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FOSSIL AMPHIBIANS FROM THE EGELHOFF LOCAL FAUNA IN NORTH-CENTRAL NEBRASKA

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FOSSIL AMPHIBIANS FROM THE EGELHOFF LOCAL FAUNA IN NORTH-CENTRAL NEBRASKA

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ABSTRACT—Fossil frogs and amphibians (members of the Egelhoff local fauna) have been recovered from the lowermost part of the Valentine Formation in north-central Nebraska. The Egelhoff Quarry is near the Norden Bridge locality and appears to lie in the same stratigraphic horizon. While the amphibians from the Egelhoff and Norden Bridge faunas are similar, the former is judged to be slightly younger (earliest Pliocene) than the latter (latest Miocene).

The amphibian component of the Egelhoff local fauna includes the following species: *Ambystoma minshalli, Scaphiopus* cf. *S. bombifrons, Scaphiopus* cf. *S. holbrookii, Bufo valentinensis, Bufo* cf. *B. hibbardi, Acris* cf. *A. crepitans, Pseudacris* cf. *P. clarki, Hyla* cf. *H. cinerea, Hyla* cf. *H. crucifer,* and *Rana* sp. The ranid species from the Egelhoff fauna show osteological similarities with modern *R. pipiens-R. clamitans-R. areolata.* The Norden Bridge *Rana* species (re-examined here) show similar affinities. The Egelhoff amphibians appear to be indicative of a more xeric paleoenvironment than that which is indicated by the Norden Bridge fauna.

Osteological observations of fossil and modern scaphiopids suggest that the extinct species *Scaphiopus alexanderi* Zweifel should be removed from the subgenus *Spea* and assigned to the subgenus *Scaphiopus.*

INTRODUCTION

AMPHIBIANS AND REPTILES from the Norden Bridge Quarry in Nebraska (Estes & Tihen, 1964) and from the WaKeeney deposit in Kansas (Wilson, 1968) constitute the only previously reported herpetofaunas of Late Tertiary age from the Great Plains. The present paper describes the amphibian element of a new large fauna (the Egelhoff local fauna) that has been recovered from the Valentine Formation in north-central Nebraska. The Egelhoff Quarry is located in the vicinity of the Norden Bridge Quarry and the faunas from each site are closely contemporaneous.

The Egelhoff fauna, taxonomically similar to the Norden Bridge fauna, offers further information toward an interpretation of the Tertiary paleoecology and phylogeny of Great Plains amphibian faunas.

LOCALITY SETTING

The Egelhoff Quarry is located one mile north of the Niobrara River (on the ranch of Franklin H. Egelhoff) in the SE corner of the NE¼ SW¼ sec. 29, T 33 N, R 23 W, Keya Paha County, Nebraska (Norden Quadrangle, United States Dept. Interior, Geol. Surv. Map, 1950). The Egelhoff locality was discovered in 1964 by Morris F. Skinner. The first collections were made in June, 1967, by Skinner and Claude W. Hibbard. Further collections from the locality were made by Hibbard and The University of Michigan field parties during 1967 and 1968. The fossils reported on herein were collected by Dr. Hibbard from a single locality in the Egelhoff Quarry (Locality UM-Nebr. 7-67).

GEOLOGIC SETTING

The Egelhoff Quarry occurs in an as yet undescribed lithic unit in the lowermost part of the Valentine Formation. The age of the deposit, at its youngest, is Early Pliocene. Morris F. Skinner is preparing a manuscript describing the geology of the Egelhoff locality (Skinner, pers. comm., 1970); hence, geologic comments here will be limited. The fossils come from a thin lens of stream-deposited sands occurring at an elevation of approximately 2195 feet. The Valentine beds extend some ten feet below and some twenty feet above the fossiliferous lens.

