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Extinct Toads and Frogs from the Upper Pliocene Deposits of Meade County, Kansas

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ABSTRACT: This is the third paper dealing with the fossil frogs and toads of Kansas. Taylor (1936), (1939), (1941), dealt with species in the middle Pliocene from which five species were described. In this paper two new genera and eleven new species are described from the Rexroad member of the upper Pliocene.

The following is the list of described forms: *Scaphiopus diversus,* n. sp.; *Neoscaphiopus,* n. gen., genotype, *Neoscaphiopus noblei,* n. sp. (Anura, Pelobatidae). *Anchylorana,* n. gen., genotype, *Anchylorana moorei,* n. sp.; *A. dubita,* n. sp.; *A. robustocondyla,* n. sp.; *Rana parvissima,* n. sp.; *R. fayeae,* n. sp.; *R. meadensis,* n. sp.; *R. ephippium,* n. sp.; *R. rexroadensis,* n. sp.; *R. valida,* n. sp. (Anura, Ranidae).

Mention is made of the presence of two species of *Bufo,* as shown by two types of bufonid ilia. One other species of *Rana* occurs which is presumably new, but the fossil sacrum is too fragmentary to describe.

The presence of ten species of frogs of the Family Ranidae suggests strongly that this region had a climate during the upper Pliocene which provided much more rainfall than at present, thus making western Kansas, during that time, a more favorable habitat for these water-loving species. In contrast, today there are but two ranid species, instead of ten, living in western Kansas.

Since all of the fossil bones of amphibians that have been discovered in the Rexroad quarries were disassociated, it has been necessary to use the sacral vertebrae only, as the basis of the type descriptions.

INTRODUCTION

SOME time ago the fossil frogs and toads belonging to the University of Kansas Museum of Vertebrate Paleontology, from the Rexroad fauna, upper Pliocene of Kansas, were placed in my hands for study. All of the skeletons had been completely disarticulated and disassociated, either prior to fossilization or during the process of recovery from the deposits by washing and sieving. They had been fossilized in either river sand or silt.

The material consists of the following elements: 11 urostyles (coccyges), including those fused with sacral vertebrae; 14 sacral vertebrae; 15 vertebrae other than sacral; 25 scapulae; 23 radioulnae; 47 humeri; 78 ilia; 7 femora; 16 tibiofibulae; 3 coracoids; 1 parasphenoid; 5 dentaries; 2 ethmoids; and 32 other elements referable to tarsals, metatarsals, carpals, metacarpals, and phalanges. From these data one deduces that from these beds, with the present method of collecting, the ilia are most likely to be recovered, since at least 39 individuals are represented; second to these are the humeri representing 24 individuals; the sacral vertebrae represent 14 individuals; while the urostyles, radioulnae, and the scapulae represent 11, 12, and 13 individuals, respectively.

The relative numbers of elements recovered depend largely on their size and solidity. The present method of collecting, that is, washing of the loose matrix and sieving, tends to destroy the more fragile elements, presuming they are present in the quarries originally. The smaller parts may escape through the sieve.

In an earlier study on the anuran fauna of the "Edson beds" of Sherman county, Kansas, I dealt with a somewhat similar lot of fossils, but this material, largely belonging to the genus *Bufo*, was less fragile and the proportions of the elements recovered was different. In all cases the bones were completely disarticulated and disassociated. I was confronted with the problem of a proper method to treat of this fauna, in describing the various species occurring in the collection. It seemed self-evident that the description of each species would have to be drawn from a single element in each case, and this same element used in the case of each species described, in order to avoid the possibility of describing two or more species, based on bones actually belonging to a single species. The element chosen, however, necessarily should be that which had the greatest number of constant differential characters, and one which was very likely to be recovered.

Having available in the Kansas University collection and my own collection, several hundred skeletons of modern Anura, I endeavored to ascertain what bone of the skeleton this might be, comparing, however, only such elements as were likely to be recovered from the fossil beds. This survey led me to the conclusion that the sacral vertebra showed a greater number of obvious, differential, specific characters than other elements, although specific differences were likewise evident in many of the bones.

In consequence, I found it expedient to utilize the sacral vertebra as the basis for the type descriptions, since not only are specific differences evident, but family differences are also apparent, and occasionally generic differences. While this element was not the one occurring most frequently, it was one which, due to its heavier structure, was likely to be recovered.

In the treatment of the Rexroad collection I am following the same procedure as formerly, utilizing the sacral vertebrae as the type specimens.

The reference of all the other elements in the collection to the various species which are indicated by the sacral vertebrae has not been possible at this time. In most cases, however, it has been possible to refer them to family. When the total number of species is

known from the Rexroad fauna, and more complete material is available, one will be able to refer this material to the various species with some degree of certainty. One may always hope to find, at least occasionally, associated bones which will help in this task.

Figures are given of many of the undescribed elements. These show, in their variety, that numerous species are represented.

SYSTEMATIC DESCRIPTIONS

ORDER ANURA

FAMILY PELOBATIDAE Boulenger 1882

GENUS *Scaphiopus* Holbrook 1836

In the Rexroad collection, save for a fragment or two of limb bones which may possibly belong here, this family is represented only by two sacro-coccygeal elements, one apparently belonging to a species of *Scaphiopus* while the other I regard as a member of a new genus. These agree, however, in the fusion of the sacral vertebra with the coccyx, the combined element being proceolous with a single fossa.

Three extinct species of this family are known from the American Pliocene, all being referred, at least tenatively, to the genus *Scaphiopus*. These are *Scaphiopus studeri* Taylor, *Scaphiopus pliobatrachus* Taylor, and *Scaphiopus antiquus* Taylor. Two of these forms are from the "Edson beds," Ogallala formation, middle Pliocene, Sherman county, Kansas; *Scaphiopus studeri* is from a diatomaceous marl, in contact (below) with the "Rhino Hill beds" at the western edge of Logan county, Kansas, also middle Pliocene in age.

Scaphiopus diversus, n. sp.

(Plate XV, figs. 2A, 2B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6368. Portion of the combined sacral vertebra and coccyx. Collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member (Frye & Hibbard [1941] p. 407), upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—Characterized by the absence of a bony web between the coccygeal shaft and the diapophyses.

Description of type.—The type specimen consists of the centrum of the ninth (sacral) vertebra, fused with the coccyx; the base of

the sacral diapophysis, is present only on the right side. The distal part of the coccygeal shaft is missing.

The following measurements are given (in millimeters): Total length, 8.4; from anterior end to ninth nerve foramen, 0.9; from anterior end to tenth nerve foramen, 2.0; width of base of the sacral diapophysis, 0.9; diameter of the articular cup, 1.25; width of the centrum of sacral vertebra, 1.15; width at the level of the tenth nerve formamina, 1.45.

There is no trace of lateral shelves along the anterior part of the shaft as is present in *Scaphiopus pliobatrachus* (continuous with the widened portion of the coccyx), or in *antiquus* (arising independently near the base). The shaft is compressed laterally, the elevation being 1.3 millimeters, while the width is 0.56 to 0.6 millimeters. The neural tube on the dorsal part of the shaft terminates by a tiny foramen about 7.0 millimeters back from the anterior end. Posterior to the foramen of the tenth nerve there is a shallow longitudinal groove, the lower edge of which is bordered by a slight elevation. There is practically no trace of a bony web between the coccygeal diapophyses and the side of the shaft (prominent in *S. pliobatrachus*, obsolete in *S. antiquus*). There appears to be no trace of the point of fusion between the two elements on either dorsal or ventral face. Although the sacral diapophyses are absent in the type, it is presumed that these were greatly widened as is typical of the genus.

Whether the type element is from a smaller form than the already described species or whether it is from a young individual I cannot say. The element, based on comparative measurements of the other living species of the genus, belonged to an animal of about 50 mm. snout to vent length, which is smaller than adult *Scaphiopus bombifrons* Cope living in western Kansas at the present time. *S. bombifrons* differs from this form in the presence of the bony web between the diapophyses of the sacrum and the side of the shaft.

Neoscaphiopus, n. gen.

A genus of anuran amphibians of the family Pelobatidae characterized by a fusion of the sacral vertebra with the coccyx and the presacral vertebra. The posterior edge of the presacral vertebra forms a strongly elevated ridge on the dorsal surface of the combined element (see figure Pl. XV, 5A). The bases of diapophyses are much narrowed at their attachment. Genotype *Neoscaphiopus noblei*.

Neoscaphiopus noblei, n. sp.

(Plate XV, figs. 5A, 5B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6367. A portion of a combined sacral vertebra and coccyx. Collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—The sacral vertebra is fused to the presacral vertebra as well as to the coccyx.

Description of type.—The type specimen consists of a part of the sacro-coccygeal element, with both diapophyses and the distal part of the coccygeal shaft missing. The thin anterior edges of the notocoele are broken away.

The measurements, in millimeters, are as follows: Greatest length, 5.1 (estimated length of entire element, 19.0); width of bases of sacral diapophyses, 0.56; distance from edge of socket to base of shaft, 1.5 (missing part estimated at 0.5); from edge of socket to the foramen of the ninth nerve, 2.1; from edge of socket to foramen of the eleventh nerve, 3.8; width of the centrum between ninth nerve foramina, 1.3.

