

**Article XVIII.—THE SKELETON OF *PÆCILOSPONDYLUS*  
*FRANCISI*, A NEW GENUS AND SPECIES OF  
 PELYCOSAURIA.**

BY E. C. CASE.

This specimen, No. 4174, Am. Mus. Nat. Hist., Cope Coll., was collected by Mr. Charles H. Sternberg on Coffee Creek in Willbarger Co., Texas, in 1895. The elongate form of the body and skull with the general suggestions of Proterosaurian affinities fixes its position in the family Poliosauridæ. The character of the cervical vertebræ shows that it does not belong to the genus *Poliosaurus*; in form of body and evident adaptation it agrees pretty well with Broili's description of *Varanosaurus acutirostris*, but the character of the dorsal vertebræ shows that it belongs in a separate genus and species. Dr. Matthew has done considerable work upon this specimen and in this description I have availed myself of his kind permission to make use of his valuable notes.

Only the anterior portion of the skull is preserved and this is badly crushed. It shows the skull to have been elongate and slender with the small nares nearly terminal. The alveolar edge of the maxillary is nearly straight and there is no notch between the maxillary and premaxillary. The cheek teeth are slender, elongate cones of uniform size and there are no enlarged teeth on either the upper or lower jaw. The condition of the skull makes it impossible to go more into detail, the whole posterior half is gone and the bones of the facial region are indistinguishable. The lower jaws are separated at the symphysis and were probably only loosely attached during life.

There are twenty-seven vertebræ in the presacral portion of the column, two sacrals and thirty-two caudals. The presacral series is probably not quite complete; though there are several places in the series where there is no contact between the different pieces, the size and form of the vertebræ make such a continuous series that it is not likely that a great deal is missing. Beginning with the atlas there are eight in series, then a break and seven more in series, the posterior part of the column is broken into three pieces the last six presacrals being in series and attached to the sacrum. The caudal series is not so perfect and it is estimated that at least ten vertebræ are missing.