Geologically, the Egelhoff setting is similar to that at the Norden Bridge Quarry. The latter outcrops 1½ miles SE of the Egelhoff locality on the south side of the Niobrara River at an elevation of 2170 feet. While the Valentine beds overlying both sites are similar, the Norden Bridge deposit rests unconformably on the underlying "Brule" (= Rosebud?) Formation (see Skinner, *et al.,* 1968, for a complete discussion of Cenozoic geology in the central Great Plains). The temporal relationships of the Norden Bridge and Egelhoff faunas are nearly the same. It will, however, be suggested here that the Egelhoff fauna is slightly younger.

MATERIALS AND METHODS

Unless noted otherwise, all fossil specimens reported herein are now deposited in The University of Michigan Museum of Paleontology.

TABLE 1—*Ambystoma* VERTEBRAL RATIOS.

Taxon	CL/CW X ± SD	N	CL Range (mm)	CZW/ZL X ± SD	N	ZL Range (mm)
A. minshalli (Egelhoff l.f.)	2.49 ± .21	29	2.1—3.5	1.23 ± .08	10	3.1—4.3
A. minshalli (Norden Bridge l.f.)	2.43 ± .13	7	2.4—2.8	1.23 ± .12	7	
A. maculatum group (Tihen, 1958)	2.2—2.9			1.1—1.4		

All specimen numbers used in this paper are preceded by a UMMP designation. Fossil and extant bones were examined with a stereozoom microscope. All measurements were taken with eyepiece reticules (compass; cross-lines: 10mm/100 parts) at a magnification of × 20.

SYSTEMATIC DISCUSSION

Family AMBYSTOMATIDAE

AMBYSTOMA Tschudi

AMBYSTOMA MINSHALLI Tihen & Chantell

Material.—Sixty-seven trunk vertebrae, three atlases (V56555); three left dentaries (V57355); two left, one right humeri (V57354); two left, one right femora (V56542).

Discussion.—Ratios of centrum length/anterior centrum width, and combined zygapophyseal width/zygapophyseal length for thirty-six trunk vertebrae from the Egelhoff fauna are listed in Table 1. The ratios lie within the range given for the *Ambystoma maculatum* group (Tihen, 1958), and are similar to those from the type material of *A. minshalli* (Tihen & Chantell, 1963). The posterior ends of the neural arch and the postzygapophyses usually extend posteriad beyond the ends of their respective centra on most of the Egelhoff vertebrae. The end of the neural arch, however, does not usually extend posteriad beyond the end of the postzygapophyses. The latter condition appears to be a function of overall body size and intracolumnar position.

The atlases have platelike odontoid processes that are flatter than those from extant *Ambystoma* specimens. The three dentaries (posterior fragments) are large (chord lengths 5.1, 6, 7 mm), have numerous teeth and/or sockets (31, 35, 47), and show Meckelian grooves that are open anteriorly, closed posteriorly. The humeri (distal fragments) are of similar length (3.6, 3.8, 3.9 mm), and possess relatively large, triangularly-shaped cubital fossae. A distal femur fragment has a long trochanteric ridge that extends close to the tibial condyle. The proximal humeri fragments have trochanters well separated from the femoral shaft and head.

The Egelhoff *A. minshalli* specimens are similar to the Norden Bridge type material. While the majority of Egelhoff *A. minshalli* fossils are indicative of small (but adult) salamanders, the dentaries and some of the vertebrae suggest snout-vent lengths approaching 90 mm. The latter body size exceeds the size range projected for the species by Tihen & Chantell (1963) and Estes & Tihen (1964).

The Egelhoff specimens affirm the allocation of *A. minshalli* to the *A. maculatum* group (*fide* Tihen, 1958). Within this group, the affinities of the fossil species appear to lie with *A. macrodactylum, A. jeffersonianum,* and *A. laterale.*

Family PELOBATIDAE

SCAPHIOPUS Holbrook

SCAPHIOPUS cf. S. BOMBIFRONS (Cope)

Pl. 1, fig. 1

Material.—Right ilium, right humerus (V-59947).