One of the significant characters is the strong contraction of the base of the sacral diapophyses, which has a somewhat greater vertical depth than width. The base of the diapophysis is back a considerable distance from the anterior end of the notocoele, and the tenth nerve foramen is farther posterior than in the numerous species of *Scaphiopus* living or extinct. There is a well-developed bony web between the dorsal surface of the diapophyses and the shaft. At the broken end of the shaft the neural cavity is separate from the main coccygeal cavity, and appears somewhat circular at this point. At the broken end of the coccyx the element is compressed, its elevation being 1.8, the width 1.1 millimeters. Although missing now in the type, it is presumed that the sacral diapophyses were greatly widened.

A ridge 0.45 millimeters high crosses the dorsal surface forming a wavy line. This represents the posterior edge of the presacral (eighth?) vertebra. There is nothing on the ventral surface to suggest the line of fusion. Certain additional characters are evident in the figure. This species is named for the late Dr. G. K. Noble, in recognition of his great contributions to our knowledge of amphibia and reptiles.

FAMILY BUFONIDAE Hogg 1841

GENUS *Bufo* Laurenti 1768

This family, members of which are usually conspicuous in any temperate or tropical living fauna, and whose remains formed a considerable portion of the extinct Anuran fauna recovered from the "Edson beds," Ogallala formation, middle Pliocene, Sherman county, Kansas (Taylor 1936, 1941), is represented in the Rexroad collections by three fossilized bones only. These are, one coccyx and two ilia. The latter are both from the right side, consequently from two different individuals which I believe represent two different species. As work in the Rexroad quarries is being continued it is very probable that sacral vertebrae or other material will be available eventually for adequate description. Consequently I shall not assign specific names at this time. It is of course impossible to state whether the coccygeal element is referable to either of the forms represented by ilia.

Bufo, sp.? Form A.

(Pl. XIX, fig. 12)

This species is represented by No. 6334, the major part of a right ilium, collected by Dr. Claude W. Hibbard and party, 1938, Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

The element, in its present state, lacks the anterior portion; it is 18.2 millimeters in length (estimated total length, 30 millimeters). Its greatest width including the ilial prominence is 6.1 millimeters; the width of the shaft varies between 2.2 and 2.45 millimeters. The shaft is distinctly, but not strongly curved. The dorsal ilial prominence rises about 1.6 millimeters above the level of the shaft. A broad, shallow groove can be traced across the anterolateral face and partly across the top of the prominence. From the posterior inner edge of the prominence, a short, low, curving crest runs back to the termination of the element; from the anterior, inner edge a sharp-edged crest runs diagonally downward nearly across the inner face of the shaft, tending to flatten out and disappear. Above this, and parallel to it, is a slight depression.

On the anterior face is the ilial part of the acetabulum, the edges moderately elevated; below the base of the shaft, just anterior to the acetabulum is a shallow pit, perforated by a small foramen. A thin projection of bone borders the posteroventral part of the acetabulum and is perforated by a foramen near the lower outer edge. The outer

face of the shaft has a curving groove beginning near the upper edge of the shaft base, and terminating at the lower edge, at about the middle of the (entire) bone. The outer surface is rounded while the inner face is less so.

The upper edge of the shaft becomes pinched into an inconspicuous crest, not visible as such from the outer face. The dorsal nerve foramen is nearer to the posterior end of the ilium than to the base of the dorsal ilial prominence.

The fossil is pure ivory in color. Based on comparative measurements and presuming the animal full grown, the ilium belonged to a toad having a snout to vent measurement of about 75 millimeters, a species comparable in size to *Bufo compactilis* Wiegmann.

Bufo, sp.? Form B.

(Plate XIX, fig. 13)

This species is represented by No. 6335, the major part of a right ilium, collected by Dr. Claude W. Hibbard and party, 1938, Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

This element, slightly smaller than the preceding form, is 16 millimeters in length (estimated total length, 26 millimeters). The greatest elevation of the acetabular end is 6 millimeters, while the width of the shaft varies from 2 to 2.5 millimeters.

The shaft is distinctly, but not strongly curved. The dorsal, ilial prominence rises above the level of the shaft about 1.15 millimeters, being somewhat thicker at its base than at the summit. A slight vertical groove is present on the middle of the outer face, and more anteriorly there are two short indistinct grooves. The ridge or crest running back from the inner posterior edge of the prominence is broken away. The anterior crest, which lacks a sharp edge, terminates abruptly near the upper edge of the shaft. The inner face of the shaft is much flattened, but apparently some of the surface has been removed. There is only a trace of a ridge on the inner face, opposite the acetabulum.

On the outer face, is the ilial portion of the acetabulum, the edges of which are somewhat elevated, the cup rather deep, its greatest vertical diameter 2.7 millimeters. Above the acetabulum the foramen is closer to the base of the prominence than to the posterior end of the element. Anterior to the acetabulum, at the lower edge of its base, is a deep pit perforated by a minute foramen; the thin fringe of bone bordering the lower part of the acetabulum is pierced by a foramen near its lower edge.

There is a shallow longitudinal depression on the outer face of the shaft. The upper edge of the shaft is pinched into a crest, not evident when the bone is viewed from the outer, somewhat rounding face.

Compared with the preceding form, the most significant difference is in the different character of the ilial prominence and its position in relation to the acetabulum. In form A, it is largely anterior to the anterior edge of the acetabular cup; in form B it is almost wholly posterior to the anterior edge of the cup. Form B lacks the curved groove on the outer face of the shaft, and the inner face is more flattened and less rounded.

FAMILY RANIDAE Linné 1758

Two genera are considered under this family. These are *Anchylorana,* new genus, and *Rana* Linné, the first with three species, the last with seven species.

GENUS *Anchylorana,* n. genus

A genus of Pliocene frogs characterized by the fusion of the last two (the eighth and ninth [sacral]) vertebrae. The genotype is *Anchylorana moorei,* n. sp.

The significance of the fusion of vertebrae in Anura is not known. Noble (1931) points out that the Roraima toad *Oreophrynella* with only six segments in the column is a terrestrial species. On the other hand *Hymenochirus,* an African form, also with six segments, is thoroughly aquatic. They belong to different families, "hence this reduction in the number of vertebrae is not correlated with a special type of habitat."

In *Atelopus* (Family Atelopidae), a genus related to *Oreophrynella,* Noble found that in some species the last two vertebrae, the eighth and ninth (sacral) vertebrae fused, and in these forms the first and second likewise might be fused in some species. In a few species of *Dendrobates,* also of the same family, he found that in certain species, when the eighth and ninth vertebrae fused, there was a fusion also of anterior vertebrae; in one species the first, second, and third fused; in another the second and third only. Noble also mentions the fusion of the last two vertebrae in a specimen of *Rana caeruleopunctata,* in one of *Rana christyi,* and in one of *Rana pipiens?.*

I have found a single fusion of vertebrae. This was the third and fourth vertebrae of a toad (*Bufo*) in the "Edson beds" fauna, but

this condition was obviously an abnormality, evidenced by a lack of symmetry. In 16 skeletons examined, belonging to *Rana pipiens (sensu lato)*, I find no trace of fusion although it may occur occasionally as an anomaly. The material includes specimens of varied ages and from various localities in Mexico and the United States. No fusions were found in other available ranid species: *Rana cantabrigensis, catesbeiana, palustris,* or *areolata.*

Anchylorana moorei, n. sp.

(Plate XV, figs. 3A, 3B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6375. Collected by Dr. Claude W. Hibbard and party, 1939.

Occurrence.—Rexroad member, upper Pliocene, locality 3, Meade county, Kansas.

Diagnosis.—The sacral and the preceding vertebra are fused; a large foramen opens at base of the ventral part of the two condylar projections of the sacral centrum; a ridge is present on ventral surface of the centrum, suggesting the line of fusion, and the possibility that the sacrum is procoelous.

Description of type.—The type specimen consists of the greater part of a sacrum, composed of a sacral vertebra fused to the preceding, eighth(?) vertebra. The distal parts of the sacral diapophyses are missing while those of the attached vertebra are broken away at their bases.

The measurements, in millimeters, for the type specimen are as follows: Total length of combined centra, practically complete, 5.0; the width, practically the same throughout the length, 3.7; width of the narrowest point on the sacral diapophyses, 1.5; width of coccygeal condyles of sacrum, 1.5, 1.35; vertical height of the anterior end of neural canal, 2.1; transverse width, 3.0; vertical height of the posterior end of the neural canal, 1.2; width, 3.0; length of the intervertebral nerve canal, 1.25; width of the neural arch, 4.8.

The coccygeal condyles may be slightly worn since they are a little shorter than what one might expect to be normal. The notch between them is broadly A-shaped, and the surfaces bordering the notch show no wear. The sacral diapophyses are subtriangular in cross section, and are attached to the centrum so that the lines projected from their lower surfaces form a very obtuse angle near the base of the stalks of the condyles. Their broken ends show them to be hollow, the cavity being somewhat triangular in cross section. From the anterodorsal surface, a ridge begins and continues to the

median line where it terminates in an elevated median spine or knob. On the anterior face of the sacral vertebra there are two depressions separated by a medial ridge. There is no ridge on the dorsal surface of the bases of the transverse processes of the eighth vertebra; however, the anterior dorsal edges on both sides become elevated and medially are continuous with a median ridge. This rises to an elevation near the posterior median edge (broken in the type). The prezygapophyses of the eighth vertebra are broken, showing the cavity within the base of the transverse processes.

