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A NEW PLEISTOCENE FAUNA From Harper County, Oklahoma

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In August, 1954, the junior author was invited by Carl C. Branson of the Oklahoma Geological Survey to accompany him and Arthur J. Myers in the examination of geological exposures in Harper County, Oklahoma. Myers took us to see some Pleistocene deposits in the NW $\frac{1}{4}$ sec. 13, T. 28 N., R. 22 W. At this locality there had been a small lake during some part of the late Pleistocene. The basin containing the old lake deposits has been dissected by the headward erosion of a tributary of Willow Creek, a small intermittent stream. Along the banks of this draw and the valley slope for a short distance are exposures of gray silt containing abundant remains of mollusks. While examining the darker silt laid down near the old lake shore a few scutes of an extinct armadillo were found in association with the mollusk shells. Since the snails observed in the deposit are different from those now found living in that region about three pounds of the fossil-bearing silt were taken for washing. A few of the large shells that had weathered from the deposit were picked up. These fossils are here designated the Bar M local fauna, Locality 1.

We then visited similar deposits 7 miles south of Buffalo, Oklahoma, along U. S. Highway 183. At this site, SE corner sec. 14, T. 26 N., R. 23 W., a number of sacks of matrix containing mollusk shells had been removed for washing in the summer of 1951. The fossils taken at this place are here designated the Bar M local fauna, Locality 2.

The deposit from which the fossils were taken is post Crooked Creek formation in age. Closer dating of the beds and more exact determination of the climate in which the fauna lived are inferred from the mollusks.

The line drawings were made by Michael O. Woodburne. The illustrations of this paper were made possible by the financial support accorded to Hibbard by the Board of Governors of the Horace H. Rackham School of Graduate Studies of the University of Michigan.