Discussion.—A nearly complete ilium (16 mm) showing a moderately wide subacetabular expansion and a poorly defined dorsal acetabular rim, and lacking a preacetabular fossa and a definitive dorsal protuberance (pl. 1, fig. 1). These characters are peculiar to the ilia of extant species in the subgenus *Spea.* The fossil is similar to the ilia of modern *S. bombifrons* (pl. 1, fig. 2). The specimen is not similar to the ilia of *Scaphiopus* (*Spea*) *wardorum* present in the Norden Bridge fauna (Estes & Tihen, 1964).

The humerus (distal 5.5 mm) has a moderately long neck region and long lateral and medial epicondylar flanges that are dorsally directed. The length and orientation of the flanges are most similar to those seen on the humeri of extant males of *S. bombifrons.*

TABLE 2—SUBGENERIC OSTEOLOGICAL CHARACTERS IN THE GENUS *Scaphiopus*.

	Spea	*Scaphiopus*
Ilium	Wide subacetabular expansion; dorsal protuberance usually absent; no preacetabular fossa; weak dorsal acetabular rim.	Narrow subacetabular expansion; dorsal protuberance usually present; strong preacetabular fossa; strong dorsal acetabular rim.
Humerus	Neck short; lateral & medial epicondylar flanges well developed, long, directed dorsolaterad.	Neck long; lateral & medial epicondylar flanges poorly developed, long (lateral flange may be absent), directed laterad.
Sacrococcyx	Webbing moderate to extensive; foramina usually small.	Webbing moderate to absent; foramina usually large.
Maxilla	No squamosal contact; unornamented; no orbital shelf.	Squamosal contact; ornamented; orbital shelf.

SCAPHIOPUS cf. S. HOLBROOKII Harlan
Pl. 1, figs. 3, 5, 7

Material.—Two left maxillae (V56549); right ilium (V59948); left humerus (V59950); right ilium, three sacrococcyges, left and right humeri, sphenethmoid (V59951).

Discussion.—The two maxillary fragments appear to constitute the anterior and posterior portions of a single bone (pl. 1, fig. 3). The anterior portion (4 mm), with 20 teeth or sockets, has a vermiculate ornamentation below the orbit. The narrowest depth from orbit to tooth row is 1.3 mm. The posterior portion (5.8 mm) has 21 teeth or sockets, similar sculpturing, an orbit-tooth row depth of 1.4 mm, and a prominent squamosal projection. The ornamentation on both portions extends 1 mm ventrad from the orbit. The dorsal (orbital) border of the maxilla takes the form of a smooth, laterally projecting shelf (see Holman, 1967).

The sculpturing, orbital shelf, and squamosal projection relate the fossil specimen to extant species of the subgenus *Scaphiopus*. The extent and form of the ornamentation, the number of teeth, and the size of the fossil specimens are distinctly different from the maxilla of *S. wardorum*. The Egelhoff maxillary fragments are similar to maxillae from modern *S. holbrookii* (pl. 1, fig. 4).

Ilium V59948 has a relatively narrow subacetabular expansion, a worn dorsal protuberance, a distinct dorsal acetabular rim, and a prominent preacetabular fossa (pl. 1, fig. 5). The ilium in V59951 is similar to the latter but larger and more massive. The characters noted are definitive for modern species of the subgenus *Scaphiopus*. The fossil specimens are most similar to ilia from extant *S. holbrookii* (pl. 1, fig. 6).

The three sacrococcyges in V59951 have little to moderate postsacral webbing, two pairs of relatively large nerve foramina, oval cotyles, and pentagonally-shaped neural canals. These characters are broadly indicative of extant species in the subgenus *Scaphiopus* (Holman, 1967; Tihen, 1960). Humerus V59950 (pl. 1, fig. 7) and the humeri in V59951 have relatively long neck regions (i.e., longer than in *Spea*), and moderately well-developed lateral and medial epicondylar flanges that are laterally directed.