The centrum seen from below has an angular ridge, the apex directed backwards, suggesting the line of contact between the fused vertebrae. However, if this is actually the case, it may be doubted that this form and the two following are correctly referred to the same genus since the doubly concave eighth vertebra of the Ranidae would not be present (in the other two species the line of contact forms a curve, convex anteriorly, suggesting the eighth vertebra is biconcave). However, until this matter can be settled conclusively I shall leave the three forms associated in the same genus.

The centrum is much flattened dorsoventrally and is hollow. The opening at the posterior end, at the base of the condylar stalks, suggests the presence of a persistant notochord. The notochord persists to a greater or lesser extent in certain species of *Rana*. This is evident in the posterior centra, especially the eighth which is often penetrated by a cylindrical cavity, and the adjoining centra may be pierced by a narrow slitlike opening. Very rarely this is evident in the posterior part of the sacral centrum.

In a skeleton of *Scaphiopus bombifrons* I found the intervertebral parts of the notochord ossified, but instead of becoming fused to the centrum, they remained free, and when the vertebrae were separated, the small notochordal balls fell away from the adjoining notocoeles. The intervening parts of the notochord lacked ossification. I did not find this condition present in other adults, so I presumed this to be a large but subadult specimen.

The species is named for Doctor Raymond C. Moore, Director of the State Geological Survey, State Geologist of Kansas, and Head of the Department of Geology, University of Kansas.

Anchylorana dubita, n. sp.

(Plate XV, figs. 4A, 4B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6377. Sacrum, collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—Sacral and preceding (eighth) vertebrae fused; the anterior vertebra biconcave, penetrated by a circular canal; sacral part with the convex articular surface penetrated for a short distance by a groove, but the centrum is not perforated, and there is no posterior opening present; coccygeal condyles not large. Characters of the diapophyses not known.

Description of type.—The type consists of a sacral vertebra, fused to the preceding (eighth) vertebra, but with the transverse processes of both broken away at the base.

The measurements in millimeters are as follows: Total length of the combined centra, 3.2; width of the centra, 2.5; dimensions of the base of the sacral diapophysis, 1.0 x 0.8; width of coccygeal condyles each, 1.2; vertical height of anterior end of neural canal, 1.8; transverse width of anterior end of same, 2.4; diameter of the intervertebral nerve foramen, 0.85; width of neural arch, 3.8; length of combined arches, 2.2.

The cross section of the sacral diapophysis, where it is broken, is oval rather than triangular, and the cavity within is likewise oval in cross section. The coccygeal condyles are worn and shortened. The notch between them is definitely not A-shaped. The diapophyses are set on the sides of the centrum and arch so that the lines coinciding with their ventral surface, if projected would intersect in the notch between the condyles, forming a very obtuse angle.

There is a very slight ridge arising on the anterodorsal faces of the bases of the diapophyses, which continues as a slight crest bordering the anterior edge of the arch of the sacral vertebra to the middle where there is a median elevation. The posterior face of the arch is directed upward and has a relatively smooth surface. The arch of the preceding vertebra is longer, reaching its greatest elevation medially. There is a slight, median, longitudinal crest, barely indicated (apparently worn). Between the two vertebrae is a deep groove, divided medially by a crest; the suture between the two vertebrae is visible ventrally. The two anterior articular surfaces of the zygopophyses are set nearly at right angles to the surface from which they arise.

The eighth vertebra is amphicoelous and perforated by a wide circular canal; the anterior articular surface of the sacral vertebra seen through this canal, shows a deep groove, but this does not pierce the centrum completely as in *Anchylorana moorei,* nor is there

an opening in the posterior part of the centrum, as obtains in that species.

From a ventral view the point of union between the vertebrae can be discerned more by a color difference than by the presence of a suture. The centrum is apparently more solid than in the preceding species *A. moorei*, and its depth is less than half its width.

I believe there is no question as to the proper association of this form with the family Ranidae. The wear that the element has undergone has probably obscured certain minor characters. I believe this to be from a fully adult animal, as judged by the texture of the bone, of a species smaller than the preceding *Anchylorana moorei*. On the basis of the measurement of the sacrum I estimate the snout to vent length of the animal to have been about 50 millimeters, while I estimate *A. moorei* to have been an animal with a snout to vent length of about 60 millimeters, and judging from the thinner bone, the type may be a young specimen.

Anchylorana robustocondyla, n. sp.

(Plate XV, fig. 1)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 5106. Centrum of sacral vertebra fused to the centrum of the preceding (eighth) vertebra. Collected by Dr. Claude Hibbard and party, 1937.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—A rather large frog characterized by very large coccygeal condyles, the sacrum fused with the preceding (eighth) vertebra. The notch between condyles is deep and narrow; the width of a condyle is equal to at least half the width of the centrum. The characters of the diapophyses are unknown.

Description of type.—The combined centrum has only fragments of the bases of the neural arches.

The measurements of the element in millimeters follows: The total length of the combined centra, 6; width of centrum, 4; transverse diameter of the coccygeal condyles, 2.4, 2.3; width of the anterior articular fossa, 3; height of same, 2; depth, 1.5.

The centrum of anterior part (eighth vertebra) is pierced by a small canal which apparently is due to a break. The edges of the opening are broken at the present time. Through a break in the side of the centrum it is possible to observe that although hollow for the most part there is some cancellous bony structure within.

The base of the sacral diapophysis is attached close to the coccygeal end of centrum. There is a well-defined groove on the dorsal surface at the base of the condylar stalks. The dorsal surface of the centra is flat, the ventral surface slightly rounded.

This specimen, though fragmentary, seems to be quite distinct from the two preceding species assigned to this genus. An examination of the figures of the three forms will disclose other differential characters.

GENUS *Rana* Linné 1758

Seven forms of *Rana* are recognizable in the collection. One of these consists of a centrum only and while apparently it is different from the other species, it is not described. I include a figure as evidence of its difference from the described forms.

Rana fayeae, n. sp.

(Plate XIV, figs. 4A, 4B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6378. Sacral vertebrae of a small ranid frog, nearly complete. Collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—Sacrum small, delicate, the lines projected parallel to the inner edge of the sacral diapophyses would intersect at the anterior end of centrum, the angle formed less than a right angle. Sacral diapophyses short, not flattened at terminations.

Description of type.—The sacrum is small and delicate. The tip of the right sacral diapophysis and a section from the side of the terminal portion of the left, is broken away.

The following measurements are given in millimeters: Total length of centrum with condyles, 2.9; greatest width of centrum, 2.3; transverse width of coccygeal condyle, 1.1; width of notch between the coccygeal condyles, 0.5; total width of the vertebra with sacral diapophyses, 8.4; posterior width of neural canal, 2.5; height of the canal, 1.3; depth of centrum, 1.05; median dorsal width of the neural arch, 1.45; length of right diapophysis measured from centrum, 3.95; narrowest width of diapophysis, 1.2; width at distal end, 1.6.

The dorsal surface of the neural arch is crossed by a high, sharp, curving crest which arises from the bases of the diapophyses. Posterior to this, the surface is directed posterodorsally, and a very slight, shallow depression parallels the crest. There is a very indistinct median longitudinal ridge present. Anterior to the transverse ridge the surface is directed anterodorsally, the posterior part some-

what overhung by the ridge; there is a sharp median ridge, but no spine. The anterior zygapophyses have their articular surfaces at right angles to the anterodorsal surface.

The diapophyses are narrowed near their bases, and are somewhat thinner here than at the distal end. They have considerable cancellous bone within.

The species is named in honor of Mrs. Faye Hibbard, who has accompanied her husband, Dr. Claude W. Hibbard, on numerous field trips in this region.

Rana meadensis, n. sp.

(Plate XIV, figs. 5A, 5B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6376. A nearly complete sacral vetebra. Collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—A medium sized frog with the coccygeal condyles rather wide apart and their articular surfaces directed somewhat posteroventrally. A distinct, broad, shallow depression on the ventral surface between the bases of the stalks of the condyles, continues back more than half the length of the centrum. The posterior edges of the sacral diapophyses if extended on neural arch, form a very obtuse median angle.

Description of type.—This sacrum is nearly complete, lacking only the distal parts of the diapophyses.

The following measurements are given in millimeters: Length of centrum and condyles, 2.8; width of the centrum, 2.7; width from outer edges of the coccygeal condyles, 3; lateral width of neural arch, 1.7; base of sacral diapophysis, 1.35; dorsal width of neural arch, 1.0; height of neural canal, 1.7; width of neural canal, 2.5; width including the sacral diapophyses vertebra (broken), 7.1; estimated total width, 8.8.

The curving, transverse ridge arising on the bases of the diapophyses crosses the neural arch, forming a slight knob or spine medially. A slight ridge divides the posterodorsal surface, the lower edge of which is very slightly ridged. Anterior to the transverse ridge, the surface is divided medially by a sharp longitudinal ridge. The articular surfaces of the anterior zygapophyses arise at right angles to the surface.

The dorsal surface of the centrum has an indistinct, broad, shallow, median groove. The ventral surface seen in profile shows a

slight notch at the base of the coccygeal stalks. A broad, shallow median groove arises between the stalks and continues down and forward for two-thirds the length of the centrum. Between the condyles the notch is in the form of a square, the inner edge forming a sharp, thin shelf. There is a very faint groove at the base of the coccygeal stalks on the dorsal surface.

The anterior articular surface of the centrum apparently has a vertical, slitlike depression or groove. A faint tubercle is indicated on the anterior face of the diapophysis near its base.