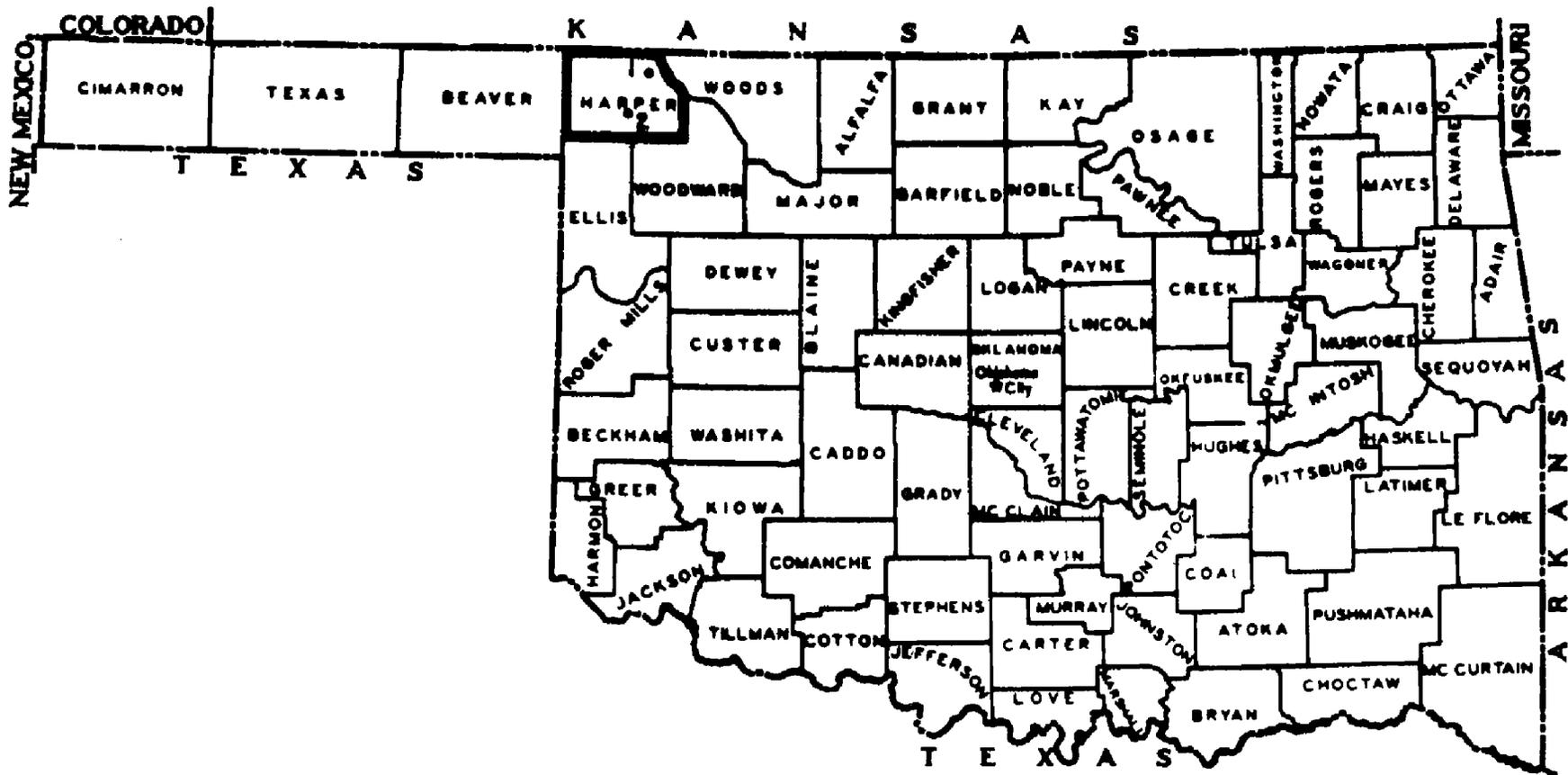
BAR M LOCAL FAUNA

The name Bar M local fauna is proposed here chiefly for the molluscan and vertebrate fossils known from the Pleistocene deposit in the NW $\frac{1}{4}$ sec. 13, T. 28 N., R. 22 W., Harper County, Oklahoma, but also for the mollusks from the SE corner sec. 14, T. 26 N., R. 23 W., in the same county. The name is derived from the brand of the Day Brothers who had a lease from the Cherokee Strip Live Stock Association from 1883 to 1888. A map made from a survey in 1883 shows that the northern sector of the ranch included the Willow Creek drainage in which the fossil site occurs. Although this new assemblage is correlated with the Berends local fauna, in Beaver County, Oklahoma, we prefer not to refer to it to the Berends local fauna because (1) the correlation is not definite, and (2) the Berends locality is about twenty miles to the west in a lithologically dissimilar sequence of deposits.

Many, perhaps most, of the later Pleistocene sediments in southwestern Kansas and western Oklahoma are difficult to assign to glacial or interglacial stages. The earlier Pleistocene Meade and Crooked Creek formations are widespread, and in some areas the Crooked Creek formation overlies the Meade formation; but younger beds were laid down in valleys cut into these units, or in isolated sinks. Each separate valley-fill and sink-hole deposit presents an independent geologic problem, for beds cannot be traced more than a short distance. Establishing faunal criteria for differentiating later Pleistocene deposits will require several sequences in which Illinoian, Sangamon, and Wisconsin assemblages are superposed. In southwestern Kansas and western Oklahoma such sequences are not yet known, and dating of the Bar M local fauna is not on a firm basis.

At least 40 species of mollusks are known from the Bar M local fauna. Only two species are common to the black and gray silts at locality 1, however, and only ten species in common occur at localities 1 and 2. This distribution suggests a difference in age and/or habitat between the sites, perhaps accentuated by sampling error. All three factors are probably effective, but the age difference is considered insignificant relative to a glacial or interglacial age.

The two faunules from Locality 1 are considered a single assemblage for the following reasons: (1) The stratigraphic separation of the two sites is slight. (2) The accompanying chart, indicating the



Index map of Oklahoma showing fossil localities.

habitats of the various species, shows that several differences may be accounted for by the absence of whole habitats. (3) Other differences lie in the presence and absence of rare species. The small sample size probably accounts for some of these differences. (4) Species living well north of the fossil locality, from which a cooler, glacial age climate is inferred, are present in both faunules — *Gyraulus circumstriatus*, *Lymnaea caperata*, *Discus cronkhitei*, and *Stenotrema leai leai* in the black silt, associated with the armadillo; and *Lymnaea stagnalis*, *L. caperata*, *Armiger crista* and *Aplexa hypnorum* in the gray silt.

Localities 1 and 2 are thought to be of about the same age because (1) nearly all the species of Locality 1 occur at Locality 2; (2) only one extinct species, *Physa skinneri*, occurs in both localities; and (3) species of northern distribution which suggest a glacial age climate are present at both localities.

Local habitat. Habitat indications of the mollusks are summarized in the accompanying chart. The most obvious differences between the two faunules are the lack of permanent-water species in the black silt, and their presence in the gray silt; and the dominance of land snails in the black silt, but of fresh-water species in the gray silt. These differences may be readily explained by deposition closer to shore, or by ecological succession correlated with filling of the lake basin, or by a combination of these factors.

Locality 2 has many more species than has Locality 1, but not a significantly greater number of habitats. Perhaps riparian vegetation and humus was less abundant at Locality 1.

The abundance of land snails provides no evidence of widespread forest. Larger genera characteristic of eastern deciduous forest are absent, and a narrow border of vegetation around a lake could account for the presence of all the terrestrial species.