Extant species of the subgenus *Spea* (*S. hammondii, S. bombifrons, S. intermontanus*) are readily separable from those in the subgenus *Scaphiopus* (*S. holbrookii, S. couchii, S. hurterii*) by characters on the frontoparietal, maxilla, humerus, ilium, and sacrococcyx. The Egelhoff scaphiopids just described belong to the subgenus *Scaphiopus* wherein they are most similar to *S. holbrookii*.

Several small bones in the Norden Bridge fauna were referred by Estes & Tihen (1964) to *Scaphiopus* cf. *S. alexanderi*. The latter is an extinct species known by a single skeleton from the Lower Pliocene of Nevada (Zweifel, 1956). The specific diagnostic character of *S. alexanderi* is the fusion of the sacral vertebra to the eighth presacral vertebra. While such fusion was not evident in the Norden Bridge sacrococcyges, Estes & Tihen (1964) suggested that this feature was probably a highly variable one in Tertiary *Scaphiopus*.

S. alexanderi has been assigned to the subgenus *Spea* (Zweifel, 1956; Tihen, 1960). The

referral was based on observations that in *Spea* sacral-presacral vertebrae fusion was more common, and postsacral webbing was usually extensive and irregular in outline. Holman (1963) and Kluge (1966) have shown that sacral-presacral vertebrae fusion readily occurs in both subgenera.

My observations of the Norden Bridge *S.* cf. *S. alexanderi* specimens and the figures of the type material (Zweifel, 1956, figs. 13, 14, 15, 16) suggest that *S. alexanderi* should be assigned to the subgenus *Scaphiopus* wherein it shows some affinities with *S. holbrookii*. Table 2 summarizes the osteological characters used.

Family Bufonidae
Bufo Laurenti
Bufo valentinensis Estes & Tihen
Pl. 1, figs. 8–10

Material.—Left frontoparietal (V56553); two left ilia (V56547).

Discussion.—The frontoparietal is nearly complete (8.1 mm long), narrow, and well ornamented from medial to lateral edges with a spongy-granular sculpturing that is heaviest laterad and posteriad (pl. 1, figs. 8, 9). The medial edge tapers moderately anteriad suggesting the presence of either an anterior fontanelle or an expanded sphenethmoid. The otic processes are not fused with the prootics and supraorbital crests are absent. The occipital canal is almost completely roofed over by the dermal encrustation.

The ilia (distal 9.6, 3.3 mm) represent adult and immature individuals. The larger specimen (pl. 1, fig. 10) has a worn, but apparently low, dorsal prominence whose height is about 33% of the base length. The posterior slope of the dorsal prominence is twice as steep as the anterior slope. The acetabulum is large, subtriangular in outline, and has strongly extruded margins. The supra-acetabular expansion is broken off. The subacetabular expansion is relatively wide.

The Egelhoff specimens are similar to the Norden Bridge type material (see Estes & Tihen, 1964). *B. valentinensis* is a small toad whose affinities seem to lie with the eastern section of the *Bufo americanus* group (*fide* Tihen, 1962a).

Bufo cf. B. hibbardi Taylor

Material.—Left ilium (V59955); two right ilia (V59956).

Discussion.—Specimen V59955 has a wide, low (probably worn) dorsal prominence (height 33% of base length) whose anterior slope is almost twice as steep as its posterior slope. The acetabulum is large, subtriangular in outline, and has strongly extruded margins. The supra-acetabular expansion, though broken, is low in height and short in length. The subacetabular expansion is relatively wide.

The specimens in V59956 are fragmentary but show large, deep acetabulae, short supra-acetabular expansions, and slightly narrower (compared to V59955) subacetabular expansions.

The type of *Bufo hibbardi* is based on a sacral vertebra from the Middle Pliocene of Kansas (Taylor, 1936). Tihen (1962b) referred *B. hibbardi* to the *Bufo americanus* group. The Egelhoff specimens are similar to the *B. hibbardi* material tentatively identified in the Norden Bridge fauna.