The *atlas* has the neural arch free and divided into halves. The anterior

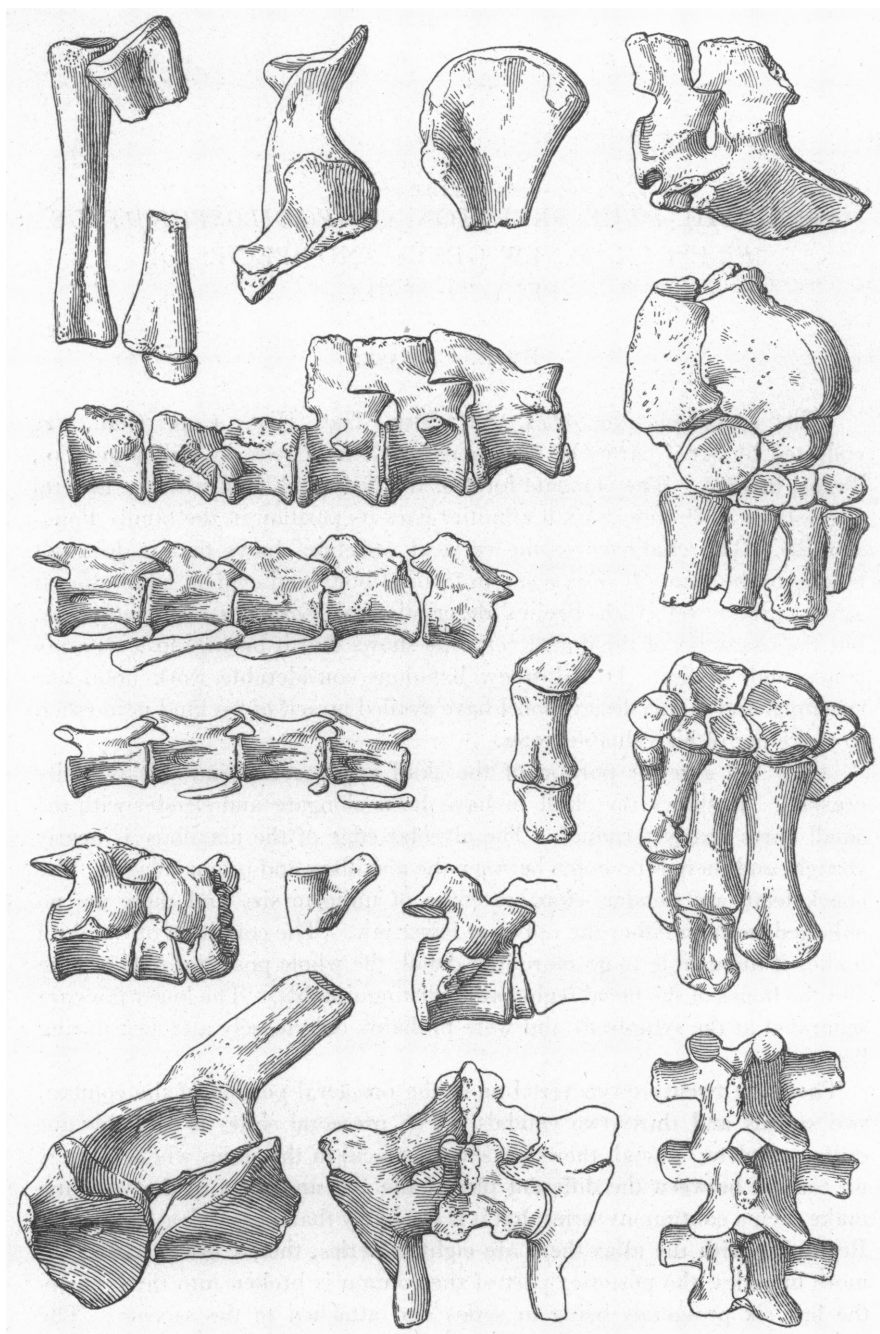


Fig. 1. *Pætilospondylus francisi*. Portions of the type, No. 4174, A. M. N. H.

Top row: Left (?) radius, ulna and ulnare, inner surface of left ilium with sacral rib attached, upper end of right humerus, sacral vertebrae. Second row: Presacra 1-6, right tarsus, upper surface showing (from right to left) tibiale, fibulare, centrale 1, centrale 2 + tarsale 4, tarsale 1, 2, 3, metatarsals 1-4. Third row: Caudals 9-13. Fourth row: Caudals 23-26, two phalanges, left tarsus, upper surface showing (from left to right) centrale 1, centrale 2 + tarsale 4, tarsale 1-3, 5, and metatarsals 1-5. Fifth row: Atlas and axis, head of dorsal rib, fourth cervical. Bottom row: Left half of pelvis, top view of sacrum, top view of thoracic vertebrae, Nos. 6, 7, 8.

All figures  $\frac{1}{2}$  nat. size.

zygapophyses are small and weak, the posterior are larger but much smaller than those of succeeding vertebræ. There is no neural spine but the upper surface of the posterior zygapophyses were elevated and prominent. The two halves of the neural arch are separated by the thin anterior end of the spine of the axis, which is thrust far forward between them as in the amphibians *Eryops* and *Acheloma*. A fragment just beneath the anterior zygapophysis of the left side indicates the possible presence of a proatlas.

The *axis* has a large spine which is very heavy posteriorly but extends anteriorly in a thin blade which is thrust in between the halves of the neural arch of the atlas. In this character the specimen differs markedly from *Poliosaurus* in which the anterior edge of the axis spine is heavy and thick and does not separate the halves of the neural arch of the atlas. The posterior pair of zygapophyses are of normal size; both pairs are located far up on the neural arch so that there is a considerable space between them and the prominent transverse processes. This constitutes another difference between *Pæcilospondylus* and *Poliosaurus* for in the latter the transverse processes lie just below the zygapophyses. There is large intercentrum with a flat lower face between the axis and atlas.

In the posterior cervicals the neural arch begins to broaden out and the sides to become swollen; this process continues until in the mid-dorsal region the vertebræ resemble those of *Pareiasaurus*, *Captorhinus* and *Diadectes*. This condition of the vertebræ seems to be a primitive character as it is found also in *Telerpeton*, *Procolophon* and others of about the same period. The more slender cervical vertebræ seems to be a departure from the primitive type and an adaptation to the development of a long neck. Beyond the mid-dorsal region the neural arches become thinner again until on the first presacrals the sides are pinched in rather than swollen out and the whole aspect of the vertebral arch is changed. The neural spines of all the vertebræ posterior to the axis have been injured so that it is impossible to give an exact description, but it is altogether probable that they were as described by Broili, low and thin with about the same anterior posterior extent throughout the series.