Climate. Eleven species (indicated by an asterisk on the accompanying chart) of the Bar M local fauna live today only well north of the fossil locality. Ranges of these forms are given in the systematic treatment of the fauna. Most of the species reach their southern limit of range in northern Nebraska, but *Pupilla* and *Lymnaea stagnalis* occur only far to the north in the Great Plains. It is inferred from

these data that the Bar M local fauna lived in a climate with summers approximating those of North Dakota, considerably cooler and moister than those of Harper County today.

Evidence relating to winter temperatures is scanty. *Gastrocopta cristata* is not known surely north of northern Kansas. Probably, therefore, winters were no more severe than those of that area. Whether they were milder, much milder, or equally severe is uncertain.

In summary, the Bar M local fauna probably lived in a climate with summers like those of North Dakota, and with winters no colder and perhaps warmer than those of northern Kansas.

BAR M LOCAL FAUNA

HABITAT	SPECIES	ABUNDANCE	
		LOC. 1	LOC. 2
		BLACK SILT	GRAY SILT
Permanent, standing water	* <i>Ferrissia parallela</i>		S
	<i>Helisoma trivolvis</i>		S S
	* <i>Lymnaea stagnalis</i>		S A
Permanent or temporary water	<i>Gyraulus parvus</i>		A A
	<i>Lymnaea palustris</i>	R	A A
	<i>Physa anatina</i>		A
	<i>P. elliptica</i>		S
Temporary water	<i>P. gyrina</i>	C	
	* <i>Aplexa hypnorum</i>		R R
	* <i>Armiger crista</i>		A A
	* <i>Gyraulus circumstriatus</i>	R	C
	* <i>Lymnaea caperata</i>	S	C C
Marginal pools and wet mud	<i>L. bulimoides cockerelli</i>		R
	<i>Lymnaea obrussa</i>		R
	<i>L. parva</i>		C

HABITAT	BAR M LOCAL FAUNA SPECIES	ABUNDANCE		
		LOC. 1		LOC. 2
		BLACK SILT	GRAY SILT	
Semiaquatic, riparian habitat	<i>Oxyloma haydeni</i>		S	C
	<i>Vertigo ovata</i>		R	C
Wet humus	<i>Cionella lubrica</i>			R
Damp humus	* <i>Discus cronkhitei</i>	S		S
	<i>Gastrocopta contracta</i>			R
Damp humus	<i>G. tappaniana</i>			R
	<i>Helicodiscus parallelus</i>			S
Damp to dry habitat	* <i>Pupilla blandi</i>			R
	* <i>P. muscorum</i>			S
	<i>Retinella electrina</i>	R		R
	* <i>Stenotrema leai</i>	R		
	<i>Strobilops labyrinthica</i>			S
	* <i>Vallonia gracilicosta</i>	R		S
	<i>Zonitoides arboreus</i>			R
	<i>Gastrocopta armifera</i>			R
	<i>G. cristata</i>		R	
	<i>Hawaiiia minuscula</i>			S
Uncertain	<i>Helicodiscus singleyanus</i>			R
	<i>Pupoides albilabris</i>			R
	<i>Ferrissia cf. pumila</i>			R
	<i>Physa skinneri</i>		C	A
	<i>Pisidium</i> spp.	R		A
	<i>Sphaerium</i> sp.			A
	<i>Succinea</i> spp.	R	R	C

Habitat implications of mollusks of Bar M fauna. Asterisk marks northern species suggesting cooler, glacial age climate. A = abundant, 100 + specimens; C = common, 25-100; S = scarce, 5-24; R = rare, 1-4.

Age. The following list compares the Bar M mollusks with those of three other late Pleistocene molluscan faunas known from southwestern Kansas and western Oklahoma.

The list of Jones local fauna mollusks is based upon the original material reported by Goodrich (1940), as reidentified by Taylor and Herrington, and on additional material in the University of Michigan Museum of Zoology. Other species have been recorded from the same locality (Franzen and Leonard, 1947; Leonard, 1952), but because their stratigraphic position is uncertain they are not included. The Jones fauna is the latest cool-climate, glacial age-correlative assemblage in southwestern Kansas and is considered of Wisconsin age (Hibbard, 1940, 1949, 1953, p. 389).

The Jinglebob molluscan list is similarly based on material reported by Rinker (1949) and van der Schalie (1953), and on additional specimens. The Jinglebob local fauna is referred to the Sangamon interglacial age (Hibbard, 1952, 1953, p. 389).

The Berends local fauna list is from Taylor (1954) with addition of Herrington's identifications of Sphaeriidae. This assemblage is considered probably Illinoian in age, for it is a cool-climate, glacial age fauna older than the Jones local fauna but younger than the late Kansan age Cudahy fauna.