Family Hylidae
Acris Dumeril & Bibron
Acris cf. A. crepitans Baird

Material.—Two procoelous sacra; one right, two left ilia (V56543).

Discussion.—The diapophyses are broken off the sacra but appear to have been unexpanded. Centrum length/width ratios (0.71, 0.84) lie within the range for species of *Acris* (Chantell, 1968). The distal ilial fragments are small and have dorsal protuberances and acetabular expansions that are characteristic for the genus (Chantell, 1968). Modern *A. crepitans* and *Acris gryllus* are difficult to separate on osteological characters; hence, my designation

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Explanation of Plate 1
All figures × 4

Figs. *1,2*—Right ilium, lateral aspect. *1, Scaphiopus* cf. *S. bombifrons;* UMMP V59947. *2,* extant *S. bombifrons.*
3,4—Left maxilla, lateral aspect. *3, Scaphiopus* cf. *S. holbrookii;* UMMP V56549. *4,* extant *S. holbrookii.*
5,6—Right ilium, lateral aspect. *5, S.* cf. *S. holbrookii;* UMMP V59948. *6,* extant *S. holbrookii.*
7—Left humerus, medial aspect. *S.* cf. *S. holbrookii;* UMMP V59950.
8–10—*Bufo valentinensis. 8,9,* left frontoparietal, dorsal and medial aspects; UMMP V56553. *10,* left ilium, lateral aspect; UMMP V56547.
11—*Hyla* cf. *H. cinerea.* Right ilium, lateral aspect; UMMP V59952.
12–14—*Rana* sp. *12,* left frontoparietal, ventral aspect; UMMP V59958. *13,* left humerus, medial aspect; UMMP V59957. *14,* right ilium, lateral aspect; UMMP V59949.