Rana ephippium, n. sp.

(Plate XIV, figs. 1A, 1B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6370. A sacral vertebra with the diapophyses fragmentary, collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—A small frog with the ventral surface of centrum saddle-shaped; the articular surfaces of the coccygeal condyles directed posteroventrally; a depression between the bases of the condyles only, and a low median ridge on the ventral surface of the centrum.

Description of type.—This sacral vertebra has the left sacral diapophyses broken away at its base, while the distal half of the right is missing.

The following measurements are given in millimeters: Total length of centrum and coccygeal condyles, 3.5; width of the centrum, 3.0; width across the condyles, 3.5; lateral width of the neural arch, 2.0; width of the base of a diapophysis, 1.7; dorsal width of the neural arch, 1.95; height of neural canal, 1.6; width of same, 3.0; width of vertebra with parts of diapophyses, 7.0; estimated total width, 12.0.

The ridge arising on the bases of the sacral diapophyses crosses the neural arch, passing near its anterior edge; while a longitudinal ridge divides the surfaces, anterior to and posterior to the transverse ridge. Posterior to the transverse ridge the surface of the arch is directed upward, while anterior to it, the surface is directed forward. The articular surfaces of the zygapophyses arise from the surface at at an angle a little greater than a right angle. When viewed laterally the centrum is seen to be saddle-shaped; moreover, it is narrower medially than at either end. The anterior articular surface of the centrum has a fine slit-like, vertical groove. The posterior edge of

the neural arch has no trace of a ridge; but a faint trace of a shallow groove is present on the dorsal surface of the centrum.

Rana rexroadensis, n. sp.

(Plate XIV, figs. 3A, 3B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6369. Sacral vertebra with the diapophyses partially broken away near the base. Collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, about 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—The coccygeal stalks short, the centrum widest posteriorly at the condyles, not strongly constricted near its anterior end.

Description of type.—The centrum of this rather large frog, has the following measurements, in millimeters: Length of the centrum and condyles, 4.9; width of centrum, 3.3; width at coccygeal condyles, 4.2; lateral width of the neural arch, 2.3; width of base of diapophysis (narrowest), 2.0; height of neural canal, 1.5; width of the neural canal, 3.1; total width of type specimen 10.0; estimated total width, 14.2.

The centrum of the vertebra shows no trace of a posterior notochordal perforation, but the convex anterior condylar surface has a suggestion of a double vertical groove. The ventral surface of the centrum is rather flattened, while the short coccygeal condyles tend to turn posteroventrally forming a slight angle when viewed laterally. The neural arch arises from the upper lateral part. The neural canal is of low elevation having somewhat the shape of a double convex lens. A transverse crest crosses the arch, dividing the surface, the anterior surface edged above by the transverse crest. Between the upper and lower edges there is a slight concavity which is perforated by several minute foramina. The posterior (dorsal) surface of the arch has a slight median longitudinal crest, forming a somewhat quadrangular knob at its termination. The outer surfaces on each side of crest is slightly concave.

The articular surface of the prezygapophysis has a distal, rather flattened area, while the proximal part is somewhat concave. A groove continues back from its upper posterior edge onto the base of the lateral diapophyses. The left diapophysis is somewhat rounding in cross section at its base, becoming a little more triangular at the middle where the terminal part is broken away. This is hollow,

the bone itself being thin. On the right side the diapophysis is broken away at the base, showing a round foramen entering the hollow body of the centrum. On the dorsal surface of the diapophyses, near the base, is a slightly elevated rugosity, and the outer edge of the prezygapophyses has a slight groove on its edge. There is a slight constriction at the outer base of the condyle so that the terminal part is slightly wider than the base. A deep notch extends between the condyles, cutting back somewhat farther on the ventral, than on the dorsal part.

Rana valida, n. sp.

(Plate XIV, figs. 2A, 2B)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 5133. A sacral vertebra, with diapophyses wanting. Collected by Dr. Claude W. Hibbard and party, 1938.

Occurrence.—Rexroad member, upper Pliocene, locality 3, 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—Characterized by the elongate stalks of the coccygeal condyles. The centrum is widest through the distal part of the condyles, and much constricted near its anterior end.

Description of type.—The following measurements are in millimeters: Length of centrum with condyles, 5.3; width of centrum, 3.7; width at ends of condyles, 4.6; lateral width of neural arch, 2.6; height of neural canal, 1.9; width of neural canal, 3.3; width of type, 7.0; estimated total width, 17.0.

The convex articular surface of the anterior end of the centrum has a slight trace of a vertical groove, but it is without a notochordal perforation. The ventral surface of the centrum is saddle-shaped rather than flat. The stalks of the condyles are equal to more than one-third of the total length of the centrum, this lengthening of the stalks being due to a strong groove that is continued back on the ventral surface from the deep notch between them. The condylar surfaces differ on the two sides, that of the right side being the larger. When seen from their posterior faces the condyles are definitely egg-shaped with the narrow ends directed outward. The stalk is somewhat constricted just back of the condylar surface. The minimum width of the side of the neural arch is half the total length of the centrum. The neural cavity in cross section is transversely oval, its elevation more than half its width. Seen from above there is a high curving transverse crest, with a small median longitudinal crest rising and crossing the transverse ridge at right angles. On each side

of the median crest the surface is concave, sloping back and down to the posterior face of the arch which forms a narrow edge. Anterior to the transverse crest the longitudinal crest continues down to the anterior edge. On each side the two anterior prezygapophyses arise at an acute angle; the articular surface lacks any concavity and there is no evident groove on the outer anterior edge. A broad, deep groove continues back, anterior to the transverse crest and onto the base of the diapophyses.

The diapophyses are broken away at their bases; in cross section the cavity in the diapophyses seems somewhat rounding, the connecting opening to the cavity of the centrum being obsolete.

Rana parvissima, n. sp.

(Plate XVI, fig. 2)

Type.—University of Kansas Museum of Vertebrate Paleontology No. 6451. Fragment of a sacral centrum, with one coccygeal condyle and the right diapophysis. Collected by Dr. Claude W. Hibbard and party, 1941.

Occurrence.—Rexroad member, upper Pliocene, locality 3, 16 miles southwest of Meade, Meade county, Kansas.

Diagnosis.—A very diminutive anuran, having a rana-like sacral diapophyses, the coccygeal condyle very short, and separated from its fellow by a distance more than four-fifths the transverse width of the condyle. The bone between the condyles forms a sharp, horizontal, posterior edge.

Description of type.—The fragmentary sacrum has the anterior articular surface divided from top to bottom by a well-defined vertical groove. The centrum is not constricted. A marked depression is present between the two condyles, terminating abruptly anteriorly. The coccygeal condyle has practically no stalk, the articular surface being terminated by a deep groove.

The following measurements are given in millimeters: Length of the centrum, 2.0; width of centrum at anterior end, 1.8; estimated width at coccygeal condyles, 2.33; length of diapophysis from centrum (posterior edge), 2.7; estimated total width for entire vertebra and diapophyses, 6.2; width of the base of the diapophysis, 0.5.

The relationship of this small species is very probably with the wood frogs represented in the United States by *Rana sylvatica* and *R. catabrigensis*. No representative of this group is living today in Kansas.

Rana sp. ?

(Plate XVI, fig. 1)

A centrum of a frog differing in the sculpturing of the ventral part of the centrum seems to represent another undescribed species. It is No. 6379, and is figured, Plate XVI, fig. 1. Owing to the fragmentary nature of this specimen, I am not suggesting a name for it. The double ridge on the ventral surface of the centrum is apparently distinctive.

COMMENTS ON THE UNDESCRIBED SPECIMENS

Among the fossil bones of the "unreferred" material I find none that can be referred to either the Families Hylidae or Microhylidae. The members of these families that occur in the Recent faunas of southwestern Kansas are diminutive, and were similar species present in the Rexroad fauna it is unlikely, without special effort, that their very tiny bones would be recognized and recovered.

Save for the two described sacrococcygeal elements I find no bones that can be referred to the Family Pelobatidae. Two ilia are definitely described as belonging to two, presumably undescribed, forms of *Bufo*. The coccyx shown in Plate IV, figs. 10A, 10B (No. 2319) is that of a *Bufo*. It is similar, but not identical with this element in *Bufo compactilis* Wiegmann. With the possible exception of certain radioulnae and scapulae, all the other figured specimens are probably referable to the Ranidae.

Since the greater number of species recovered belong to this family it is not surprising that so large a part of the bones recovered other than the sacra used as type specimens, should likewise be referable to the family. Whether one examines the figured radioulnae, the coccyges, or the ilia it is obvious that several species are represented. In the figures given of the coccyges there are at least six species (possibly more represented) while a still larger number of species are represented among the ilia figured.

At first I was inclined to believe that it would be possible to refer all these figured specimens to the described species. However, I find that, due to my own inadequate knowledge, and the fragmentary character of so many of the elements, this work cannot be done at this time with any degree of certainty. It is to be hoped that the finding of specimens with the bones articulated or at least associated, will make the task possible at some later time.

In the entire lot only three elements were found associated closely enough to be regarded certainly as coming from the same individual.