COMPARISON OF FOUR LATE PLEISTOCENE
MOLLUSCAN FAUNAS FROM SOUTHWESTERN
KANSAS AND WESTERN OKLAHOMA

	JONES	JINGLEBOB	BERENDS	BAR M Loc. 1	Loc. 2
<i>Valvata tricarinata</i> (Say)	X	X	X		
<i>Carychium exiguum</i> (Say)		X			
<i>Lymnaea stagnalis</i> (Linne)	X			X	X
<i>L. palustris</i> (Müller)	X	X	X	X	X
<i>L. bulimoides cockerelli</i> Pilsbry	X				X
<i>L. caperata</i> Say	X	X	X	X	X
<i>L. obrussa</i> Say		X	X		X
<i>L. parva</i> Lea	X				X
<i>L. turritella</i> Leonard		X	X		
<i>Gyraulus parvus</i> (Say)	X	X	X	X	X
<i>G. circumstriatus</i> (Tryon)		X	X	X	X
<i>Armiger crista</i> (Linne)			X	X	X
<i>Helisoma anceps</i> (Menke)		X			
<i>H. trivolvis</i> (Say)	X	X	X	X	X
<i>Planorbula vulcanata</i> Leonard			X		
<i>Promenetus pearlettei</i> (Leonard)			X		
<i>P. exacuus</i> (Say)	X	X			
<i>Physa anatina</i> Lea	X	X			X
<i>P. gyrina</i> Say				X	
<i>P. elliptica</i> Lea		X	X		X
<i>P. skinneri</i> Taylor			X	X	X
<i>Aplexa hypnorum</i> (Linne)	X	X	X	X	X

	JONES	JINGLEBOB	BERENDS	BAR M LOC. 1	LOC. 2
<i>Ferrissia parallela</i> (Haldeman)		X			X
<i>F. rivularis</i> (Say)		X			
<i>F. cf. pumila</i> (Sterki)		X			X
<i>F. fusca</i> (Adams)		X			
<i>Strobilops texasiana</i> (Pilsbry and Ferriss)		X			
<i>S. labyrinthica</i> (Say)					X
<i>Gastrocopta armifera</i> (Say)	X	X	X		X
<i>G. contracta</i> (Say)		X			X
<i>G. holzingeri</i> (Sterki)		X			
<i>G. cristata</i> (Pilsbry and Vanatta)		X		X	
<i>G. procera</i> (Gould)	X	X	X		
<i>G. tappaniana</i> (Adams)		X	X		X
<i>Pupoides albilabris</i> (Adams)	X	X	X		X
<i>P. inornatus</i> Vanatta	X				
<i>Pupilla muscorum</i> (Linne)	X				X
<i>P. blandi</i> Morse	X	X			X
<i>Vertigo ovata</i> Say	X	X	X	X	X
<i>V. milium</i> (Gould)		X			
Pupillidae, 2 indet. spp.		X			
<i>Vallonia parvula</i> Sterki		X			
<i>V. gracilicosta</i> Reinhardt	X	X		X	X
<i>Cionella lubrica</i> (Müller)					X
<i>Succinea cf. avara</i> Say	X			X	X
<i>S. cf. concordialis</i> Gould		X			
<i>S. cf. grosvenori</i> Lea	X	X	X	X	

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	JONES	JINGLEBOB	BERENDS	BAR M
				LOC. 1 LOC. 2
<i>Oxyloma haydeni</i> (Binney)		X	X	X X
<i>Discus cronkhitei</i> (Newcomb)				X X
<i>Helicodiscus parallelus</i> (Say)		X	X	X
<i>Helicodiscus singleyanus</i> (Pilsbry)				X
<i>Punctum minutissimum</i> (Lea)		X		
<i>Deroceras</i> cf. <i>laeve</i> (Müller)		X	X	
<i>D. aenigma</i> Leonard		X		
<i>Euconulus fulvus</i> (Müller)		X		X
<i>Retinella electrina</i> (Gould)		X		X X
<i>R.</i> cf. <i>rhoadsi</i> (Pilsbry)		X		
<i>Hawaiiia minuscula</i> (Binney)	X	X	X	X
<i>Zonitoides arboreus</i> (Say)		X		X
<i>Stenotrema leai</i> (Binney)		X	X	X
<i>Sphaerium</i> cf. <i>lacustre</i> (Müller)			X	
<i>S. occidentale</i> Prime		X		
<i>S. striatinum</i> (Lamarck)		X	X	
<i>S. sulcatum</i> (Lamarck)		X	X	
<i>S. transversum</i> (Say)		X	X	
<i>S.</i> cf. <i>truncatum</i> (Linsley)		X		
<i>Pisidium casertanum</i> (Poli)		X	X	
<i>P. compressum</i> Prime	X	X	X	
<i>P. ferrugineum</i> Prime	X			
<i>P. lilljeborgi</i> Clessin	?			
<i>P. nitidum</i> Jenyns	X	X	X	
<i>P. obtusale</i> Pfeiffer		X	X	
<i>P. walkeri</i> Sterki	?	?		
<i>Anodonta</i> sp.		X		