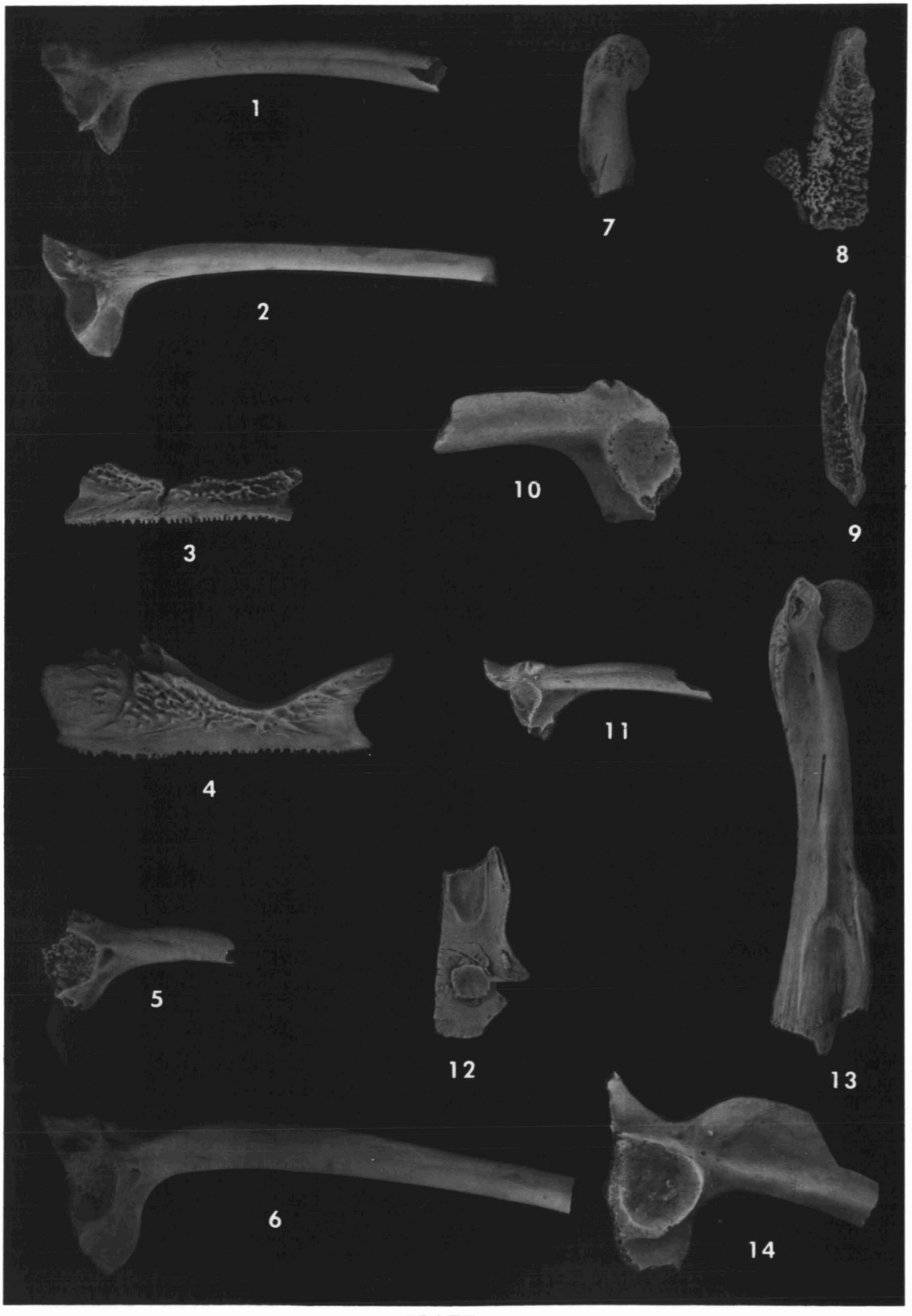

PLATE 1

TABLE 3—MIOCENE-PLIOCENE AMPHIBIAN FAUNAS FROM NEBRASKA.

Norden Bridge & University of California Localities (Chantell, 1964, 1966; Estes & Tihen, 1964)	Egelhoff Ranch Locality (this paper)
*Andrias matthewi**	
*Ambystoma minshalli**	*Ambystoma minshalli**
*Scaphiopus wardorum**	
Scaphiopus cf. *S. alexanderi**	
	Scaphiopus cf. *S. bombifrons*
	Scaphiopus cf. *S. holbrookii*
*Bufo valentinensis**	*Bufo* cf. *B. valentinensis**
Bufo cf. *B. hibbardi**	*Bufo* cf. *B. hibbardi**
Acris cf. *A. crepitans*	*Acris* cf. *A. crepitans*
Pseudacris cf. *P. clarki*	*Pseudacris* cf. *P. clarki*
*Pseudacris nordensis**	
Hyla cf. *H. gratiosa*	
Hyla cf. *H. squirella*	
Hyla cf. *H. versicolor*	
Hyla cf. *H. cinerea*	*Hyla* cf. *H. cinerea*
	Hyla cf. *H. crucifer*
Rana sp.	*Rana* sp.

* Extinct

of this fossil material to *A.* cf. *A. crepitans* is an arbitrary one.

PSEUDACRIS Fitzinger
PSEUDACRIS cf. P. CLARKI Baird

Material.—Left, right ilia (V56548).

Discussion.—Both ilia (distal fragments) have subacetabular expansions whose anterior margins are convex anteriad. The latter condition is peculiar to extant *P. clarki* specimens (Chantell, 1964).

HYLA Laurenti
HYLA cf. H. CINEREA Schneider
Pl. 1, fig. 11

Material.—Right ilium (V59952); left, right ilia (V59953).

Discussion.—Specimen V59952 (pl. 1, fig. 11) is nearly complete (9.1 mm long) and has a large dorsal protuberance whose anterior edge is posterior by more than half its length to the anterior edge of the acetabulum. The subacetabular expansion is wide. The supra-acetabular expansion is short and its dorsal surface is straight.