These are a humerus, a femur, and a tibiofibula represented by Plate XVI, figs. 11, 12, 13 (Nos. 6314, 5107, 5107A, respectively). These bones are from a frog with a probable snout-to-vent measurement of about 100 millimeters, a frog about the size of an adult *Rana areolata* or *R. brachycephala.*

The parasphenoid, Plate XVI, fig. 3A, 3B (No. 6384) an exoccipital, an unfigured specimen (No. 6448), two ethmoids, and 5 dentaries represent the only skull elements recovered. All of these I believe are referable to the Ranidae.

COMPARISON OF THE REXROAD AMPHIBIAN FAUNA WITH THE RECENT FAUNA OF WESTERN KANSAS

The work of Dr. Hobart M. Smith (1934) on the amphibian fauna of Kansas, and that of Tihen and Sprague (1939) on the Fauna of the Meade County State Park provides us with the following list of specimens occurring in Meade county or very likely to be found there since they are present in southwestern Kansas.

SALIENTIA

PELOBATIDAE Boulenger
**Scaphiopus bombifrons* Cope

BUFONIDAE Hogg
**Bufo cognatus* Say
Bufo punctatus Baird and Girard
Bufo insidior Girard
**Bufo woodhousii woodhousii* Girard

RANIDAE Linné
**Rana brachycephala* (Cope)
**Rana catesbeiana* Shaw

HYLIDAE
**Acris gryllus* LeConte
†Pseudacris clarki (Baird)
Pseudacris triseriata (Wied.)

MICROHYLIDAE
**Microhyla olivacea* (Hallowell)

---

* Reported from Meade County.
† Collected in Meade County by C. W. Hibbard in 1941.

CAUDATA

AMBYSTOMIDAE

**Ambystoma tigrinum mavortium*

The comparative data on Salientia may be tabulated as follows:

	Recent Fauna		Rexroad Fauna	
Family	*genus*	*species*	*genus*	*species*
PELOBATIDAE	1	1	2	2
BUFONIDAE	1	4	1	2
RANIDAE	1	2	2	10
HYLIDAE	2	3	0	0
MICROHYLIDAE	1	1	0	0

Total: Recent, 5 families, 6 genera, 11 species.
Rexroad, 3 families, 5 genera, 14 species.

It seems safe to postulate that a very much larger amphibian fauna was present in the Rexroad than is represented by the finds to date. So large a number of ranid frogs warrants the postulation that the climate was such as to supply a much heavier rainfall, in order to provide sufficient moisture for these water-loving frogs. It seems strongly probable that with forests, which would be a concomitant of the heavier rainfall, numerous species of the HYLIDAE small LEPTODACTYLIDAE and MICROHYLIDAE would be present. It is likewise probable that there was a population of small salamanders, although not a single species has been so far recovered.

For example, the present climate of North Carolina supports an Anuran population of 26 species and subspecies, representing 5 families and 8 genera. The CAUDATA are even richer with 40 species and subspecies, representing 6 families and 16 genera. In the case of the caudate fauna the mountainous character of the country is a contributing factor to its diversity. While the two areas are not entirely comparable, the presence in the Rexroad of so large a number of *Rana* in the fauna suggests the possibility that the climates were similar in character, and at least the anuran fauna may eventually prove even richer than the present day fauna of North Carolina.

Comparison of the sacral vertebrae, which serve as the type specimens of the ranid species of the Rexroad fauna, with those of living specimens in Kansas, shows that none is identical.

The unusual and elaborate perforation of the bone in *Rana catesbeiana* was found in none of the Rexroad specimens. *Rana areolata* has a flattened platform on the ventral surface of the centrum at the

* Reported from Meade County.

base of the coccygeal stalks which is lacking in all the Rexroad specimens.

The present day *Rana brachycephala* apparently approaches closest to *Rana valida*. They are, however, not identical, differing as they do in several details. Thus, the centrum of the former is somewhat constricted but the constriction is around the middle of the centrum instead of near the anterior end as in *R. valida*. The stalks of the coccygeal condyles are short instead of being elongated by a groove between them.

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EXPLANATION OF PLATES

[Numbers refer to specimens in the University of Kansas Museum of Vertebrate Paleontology from the Rexroad member, upper Pliocene, Meade county, Kansas.]

PLATE XIV

FIG. 1A. *Rana ephippium,* n. sp. Type, No. 6370; dorsal view, × 6.
FIG. 1B. Same, ventral view.
FIG. 2A. *Rana valida,* n. sp. Type, No. 5133; dorsal view, × 6.
FIG. 2B. Same, ventral view.
FIG. 3A. *Rana rexroadensis,* n. sp. Type, No. 6369; dorsal view, × 6.
FIG. 3B. Same, ventral view.
FIG. 4A. *Rana fayeae,* n. sp. Type, No. 6378; dorsal view, × 6.
FIG. 4B. Same, ventral view.
FIG. 5A. *Rana meadensis,* n. sp. Type, No. 6376; dorsal view, × 6.
FIG. 5B. Same, ventral view.

PLATE XIV

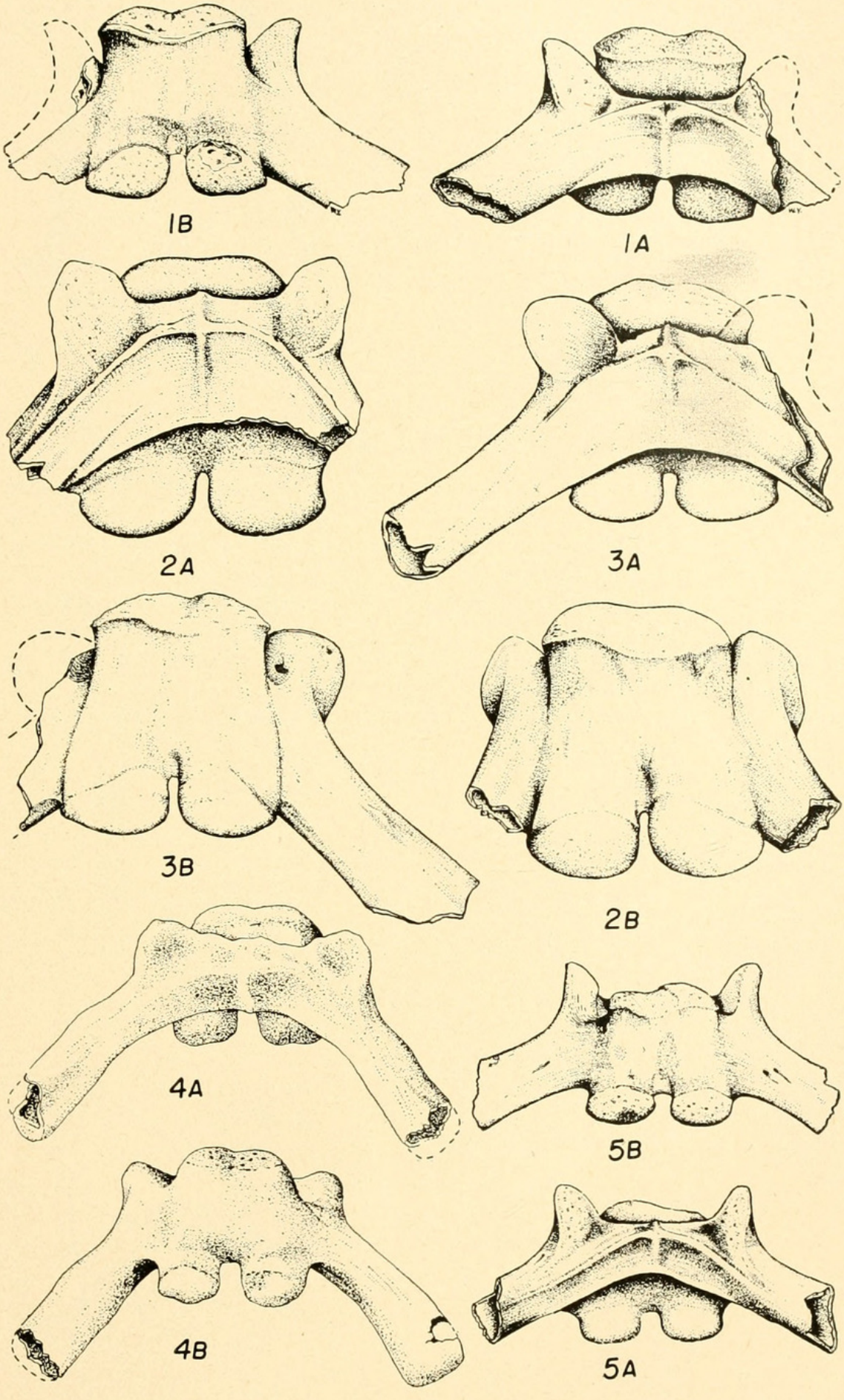


PLATE XV

FIG. 1. *Anchylorana robustocondyla,* n. sp. Type, No. 5106; ventral view, × 6.

FIG. 2A. *Scaphiopus diversus,* n. sp. Type, No. 6368; dorsal view, × 6.

FIG. 2B. Same, ventral view.

FIG. 3A. *Anchylorana moorei,* n. sp. Type, No. 6375; dorsal view, × 6.

FIG. 3B. Same, ventral view.

FIG. 4A. *Anchylorana dubita,* n. sp. Type, No. 6377; dorsal view, × 6.

FIG. 4B. Same, ventral view.

FIG. 5A. *Neoscaphiopus noblei,* n. sp. Type, No. 6367; dorsal view, × 6.

FIG. 5B. Same, ventral view.