The Bar M local fauna has 17 species in common with the Jones, 27 with the Jinglebob, and 19 with the Berends. Considering the large number of species in the Jinglebob, we think these figures show about the same degree of similarity in general faunal aspect. The Jinglebob local fauna is considered of interglacial age, however, and it lived under conditions quite different from those inferred from the Bar M local fauna. Only one species is considered significant in showing relation to the Berends, rather than Jones fauna: *Physa skinneri*. No other adequately sampled Wisconsin faunas are known from the area, however, and it is possible that *P. skinneri* occurs in Jones-age assemblages. Tentatively, however, the Bar M local fauna is correlated with the Berends fauna, and is considered probably of Illinoian age also.

MOLLUSCA

CLASS PELECYPODA

Sphaeriidae

Pisidium spp. UMMZ 184423. Two fragmentary valves from Locality 1, both perhaps immature, are specifically indeterminate. Abundant material from Locality 2 probably contains several species.

Sphaerium sp. Abundant material from Locality 2 of this genus and of *Pisidium* is being studied by H. B. Herrington.

CLASS GASTROPODA

Lymnaeidae

Lymnaea bulimoides cockerelli Pilsbry. UMMZ 184375. This form is of uncertain status within *L. bulimoides* s. l., widely distributed in the western United States. Perhaps only a habitat form, it has been reported most often from temporary water bodies in the arid and semiarid southwest.

Lymnaea caperata Say. UMMZ 184368, 184369, 184370. This widely distributed species is characteristic of temporary bodies of water, such as ponds, pools, and intermittent streams. In the Great Plains area it is not known to live at the present time south of northern Nebraska.

L. obrussa Say. UMMZ 184371. Found over practically all of North America, *L. obrussa* is characteristic of shallow, permanent

water and marginal situations. It lives among vegetation or debris close to shore, sometimes partly out of water.

L. palustris (Müller). UMMZ 184372, 184373. Like *L. caperata*, this species is frequently found in temporary water, but may occur in permanent ponds as well. It is circumpolar, ranging to southeastern Kansas. At the longitude of this fossil occurrence, however, it may reach its southern limit in Nebraska.

L. parva Lea. UMMZ 184374.

"Connecticut west to Idaho, James Bay and Montana south to Maryland, Kentucky, Oklahoma, southern New Mexico and Arizona" (Baker, 1928, p. 287).

"*Parva* inhabits wet, marshy places, generally out of the water, on sticks, stones, or muddy flats. The animal is more prone to leave the water than any other species of the family" (Baker, 1928, p. 287).

L. stagnalis (Linne). UMMZ 184376, 184377. The few localities from which this species has been previously reported as a fossil in the Great Plains are all in Kansas or Nebraska, hence this Oklahoma record is of particular interest. Goodrich (1940, p. 78) listed it from the Wisconsin age Jones fauna in nearby Meade County, southwest Kansas. Frye, Leonard, and Hibbard (1943, p. 41) may have confused spires or young of this species with the similar *L. haldemani*, which they recorded. If so, this Kansan Cudahy fauna locality is the earliest known occurrence in North America. In a later list of mollusks from the site, however, Leonard (1950) did not indicate the presence of either *L. stagnalis* or *L. haldemani*. Baker's (1938, p. 131) *Lymnaea* cf. *stagnalis jugularis* is *L. megasoma*, as shown by examination of his material. "The American form of *stagnalis* is usually found in more or less stagnant parts of ponds or lakes and rivers about vegetation" (Baker, 1928, p. 202). A circumboreal species, it ranges south to 37° N. latitude in Colorado and to 41° in Illinois, but in the Great Plains is rare or absent from the United States.

Planorbidae

Gyraulus circumstriatus (Tryon). UMMZ 184378, 184379. Of uncertain habitat requirements, this form is at least frequently found in temporary ponds. In the Great Plains it ranges south to northern Nebraska.

G. parvus parvus (Say). UMMZ 184380, 184381. Widely distributed and abundant, it inhabits permanent or temporary standing water, usually in debris or vegetation. This typical form of the species is known throughout North America east of the Rocky Mountains.