Both ilia in V59953 are small and fragmented but are generally similar to V59952. The right ilium in V59953 is quite small and its dorsal protuberance is relatively far from the dorsal rim of the acetabulum. Further, the anterior edge of the dorsal protuberance is anterior to the anterior edge of the acetabulum. This particular specimen is probably from an immature individual whose protuberance-acetabulum relationship would have changed with age (see Lynch, 1965, for a discussion of ontogenetic change in the ilium).

HYLA cf. H. CRUCIFER Weid

Material.—Left ilium (V59954).

Discussion.—The dorsal protuberance is relatively far from the dorsal rim of the acetabulum and its anterior edge is anterior by half its length to the anterior edge of the acetabulum. The subacetabular expansion is wide but less so than in *H. cinerea.*

This species is the only Egelhoff hylid not reported from the Norden Bridge fauna.

Family RANIDAE
RANA Linnaeus
RANA sp.
Pl. 1, figs. 12–14

Material.—Left frontoparietal (V59958); right ilium (V59949); left humerus (V59957); two sacra, nine right and four left ilia (V59959).

Discussion.—The frontoparietal is broad and flat, has no anterior taper, and is unornamented dorsally. Ventrally (pl. 1, fig. 12), the forebrain

trough is prominent and the otic capsule is situated posteriad relative to the trough. Humerus V59957 (pl. 1, fig. 13) is complete except for the proximal ball. A long, well-developed, laterally directed median epicondylar flange is present. The ventral crest is wide, relatively short in length, and does not overlap with the median epicondylar flange. The cubital fossa is shallow and narrow, lunate in outline. The specimen is comparable in size to the humerus from a *R. pipiens* individual with a SV length of 100 mm. Ilium V59949 (distal 10.5 mm) has an angle of 120° between the anterior surface of the supra-acetabular expansion and the posterior surface of the ilial crest. The pit serving as the origin for the biceps femoris is shallow and small (pl. 1, fig. 14).

The thirteen ilia in V59959 are similar to one another and to specimen V59949. The angles between the surfaces of the supra-acetabular expansion and the ilial crest range from 110° to 120°. In all fourteen ilia the terminal portions of the supra and/or subacetabular expansions are broken such that distal head width/acetabulum width ratios are not measurable. The two sacra in V59959 have cylindrical diapophyses, and centrum length/width ratios of 0.86 and 0.92.

A re-examination of the Norden Bridge *Rana* sp. material (University of Nebraska State Museum 61022) shows four humeri similar to the one described here, and three others whose median epicondylar flanges are long and dorsolaterally directed. Two relatively complete and several fragmentary frontoparietals are present. All are flat dorsally, moderately narrow, show no anterior taper, and have otic capsules situated far (posteriad) from the forebrain troughs. Five measurable ilia have expansion-crest angles of 110° to 120°.

I have noted (Chantell, 1970) that definitive osteological characters at the species level in North American ranids are scant. Characters on certain bones (e.g., humerus, scapula, ilium, frontoparietal) can be used to distinguish between United States western and non-western ranids.

The *Rana* fossils from the Egelhoff and Norden Bridge local faunas show a mix of modern characters. There are probably a minimum of two different ranid species (all relatable to extant forms) in each fauna. The *Rana* fossils from the Egelhoff fauna show *pipiens-clamitans-areolata*-like affinities. The Norden Bridge specimens are also *pipiens-areolata*-like but, in addition, have some *sylvatica*-like features. The difficulty in delimiting extant ranid species solely on their osteology precludes specifical designations of the fossil specimens herein.

FAUNAL AND TEMPORAL CONSIDERATIONS

With one exception, the Norden Bridge and Egelhoff faunas are generically identical (see table 3). *Andrias,* a genus of large salamanders, whose North American fossil record is limited primarily to the Miocene, is the only Norden Bridge genus not present in the Egelhoff fauna. The remaining fossil genera from each site are all represented in the area today by extant species.