PLATE XV

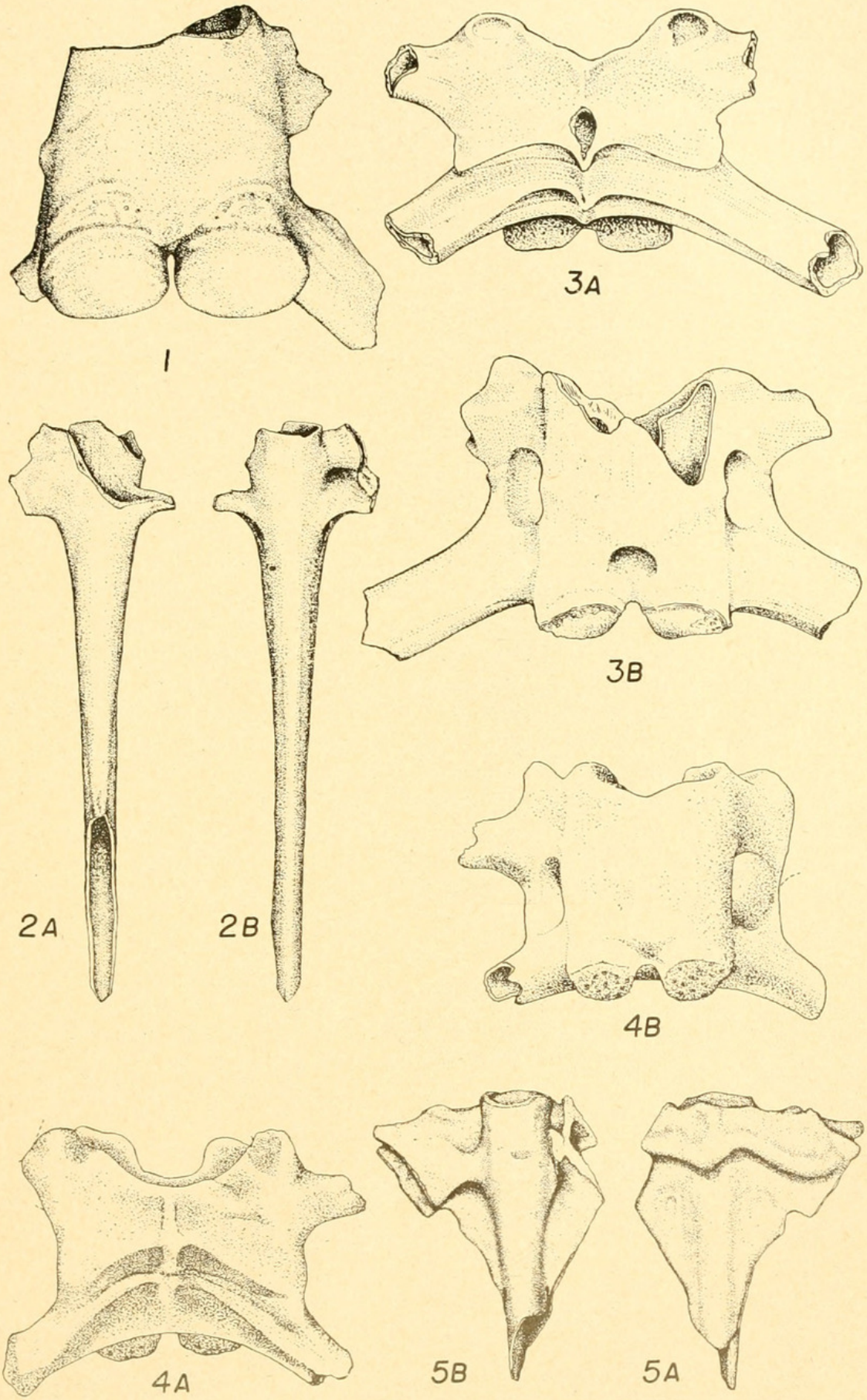


PLATE XVI

FIG. 1. *Rana sp.*, No. 6379, ventral view, × 6.

FIG. 2. *Rana parvissima*, n. sp. Type, No. 6451; ventral view, × 6.

FIGS. 3A, 3B. Anura, No. 6384, dorsal and ventral views of parasphenoid.

FIGS. 4A, 4B. Anura, No. 5096, radioulna, inner and outer view, × 3.

FIGS. 5A, 5B. Anura, No. 6320, radioulna, inner and outer view, × 3.

FIGS. 6A, 6B. Anura, No. 6322, radioulna, outer and inner view, × 3.

FIGS. 7A, 7B. Anura, No. 6321, radioulna, outer and inner view, × 3.

FIGS. 8A, 8B. Anura, No. 6324, radioulna, outer and inner view, × 3.

FIGS. 9A, 9B. Anura, No. 6382, radioulna, outer and inner view, × 3.

FIGS. 10A, 10B. Anura, No. 6381, radioulna, outer and inner views, × 3.

FIG. 11. *Rana sp.*, No. 6314; humerus, × 1½.

FIG. 12. *Rana sp.*, No. 5107; tibiofibula, × 1½.

FIG. 13. *Rana sp.*, No. 5107A; femur, × 1½ (this and the two preceding elements probably from same animal).

PLATE XVI

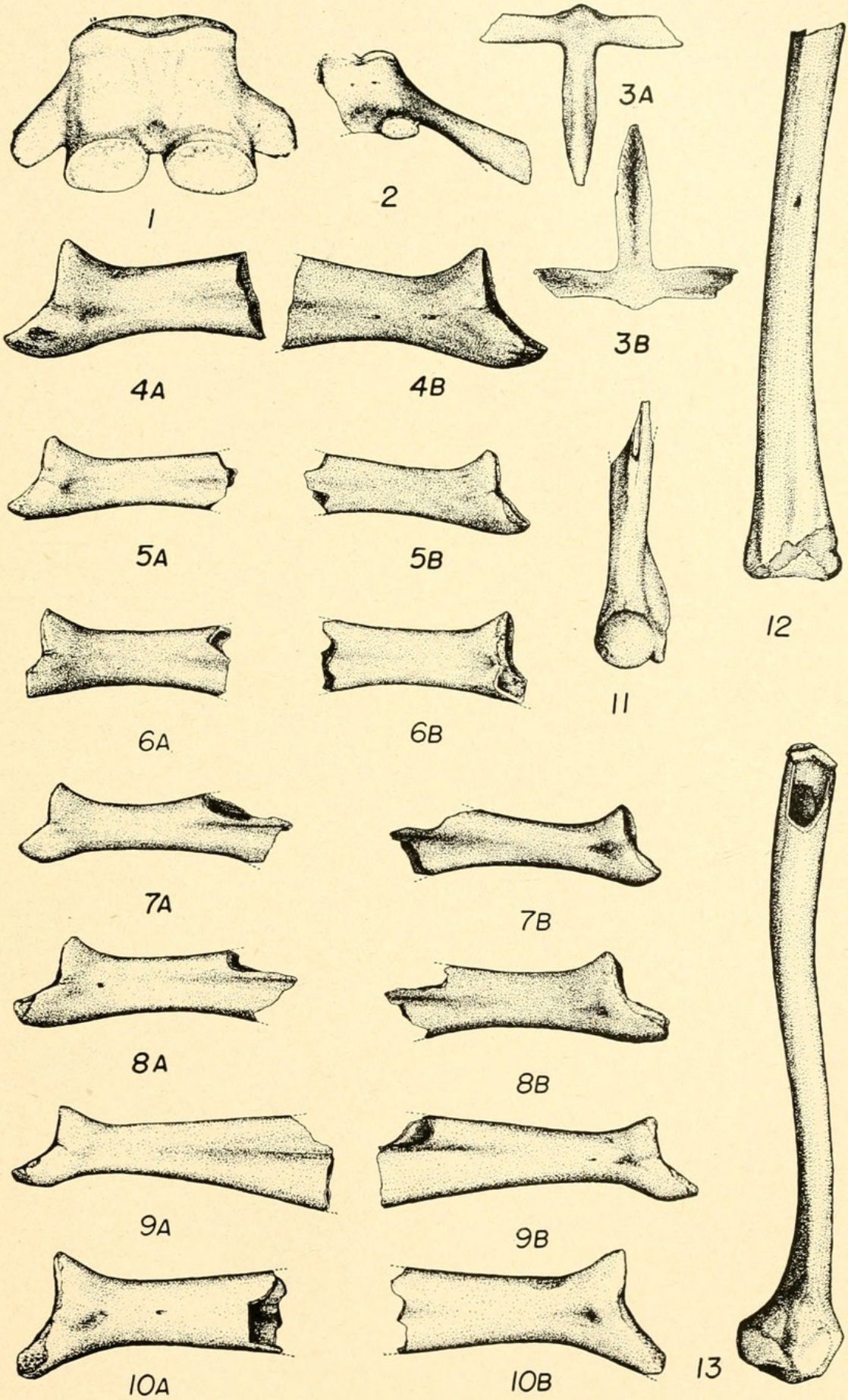


PLATE XVII

FIGS. 1A, 1B. *Rana sp?,* No. 6385; scapula, ventral and dorsal views, × 3.

FIGS. 2A, 2B. *Rana sp?,* No. 5134; scapula, ventral and dorsal views, × 3.

FIGS. 3A, 3B. *Rana sp?,* No. 5105; scapula, ventral and dorsal views, × 3.

FIG. 4. *Rana sp?,* No. 5103; scapula, ventral view, × 3.