Armiger crista (Linne'). UMMZ 184382, 184383. A sporadically reported Holarctic species known only north of about 41° N. latitude; the only record of its occurrence in the Plains is in north-central Nebraska. *Armiger* lives in, and may be restricted to, temporary bodies of water.

Helisoma trivolvis (Say). UMMZ 184424. Widely distributed in North America east of the Rocky Mountains, this species inhabits quiet, permanent water, such as ponds and the edges of lakes and streams.

Physidae

Physa anatina Lea. UMMZ 184384.

"This species ranges from the western Mississippi Valley to Colorado and Wyoming, and southward to Oklahoma. *Physa anatina* is an inhabitant of quiet and stagnant water; it thrives in small ponds, or even in metal stock tanks" (Leonard, 1950, p. 21).

Physa elliptica Lea. UMMZ 184385. The distribution of this form (perhaps better ranked as a subspecies of *P. gyrina*) is uncertain, but it seems to occur in much of the central United States. Standing and running, permanent or temporary water bodies are suitable habitats.

Physa gyrina Say. UMMZ 184388.

"From the Arctic regions south to Alabama and Texas. The typical form is characteristic of the Mississippi Valley where it reaches its greatest perfection" (Baker, 1928, p. 452).

It occurs in almost any sort of water body, permanent or temporary, save swift-flowing streams. The material from Locality 1 includes shells which could be called *P. elliptica* Lea, but because surely only one population is represented all are grouped under the older name *gyrina*.

P. skinneri Taylor. UMMZ 184386, 184387. The only extinct species of mollusk in the Bar M fauna, this is known from the Nebraskan age Sand Draw local fauna to the probably Illinoian age Berends local fauna in Beaver County, Oklahoma.

Aplexa hypnorum (Linne'). UMMZ 184389, 184390. Another circumboreal species widespread in northern North America, it ranges south in the Great Plains to northern Nebraska. "It is characteristic of swales, stagnant pools, and ephemeral ponds, with *Stagnicola caperata*, *Physella hildrethiana*, and *Sphaerium occidentale*, forming a peculiar ecological fauna" (Baker, 1928, p. 474; according to the less finely discriminating classification used here *Stagnicola caperata* and *Physella hildrethiana* are called *Lymnaea caperata* and *Physa gyrina*).

Ancylidae

Ferrissia parallela (Haldeman). UMMZ 184391. Nova Scotia and New England to Manitoba and northeastern Illinois (Baker, 1928, p. 397).

"*Ferrissia parallela* is usually found in quiet water, on plants, the water in such places ranging from .3 to 2 meters in depth. The animal is usually found near the surface but may occur on the lower part of such plants as *Scirpus*, near the bottom. *Parallela* appears to be a pond or lake species, at least in Wisconsin" (Baker, 1928, p. 397).

F. cf. pumila (Sterki). UMMZ 184392. Distribution and habitat of this species are uncertain, because of lack of information.

Strobilopsidae

Strobilops labyrinthica (Say). UMMZ 184393.

"Maine and Quebec west to Manitoba, Minnesota, Kansas and Arkansas, south to Georgia and Alabama. Its usual stations are under loose bark of logs, in half-decayed wood, among dead leaves and in sod at bases of trees" (Pilsbry, 1948, p. 854).

Pupillidae

Gastrocopta armifera (Say). UMMZ 184394. Found over most of North America east of the Rocky Mountains, in protected habitats with some or little moisture.

G. contracta (Say). UMMZ 184395. Eastern North America, from Maine and Florida west to eastern South Dakota, south-central Kansas, and western Texas; south to Vera Cruz, Mexico (Franzen and Leonard, 1947, p. 331; Pilsbry, 1948, p. 881).

G. cristata (Pilsbry and Vanatta). UMMZ 184397. This land snail is predominantly a southern Plains species, found from Kansas and southern Texas to Arizona. It lives chiefly in the valleys of streams or dry washes, wherever timber, scrub, or grass provides some cover.

G. tappaniana (Adams). UMMZ 184396. Found over most of the eastern United States save for the southeastern states, and west to Arizona. It lives in damp leaf mold where vegetation or other cover provides protection.

Pupilla blandi Morse. UMMZ 184398. "Rocky Mountain region, from Montana and Red Deer, Alberta, to New Mexico; west to Nevada" (Pilsbry, 1948, p. 931). Presumably this species, like *P. muscorum*, lives in damp situations among humus, logs, etc.

P. muscorum (Linne). UMMZ 184399.

"Eastern North America from Anticosti Island south to Atlantic City, New Jersey, westward in Canada and the northern tier of states to Milton, Oregon; south in the Rocky Mountain region through Colorado to Socorro County, New Mexico, and northern Arizona; north to Anuk, Alaska" (Pilsbry, 1948, p. 934).