In the fourth cervical the neural arch is not greatly widened and the centrum is elongate; the lower face of the centrum is entirely devoid of any keel and is much more slender and elongate than the corresponding bone in *Poliosaurus* which is wide and has a sharp keel on the lower surface. In the last mentioned genus the axis is much longer than the other cervicals, in *Pæcilospondylus* it is about the same length. The transverse processes rise from the base of the neural arch and the faces of the zygapophyses are nearly horizontal.

Attached to the fifth vertebra is the head of a rib with distinct capitular

and tubercular faces but the two are not separated, being connected by a thin plate of bone.

On the *seventh vertebra* the neural arch has become broad and rounded, in great contrast to the thin pinched-in arches of *Poliosaurus*. The transverse process rises from the base of the zygapophysis and is supported by a thin buttress which runs downward and forward to the anterior edge of the centrum. The bottom of the centrum is narrowed but there is no keel.

The vertebræ from the *eighth* to the *seventeenth* are very similar to the seventh. The neural arches remain broad and rounded and the only apparent change is in the transverse process which becomes shorter and more slender. Fragments of an abdominal armor cling to the lower side of the twelfth to the seventeenth vertebræ; this is similar in character to that found in *Labidosaurus*, consisting of elongate scales arranged in an imbricate manner in the usual chevron pattern. Posterior to the seventeenth the vertebræ become more elongate and the arches more slender. The narrowed arches continue through the rest of the vertebræ to the sacrum, but the elongation quickly ceases; the greatest length is reached in the twentieth and twenty-first. From this point back the vertebræ shorten rapidly until in the twenty-seventh the first presacral is only 11 mm. as compared with 15 mm. of the mid-dorsal region. The shortening of the vertebræ is accompanied by an increasing concavity of the bottom line, but there is no keel. It is impossible to tell upon which vertebra the last free rib occurs, but the last seven, at least, had the ribs ankylosed to the transverse processes.

The *first sacral* is not more elongate than the last presacral. The neural arch is peculiar in being considerably wider anteriorly than posteriorly; this is largely due to the necessity for a support for the great transverse process and the sacral rib. The transverse process is very short and stout and the face for the rib looks largely downward. The *second sacral* is smaller than the first and the transverse processes do not widen the anterior portion; the rib is much smaller than the first. The vertebræ remain distinct, with well developed zygapophyses between them, there has been little or no progress toward the formation of a sacrum.

In the first *three caudals* the ribs are free and the neural arches much narrowed. The ribs have distinct tubercular and capitular portions but they are joined by a thin plate of bone as in the presacrals. The first series of caudals free from the sacrum begins with the fifth or sixth, the ribs are united with the transverse processes and there are well developed chevrons. The upper end of the chevron is perforated by a large foramen. The spine was pretty long, as an incomplete one measures 15 mm. while the length of the centrum is only 11 mm. Reckoning the first vertebra of the series as the fifth, there is a continuous series to the fourteenth; they show a gradual

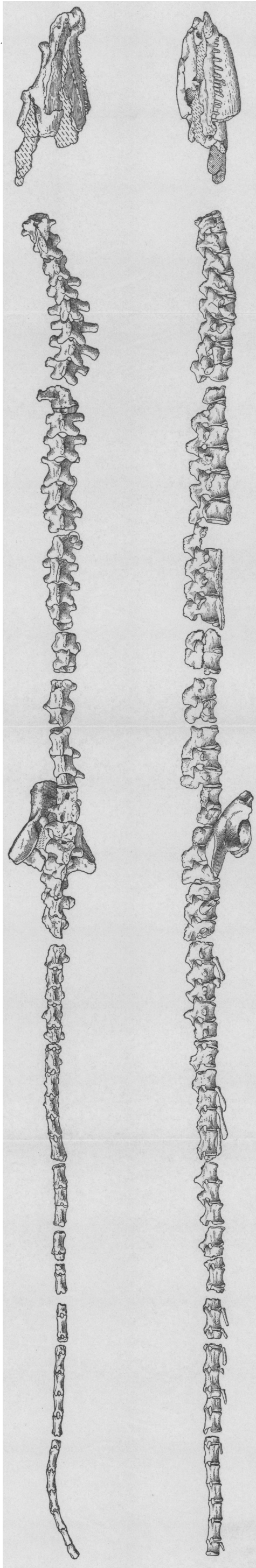


Fig. 2. *Paciospondylus francisi*, superior and lateral aspects of type.  $\times \frac{1}{3}$  nat. size.