FIG. 5A. Anura, No. 6326; fragment of coccyx, lateral view, × 3.

FIG. 5B. Same, cross section, × 3.

FIG. 6A. Ranidae, No. 6327; fragment of coccyx, lateral view, × 3 (probably referable to *Anchylorana*).

FIG. 6B. Same, view of proximal end, × 3.

FIG. 7A. Ranidae, No. 6328; fragment of coccyx, lateral view, × 3 (probably referable to *Rana*).

FIG. 7B. Same, view of proximal end, × 3.

FIG. 8A. Ranidae, No. 6323; fragment of coccyx, lateral view, × 3 (probably referable to *Rana*).

FIG. 8B. Same, view of proximal end, × 3.

FIG. 9A. Ranidae, No. 5088; fragment of coccyx, × 3 (probably referable to *Rana*).

FIG. 9B. Same, view of proximal end, × 3.

FIG. 10A. *Bufo sp?,* No. 6319; coccyx, lateral view, × 3.

FIG. 10B. Same, view of proximal end, × 3.

FIG. 11A. Ranidae, No. 6325; coccyx, lateral view, × 3.

FIG. 11B. Same, view of proximal end, × 3.

FIG. 12A. Ranidae, No. 6383; coccyx, lateral view, × 3 (probably referable to *Rana*).

FIG. 12B. Same, view of proximal end, × 3.

FIG. 13A. Ranidae, No. 6318; coccyx, lateral view, × 3 (probably referable to *Rana*).

FIG. 13B. Same, view of proximal end, × 3.

PLATE XVII

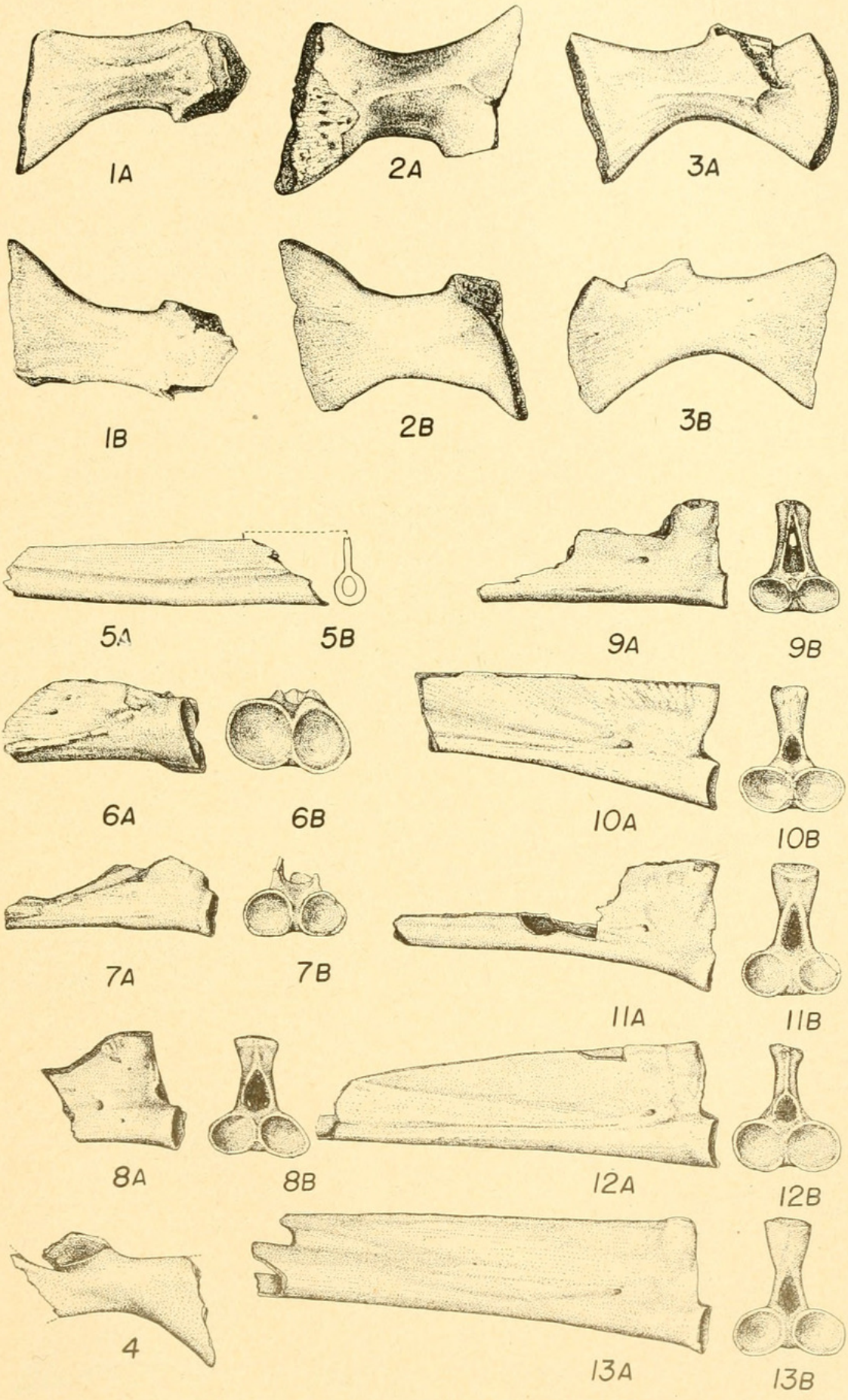

1A
2A
3A
1B
2B
3B
5A
5B
9A
9B
6A
6B
10A
10B
7A
7B
11A
11B
8A
8B
12A
12B
4
13A
13B

PLATE XVIII

FIGS. 1-23. Anura; ilia, all, × 3. Nos. 1-14 may represent the same species of *Rana*. Nos. 18-23 may represent specimens of another species of *Rana*. Nos. 15-17 represent three different species of unknown generic reference. The figures represent the following museum numbers: 1, 6306; 2, 6356; 3, 6371; 4, 6312; 5, 6352; 6, 6342; 7, 6355; 8, 6373; 9, 6372; 10, 6346; 11, 6311; 12, 6348; 13, 5086; 14, 6331; 15, 6307; 16, 6333; 17, 6315; 18, 6359; 19, 6340; 20, 6341; 21, 6353; 22, 6350; 23, 6358.

PLATE XVIII

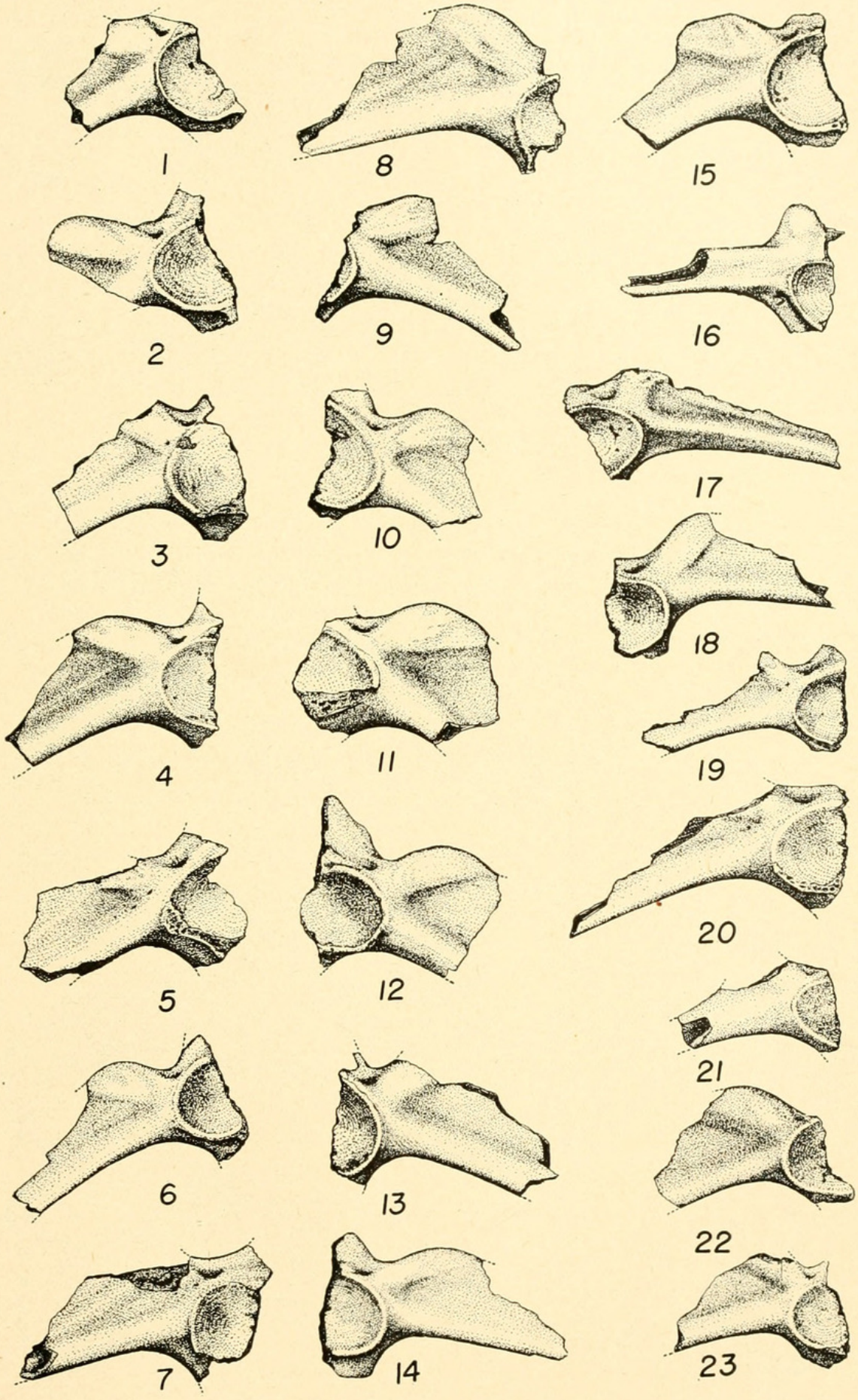


PLATE XIX

FIGS. 1-11. *Rana sp.;* ilia, outer lateral view, × 3 (at least two species are represented). Figs. 1-11 represent the following numbers: 1, 6364; 2, 6365; 3, 6360; 4, 5121; 5, 6317; 6, 6354; 7, 6345; 8, 6362; 9, 6364A; 10, 6349; 11, 6310.