"Lives in regions having a cool, humid climate. Is found living on the ground, under wood, stones and leaves" (Franzen and Leonard, 1947, p. 376).

Pupoides albilabris (Adams). UMMZ 184400. North America, from Maine and Ontario to the West Indies and Mexico, east of the Rocky Mountains. This species can withstand perhaps more heat and aridity than any land snail of its area of distribution; it is abundant where almost no other mollusk occurs.

Vertigo ovata Say. UMMZ 184401, 184402. Although widespread over most of North America, this species is limited by relatively high moisture requirements. In the High Plains it is found only close to water bodies, such as streams or ponds.

Valloniidae

Vallonia gracilicosta Reinhardt. UMMZ 184403, 184404. According to Pilsbry (1948, p. 1029-1030), this species is found from Minnesota to Montana, south and southwest to Nebraska, New Mexico, Arizona, and California. It is usually found among slightly damp humus or grass in wooded areas.

Cionellidae

Cionella lubrica (Müller). UMMZ 184405. Holarctic; in North America from "Point Barrow, Alaska, and Queen Charlotte Islands to Labrador and Newfoundland, south in the East to Washington, D. C., and southern Missouri; in all the western and mountain states except California; to the Mexican boundary in Arizona; in the Sierra Madre of western Chihuahua" (Pilsbry, 1948, p. 1048). "*C. lubrica* lives among the damp under-leaves in densely shaded places; under wood . . ." (Pilsbry, 1948, p. 1049).

Succineidae

Succinea spp. UMMZ 184406, 184407, 184408, 184409. The shells of *Succinea* are usually not specifically diagnostic; in fossil collections the number of species is all that can be determined reliably. The Bar M local fauna surely contains two species: a narrow, high-spined form like *S. avara* Say, and a larger, blunt-spined one resembling *S. grosvenori* Lea.

Oxyloma cf. *haydeni* (Binney). UMMZ 184410, 184411. Shells from the Bar M local fauna agree well with this species. It is possible, however, that *Oxyloma* as well as *Succinea* includes species with indistinguishable shells. In the region of its type locality, in central Nebraska, *O. haydeni* lives among dead wood and riparian vegetation within a few inches of permanent water.

Endodontidae

Discus cronkhitei (Newcomb). UMMZ 184412, 184413. This woodland-inhabiting snail occurs over most of northern North America east of the Rocky Mountains. In the Great Plains it occurs as far south as northern Nebraska, where it lives among moist humus and forest litter close to water.

Helicodiscus parallelus (Say). UMMZ 184414. Eastern North America west to the High Plains, south to Georgia and Alabama. This species lives among damp forest litter and humus in wooded areas.

H. singleyanus (Pilsbry). UMMZ 184415. Eastern North America from Pennsylvania and Florida to South Dakota and Kansas; west through Texas and Colorado to Arizona (Pilsbry, 1948, p. 636). Habitat requirements are not certain, but from the distribution one may judge it able to tolerate heat and drouth.

Zonitidae

Euconulus fulvus (Müller). UMMZ 184416.

"Almost throughout the Holarctic realm, but wanting in the Gulf and South Atlantic states from Texas to North Carolina . . . *E. fulvus* lives among damp leaves in well-shaded places . . ." (Pilsbry, 1946, p. 236) .

Retinella electrina (Gould). UMMZ 184417, 184418. Common throughout northern North America, this species occurs as far south as eastern Kansas. In the High Plains to the west, however, it is absent, and at this longitude occurs only as far south as Nebraska. Like *Discus*, it lives among humus in wooded areas.

Hawaiia minuscula (Binney). UMMZ 184419. Known from all of North America, this species is apparently able to live under greatly varied conditions of temperature and humidity.

Zonitoides arboreus (Say). UMMZ 184420. All North America (Pilsbry, 1946, p. 481).

"In the eastern states and Mississippi valley this snail is everywhere abundant, to be found wherever there are trees or shelter of any kind; on or under the bark of logs, under boards, bricks or stones in the grass, or in any like situation offering protection from the sun and a reasonable degree of moisture" (Pilsbry, 1946, p. 482).

Polygyridae

Stenotrema leai leai (Binney). UMMZ 184422. This species in the broad sense is distributed over most of the northeastern United States south to Kansas. In Kansas and presumably part of Nebraska, however, the typical form does not occur (Leonard, 1950, p. 36); in the Great Plains its southernmost recorded occurrence is in north-central Nebraska. In that area it was found on a low, river flood-plain, under cover.