Ambystoma minshalli is an extinct species of small salamander whose fossil record, like *Andrias,* is limited primarily to the Miocene. In addition to being present in both the faunas discussed here, according to Tihen (1969), "... skeletal elements recovered from ... deposits ... of Middle Miocene age in western Nebraska, northeastern Colorado and southern South Dakota are probably *A. minshalli.*" Assuming that the two faunas may be nonsynchronous, the larger Egelhoff specimens may then be indicative of a morphological trend into the Pliocene for increased body size.

The scaphiopids in the Norden Bridge fauna are extinct, those in the Egelhoff fauna are extant. *S. wardorum,* presumably a phylogenetic dead-end, differs from extant scaphiopids in (among other things) its larger size (Estes & Tihen, 1964). *S. alexanderi,* a moderate size scaphiopid with a Miocene-Pliocene fossil record, is judged here to be close to *S. holbrookii.* The latter, tentatively present in the Egelhoff fauna, has also been reported from the Lower Miocene of Florida (Auffenberg, 1956; Holman, 1967). *S. holbrookii* has probably ecologically replaced *S. alexanderi* in the Egelhoff fauna. *S.* cf. *S. bombifrons,* represented in the Egelhoff fauna by a single bone, has previously had only a Pleistocene fossil record.

Two extinct *Bufo* species, *B.* cf. *B. hibbardi* and *B. valentinensis,* occur in each fauna. The only other record of *B. hibbardi* is from the Middle Pliocene of Kansas (Tihen, 1962b). The Egelhoff *B. valentinensis* individuals appear to have had a greater body size than their Norden Bridge counterparts. Further, the dermal ornamentation on the Egelhoff frontoparietal is more characteristic of extant species in the *americanus* group than is the ornamentation on the Norden Bridge specimen.

Acris cf. *A. crepitans* and *Pseudacris* cf. *P. clarki* specimens from both fossil sites are modern in their morphology. While some of the Norden Bridge *Acris* specimens were indicative of a body size exceeding that in extant individuals (Chantell, 1964, 1966), no such size increase is evident in the Egelhoff *Acris* specimens. Four *Hyla* species are present in the

Norden Bridge fauna. Two *Hyla* species are recognized in the Egelhoff fauna of which only one, *H.* cf. *H. cinerea,* is common to both faunas. The reduced hylid fauna may be attributable to the general cooling trend in the Tertiary with its attendant vegetational changes (Dorf, 1960).

The Egelhoff ranid specimens, though similar to the Norden Bridge *Rana* material, are less variable and seem closer to extant eastern United States *pipiens*-type *Rana.* The Norden Bridge *Rana* specimens have some of the characters of both eastern and west coast ranids.

The Egelhoff amphibian fauna differs from the Norden Bridge amphibian fauna in the following respects: (1) absence of four extinct forms (*Andrias matthewi, Scaphiopus wardorum, S. alexanderi, Pseudacris nordensis*); (2) replacement of extinct scaphiopids by extant species (*S. holbrookii, S. bombifrons*); (3) changes in body size and/or morphology (*A. minshalli, B. valentinensis, A. crepitans*); and (4) reduction of hylid fauna. While items 1 and 4 could be construed as negative evidence, all four factors coupled with the presumably higher stratigraphic position of the Egelhoff Quarry suggest to me that the Egelhoff local fauna is younger than the Norden Bridge local fauna. The former is probably exclusively Early Pliocene in age; the latter is probably exclusively Late Miocene in age.

The paleoecology of the Norden Bridge lower vertebrate fauna has been discussed by Chantell (1964) and Estes & Tihen (1964). The Egelhoff and Norden Bridge quarries are stream channel deposits and probably represent, through time, the river bottom of the same major stream. The Egelhoff amphibian fauna suggests to me a more xeric environment than that indicated by the fossils from the Norden Bridge site. While the majority of species from both deposits were members of the streamside-floodplain community, the change in scaphiopid taxa and the reduction in number of hylid species in the Egelhoff fauna may be indicative of drier conditions in the upland community. The Egelhoff habitat was probably more similar to that of the present day than was the Norden Bridge habitat.

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