FIG. 12. *Bufo sp.* Form A, No. 6334; ilium, outer lateral view, × 3.

FIG. 13. *Bufo sp.* Form B, No. 6335; ilium, outer lateral view, × 3.

PLATE XIX

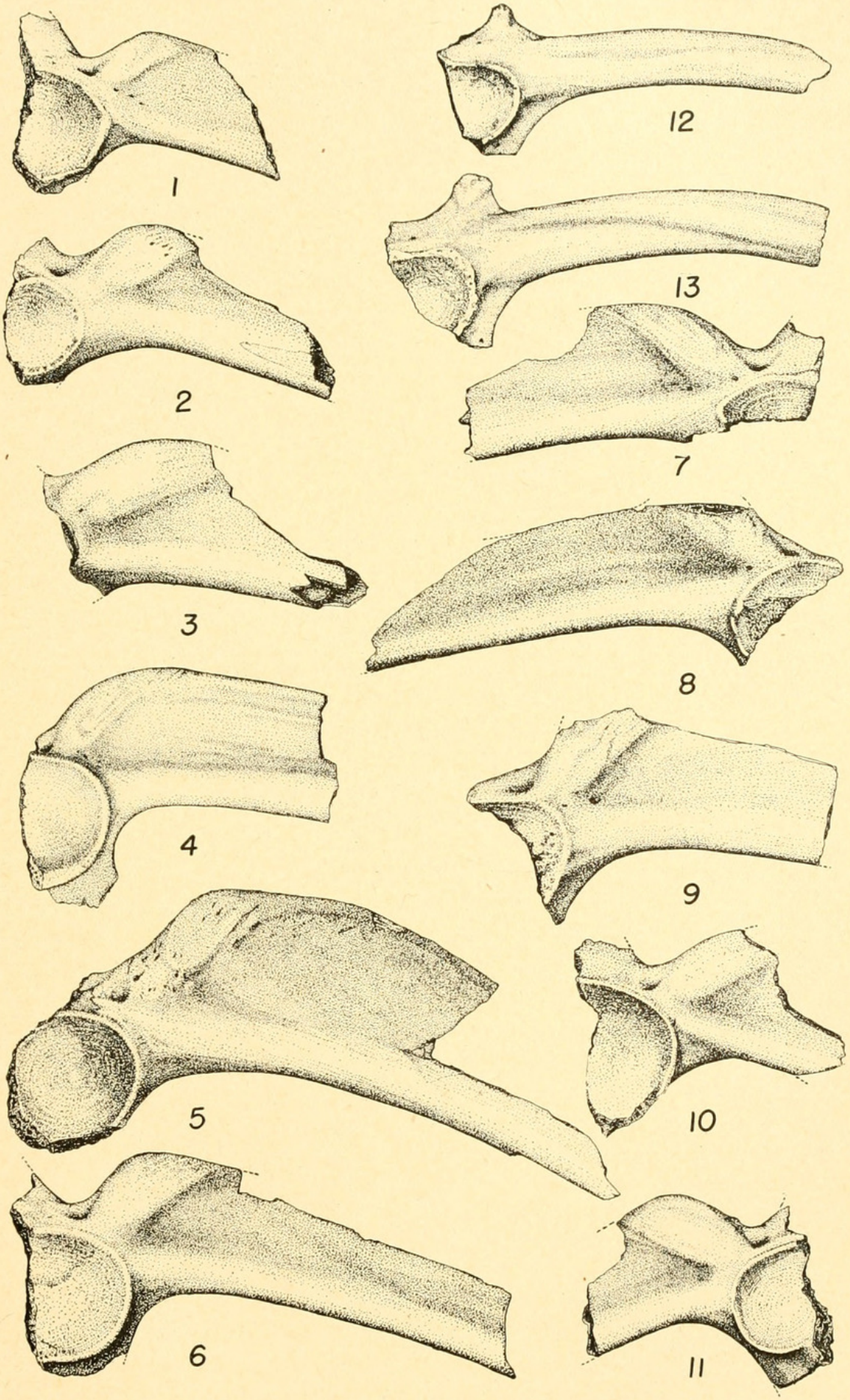
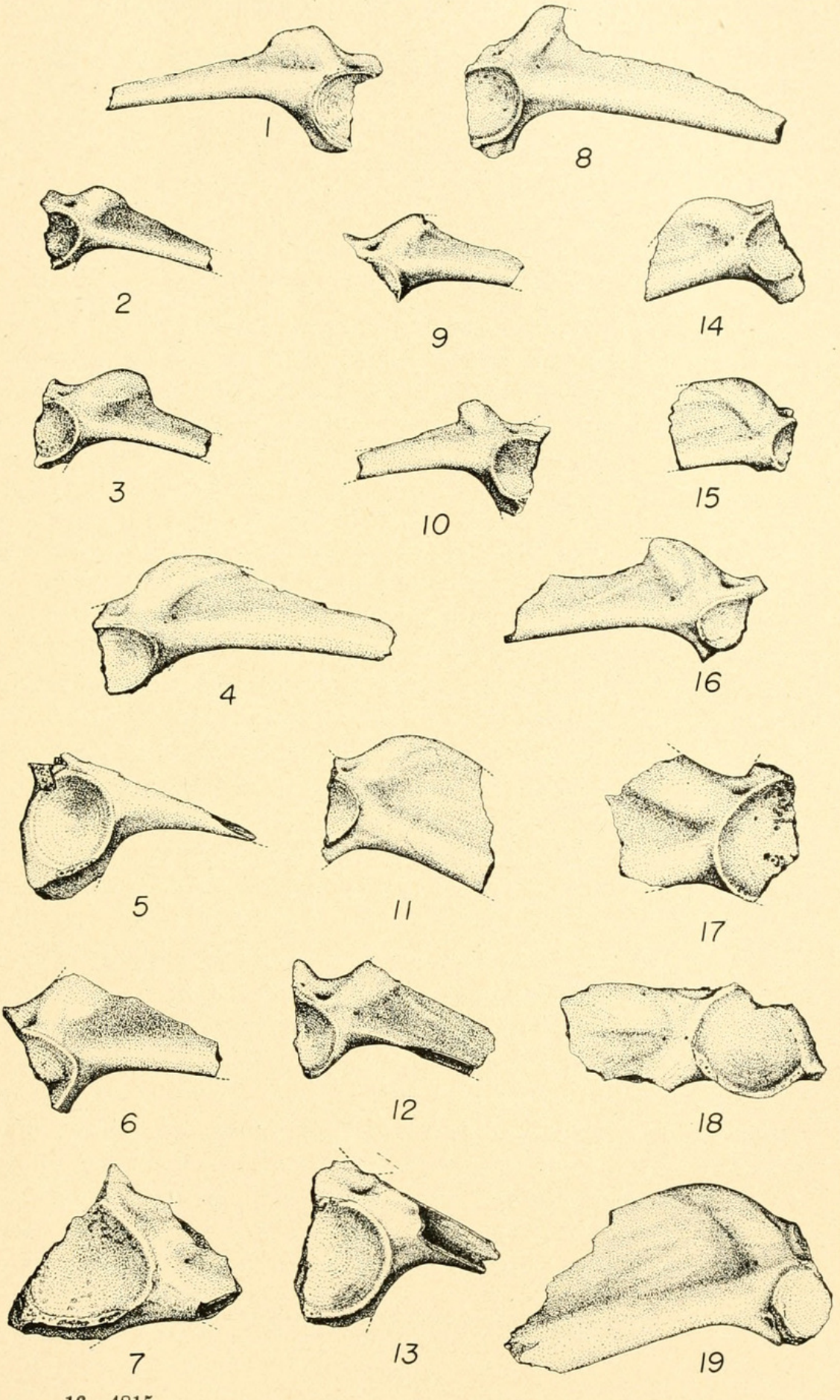


PLATE XX

FIGS. 1-19. Ilia of Anura, mostly referable to *Rana*. All are shown from outer lateral view, × 3. The figures represent the following numbers: 1, 6316; 2, 6336; 3, 6332; 4, 6339; 5, 6363; 6, 6357; 7, 6366; 8, 6337; 9, 6374; 10, 6361; 11, 6309; 12, 6347; 13, 6309; 14, 6336A; 15, 6351; 16, 6338; 17, 6344; 18, 6343; 19, 6329.

PLATE XX



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