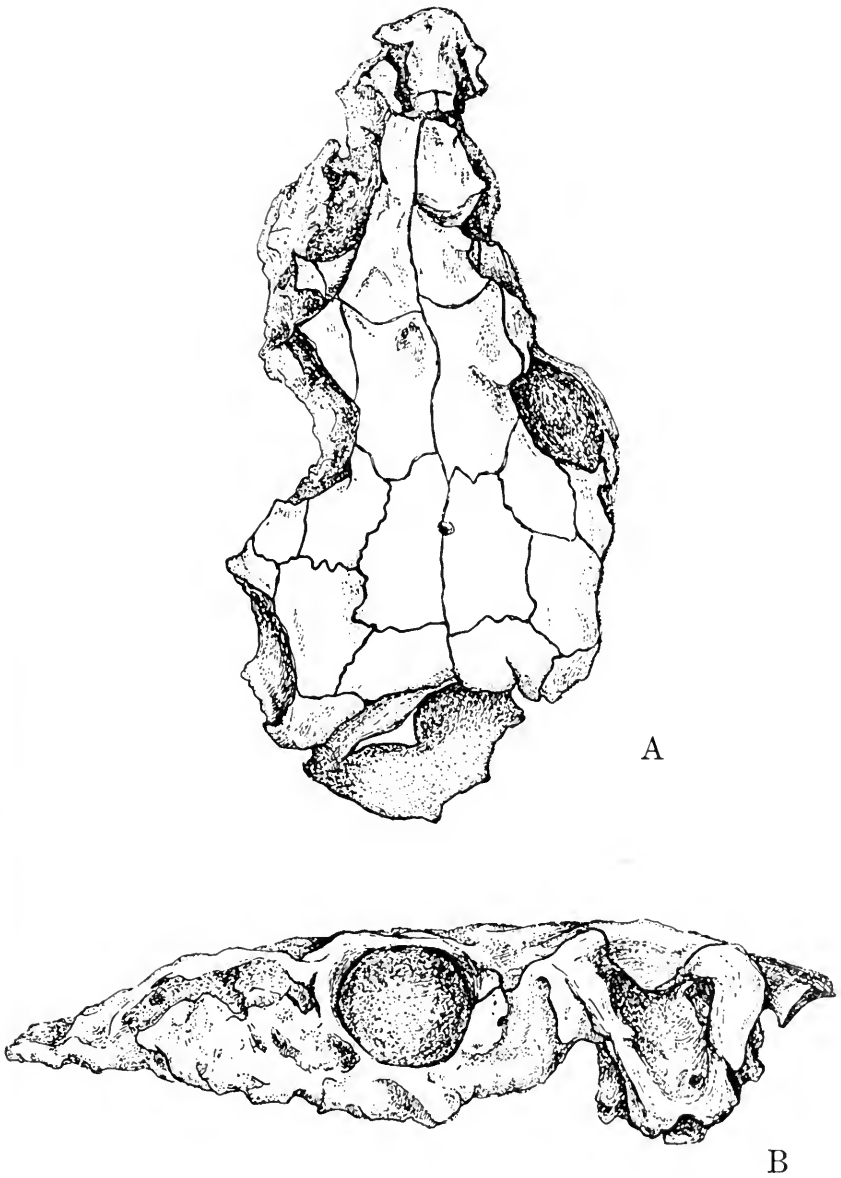


FIG. 1. The skull of *Longiscitula houghae*, type CNHM UR 430. A, Dorsal view. B, Lateral view from the left. Both views × ⅔.

The orbits are large (3 cm. in diameter), nearly round, and face laterally in connection with the great depth of the skull. They intersect the prefrontal, frontal, post frontal, post orbital, jugal, and lacrimal bones, as is the usual condition in the dissorophids and trematopsids.

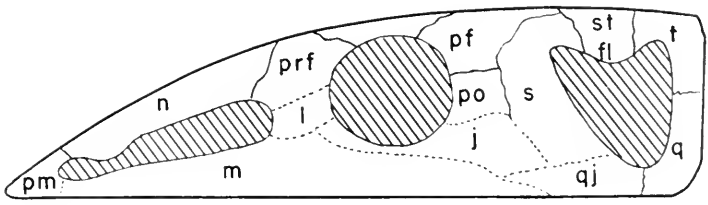
The pineal foramen is relatively small, somewhat wider than long, and lies just posterior to a line connecting the posterior margins of the orbits.