VERTEBRATA
CLASS MAMMALIA
ORDER EDENTATA
FAMILY DASYPODIDAE
Dasypus bellus (Simpson)
Fig. 1

Parts of 12 scutes, No. 32465 UMMP, of an armadillo larger than the recent nine-banded armadillo (*Dasypus novemcinctus mexicanus* Peters) were found with the shells in the dark silt at Locality 1. The deposits containing the fossils are located northeast of Buffalo, Oklahoma, north of the North Canadian River and south of the Cimarron River. These scutes compare in size, shape and pattern with those of *Dasypus bellus* figured by Holmes and Simpson (1931, pp. 395-396) from the Pleistocene of Florida. This is the 2nd record of this extinct armadillo outside of the state of Florida.

The locality from which the fossils were taken in Oklahoma is in the semi-arid region northwest of the present range of *Dasypus novemcinctus* (Talmage and Buchanan, 1954, fig. 1-A). Talmage and Buchanan (pp. 12-13) make the following remarks concerning the Recent armadillo in the United States,

"Two factors, probably, have allowed the armadillo to reach its present northern range. First, its nest is of such a construction that the animal literally packs itself in insulation. While in the nest it can survive for some time unless the ground is frozen down to that level. Second, in the northern part of the area now inhabited, although it may get quite cold at times, the periods of cold weather are not normally protracted and the interim periods of relatively mild weather allow the animals to forage for food. The animal does not hibernate, and while able to go for relatively long periods without eating, must seek food during all seasons of the year . . . The amount of rainfall apparently limits the armadillo quite sharply by its effects on the food supply . . . The lack of rainfall in west Texas appears to be the limiting factor in the westward extension of its range."

It appears that *Dasypus bellus* possessed a greater tolerance for cold, like some of its Recent relatives in South America, than does the present nine-banded armadillo. From the scanty evidence at hand it

appears that the late Pleistocene vertebrate faunas of western Oklahoma and southwestern Kansas contained a number of species in common with the faunas (Illinoian and Sangamon) of Florida.

Future collecting should extend the late Pleistocene range of the armadillo considerably northward.¹ In the early 1930's Mr. A. C. Carpenter of Ottawa, Kansas, brought to the Museum at the University of Kansas part of a carapace and a few skeletal elements of an armadillo from a limestone quarry. The material was recovered from a small fissure deposit of buff silt, when the quarry face was blasted away for the removal of limestone. The quarry is situated just north of Garnett on the east side of U. S. Highway 59, Anderson County, Kansas. The scutes were different and slightly larger than those of the nine-banded armadillo in the University of Kansas Museum of Natural History. Mr. Carpenter had to return the specimen to the owner at Garnett. We were unable to get it for the Museum and in later years it was destroyed or lost.

A specimen of *Dasypus bellus* consisting of six band scutes was collected from cave filling in St. Louis, Missouri, where it was associated with an extinct woodchuck, the American beaver, the Canada porcupine, the black bear, the raccoon, a wolf, and an extinct peccary. The material was described by G. G. Simpson in 1949, *Amer. Museum Nat. History, Novitates*, No. 1408, pp. 11-12.

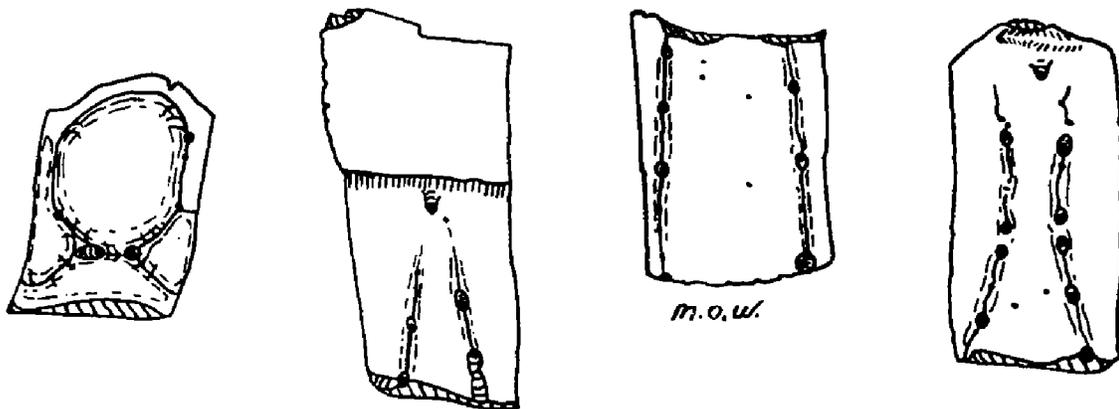


Fig. 1. *Dasypus bellus* (Simpson). Armadillo scutes from Harper County, Oklahoma. Natural size.

¹Dr. David B. Kitts called Hibbard's attention to the occurrence in a cave in St. Louis, Missouri.

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