shortening of the transverse processes and the ribs until on the thirteenth the last trace disappears; at the same time there is a very gradual increase in the length of the centrum which is first noticeable on the twelfth. At this point the caudals have definitely assumed the characters which go with a long and slender tail, the neural arches are low and elongate with the spines far back. There is a complete chevron, twenty-three mm. long, on the twelfth, while the length of the centrum is only fourteen and a half. The end of this chevron is expanded vertically and is very thin.

From the fourteenth to the thirty-second counted vertebra the series is broken and there are undoubtedly several missing, as well as some from the tip of the tail. The distal vertebræ become very long and thin and gradually lose the spines but retain some traces of the chevrons to the very last.

The *ribs* of the thoracic region are quite long and slender and are rounded in section. The first sacral rib has the distal end widely expanded and concave where it is applied to the inner face of the ilium. The distal end of the second sacral is smaller than that of the first and is partly applied to the posterior edge of the first and partly to the ilium.

The *shoulder girdle* is not preserved.

In the *pelvis* the ilium and the proximal ends of the ischium and pubis can be made out. The ilium has a strong crest sharply inclined to the rear, this is thickened and has a triangular section. It formed the major portion of the cotylus. The ischium and pubis are represented by the ends only, they are broad and plate like and it is probable that they lay horizontally as do the same bones in *Diadectes*, *Captorhinus*, etc.

The lower end of the *femur* only, is preserved; it shows that the whole bone was quite elongate and slender. There was no prominent ridge on the lower end such as occurs in the Pelycosaurs. The tibia and fibula, in keeping with the femur, are relatively long and slender. The *tibia* is only slightly curved and there is a shallow groove on the anterior face. The *fibula* is thin but the lower end is very wide and the bone is much more curved than is the tibia.

The *fore-limb* is represented by the proximal end of the humerus, the lower half of an ulna and a radius. The upper end of the humerus has a poorly defined articular surface and a strong but short deltoid ridge. The radius is nearly cylindrical.

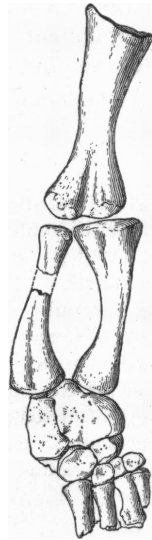


Fig. 3. *Pæcilospondylus francisi*, right hind limb of type, external, or dorsal view. (The tibial border is on the right.)

The *tarsus* is represented by parts from both sides. The astragalus and calcaneum with two bones of the distal row are preserved in one piece, from the right side, and three distal tarsals and four metatarsals in another. Six tarsals and metatarsals of the left side are in a third piece. The astragalus is of the form common among the Permian reptiles: there is a flat inner face with a notch which, with a similar notch on the inner face of the calcaneum, forms a foramen through the tarsus. The outer face of the astragalus is broad with a thickened process on the lower corner. The calcaneum is a flat disc-like element with a thick inner edge and a notch to unite with that of the astragalus. In the median row there is a slender element, elongate horizontally, lying beneath the union of the astragalus and the calcaneum, a smaller one beneath the astragalus and another outside the median element on the calcaneal side. The large median element articulates directly with the fourth and fifth metatarsals. Below the small element on the astragalus side there are three small elements supporting the first, second and third metatarsals. The fifth metatarsal is represented by the proximal end only but this shows it to have been of considerable size. The fifth was probably as large as the fourth, the third, first and second are progressively smaller. One fragment shows three phalanges, they are fairly long but proportionately wide and thin. The terminal phalanx is missing.

The *carpus* is not represented.

#### Measurements.

	mm.
Length of the specimen as laid out . . . . .	980.
Add for the skull about . . . . .	200.
Add for 10(?) missing caudals about . . . . .	170.
Total length . . . . .	1350.
Length of tail . . . . .	480.
Length of femur . . . . .	86.5
Length of tibia . . . . .	70.
Lower jaw incomplete . . . . .	109.5.
Length of tarsus with longest metatarsal . . . . .	79.
Longest metatarsal . . . . .	55.5.
Length of radius . . . . .	54.