The otic notch is well preserved. It is deep, as would be expected, and faces mostly laterally. It has roughly the shape of a right triangle, with the right angle at the posterior dorsal corner, and with the posterior margin somewhat longer than the dorsal margin. Posteriorly, the notch is closed by a thick rod composed of the quadrate and tabular. Dorsally, there is a half-moon-shaped, ventrally directed flange which narrows the notch from above. This flange is composed largely of the supratemporal, but also of the squamosal and tabular bones. Anteriorly and ventrally, a wide shelf formed by the squamosal faces posteriorly and slightly dorsally, and slopes at a 60° angle from the horizontal to a point just dorsal to the quadrate condyle. This steep angle of the anterior margin of the otic notch is apparently developed in connection with the relatively great depth of the skull.

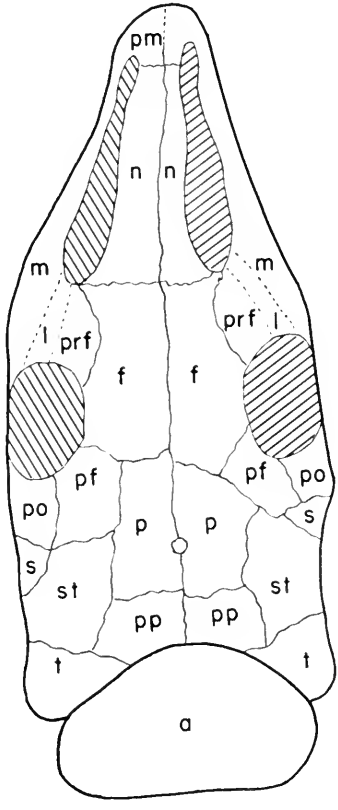
Only a few teeth are visible and these are not well preserved. They are small, conical and typically dissorophid. Unfortunately, they cannot be counted, or assessed as to their regional variation.

The sutures between the roofing bones of the skull are readily distinguished, except on the anterior lateral margins where the skull is damaged or crushed. In keeping with the general shape of the skull, the bones, such as the frontals and parietals, are all elongate. In general, the bones are similar to those of *Broiliellus*, the only previously described dissorophid. Work completed but as yet unpublished, suggests, as would be expected, that *Dissorophus* is the same as *Broiliellus* in this regard. Because of this general similarity of the dissorophids, only those descriptive details of general interest will be included here.

The tabulars are large, and are directed posteriorly, causing the posterior dorsal margin of the skull to be concave, when viewed dorsally. Posteriorly, the tabulars bend sharply downward and meet the quadrates, thus closing the posterior margin of the otic notch. The external lateral margins of the tabulars bend sharply downward and thus form the posterior part of the previously mentioned half-



A



B

FIG. 2. Diagrams of *Longiscitula houghae*. A, Lateral view from the left. B, Dorsal view. Abbreviations: a, armor; f, frontal; fl, flange; j, jugal; l, lacrimal; m, maxillary; n, nasal; p, parietal; pf, post frontal; pm, premaxillary; po, postorbital; pp, postparietal; prf, prefrontal; q, quadrate; qj, quadratojugal; s, squamosal; st, supratemporal. Both views × ⅔.

moon-shaped flange which narrows the otic notch from above. The post parietals are large, and have no massive exostoses, such as occur in *Dissorophus* and *Cacops*. The supratemporals are large, and form the central part of the half-moon-shaped flange in the otic notch, and thus have a ventrally directed lateral margin. All other bones are essentially the same as in *Broiliellus*, with the lacrimals and frontals intersecting the orbits, and with no intertemporals. The jugals, maxillaries, and quadratojugals cannot be described with any accuracy, though one would not expect any pecularities in them.

The nature of the condyles and the sutures separating the quadrate bones from adjacent elements are not discernible because of poor preservation. However, the condyles lie directly below the stout post-otic bar, suggesting a functional relationship between the position and size of the post-otic bar and mastication.

The shape and position of the ridges and other exostoses on the skull roof provide fruitful comparisons of *Broiliellus*, *Dissorophus* and *Cacops*, and will be described in some detail, although the comparisons with other dissorophids and with the trematopsids, does not strongly suggest close relationships.

Reminiscent of *Broiliellus*, there is a large tubercule just anterior to the orbit on the ventral posterior corner of the prefrontal, with a continuous ridge running both dorsally and ventrally around the orbit, which ridge apparently gradually disappears toward the posterior part of the orbit. A strong ridge runs internally and anteriorly from the prefrontal tubercule, curves anteriorly after 2 cm., and ends about 3 cm. from the anterior tip of the snout. Just external to, and partly underlying this ridge, is the previously described deep groove, which is continuous with the elongate nares.

The other exostoses, observed in *Broiliellus* (Williston, 1914) on the dorsal surface of the skull, do not exist. The pattern on the posterior margin of the postparietals is smooth, except for minor dermal pitting, like that of the rest of the skull table. The squamosal, supratemporal and tabular are thickened into a broad ridge, dorsal to the otic notch, as is the case in many other rhachitomes.

Armor

Immediately behind the skull, and apparently in place, is dorsal dermal armor representing about one-half of a plate. This armor segment looks very similar to the first armor segment posterior to the skull in *Dissorophus*. It is about as broad as the skull (6 cm. is the minimum width), and fits into the concave posterior part of the

skull. Like the first segment in *Dissorophus*, it is nearly as long anteroposteriorly (± 2.6 cm.) as it is broad. Laterally, it is gently curved ventrally, along an anteroposterior line.

The entire dorsal surface of the armor segment has dermal pitting similar to that of the skull. However, the posterior margin is very thin. It has a transverse border which is pitted less than the body of the armor, suggesting that at one time additional armor segments lay posterior to the preserved segment.

On the ventral anteroposterior midline, the roots of a ventrally directed flange are preserved. Although nothing more can be said about this flange, it appears to be very similar to that of the first armor segment of *Dissorophus*. Unfortunately, the relationship of this armor to the vertebral column is not represented by any specimen. As will be discussed in a future paper on dissorophid armor, this relationship is important.

Conclusions

The striking thing about *Longiscitula* is the mixture of dissorophid and trematopsid features in the same genus. Noteworthy dissorophid features are the armor and the half-moon-shaped flange directed ventrally on the dorsal margin of the otic notch. Noteworthy trematopsid features are the elongate, high skull, and especially the elongated openings anterior to the external nares. It has been repeatedly stated (Olson, 1941, p. 173; and others) that the Tremotopsidae and the Dissorophidae are closely related families, and these features emphasize the closeness of the relationship.

From another point of view, examination of the other Dissorophidae, particularly *Dissorophus* and *Cacops*, suggests that these genera represent two separate subfamilies, each of which separately evolved armor. Briefly, the reasons for this conclusion are that the armor along the dorsal midline is not homologous in the two subfamilies, and that the sacral rib is single in *Dissorophus* and its allies, and double in *Cacops* and its allies. These matters will be discussed in detail in a separate paper.

From these data, it is possible to conclude that the armored Dissorophidae have had at least three separate evolutions of armor: one represented by *Cacops*, another by *Dissorophus*, and a third by *Longiscitula*. Since it is now generally accepted that there are a number of unarmored dissorophids in the Pennsylvanian (see Gregory, 1950), a comparison of these unarmored dissorophids with *Trematops* and *Acheloma* is especially pertinent. The differences between these un-

armored dissorophids and the trematopsids are few, relating primarily to elongated external nares, elongate skulls, and somewhat stereospondyl-like intercentra of the trematopsids. In light of the fact that *Longiscitula* contains some dissorophid and some trematopsid features, it would appear that the distinctions between these two groups are now even less clear than before. In addition, there appear to be several phyletic lines of amphibians in the Early Permian, evolving in a parallel and convergent manner.

One possibility is that the late Pennsylvanian amphibians were largely aquatic, but that the morphological condition of these animals was such that they were preadapted for terrestrial life, so that a few additional trappings would make terrestrial life possible. This conclusion is consistent with the conclusions of all modern writers (see Romer, 1947): that certain Permian amphibians were highly terrestrial when compared with the group as a whole. Some additional information on the distribution of these animals exists, which leads in the same direction, but which will be discussed in a later paper.

SKULL MEASUREMENTS

(measurements in centimeters)

	Length along midline	Mid orbital width	Width of skull table at posterior edge of otic notch	Mid orbital depth	Posteriormost depth
UR 430 *Longiscitula*	12.0	6.4	5.2	3.3	3.6
MCZ 2122A *Dissorophus*	13.7	10.9	8.5	2.8	4.3
CNHM UC 649 *Cacops*	12.5	9.2	6.8	4.4	4.9
CNHM UC 1760 *Trematops*	16.5	8.2	10.6	4.0	4.7

	Length/mid orbital width	Length/posteriormost depth
UR 430 *Longiscitula*	1.9	3.3
MCZ 2122A *Dissorophus*	1.3	3.2
CNHM UC 649 *Cacops*	1.4	2.6
CNHM UC 1760 *Trematops*	2.0	3.5

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