

The Duck Creek Molluscan Fauna (Illinoian)

from Ellis County, Kansas¹

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Abstract

A late Pleistocene molluscan fauna containing 35 species is reported from sediments deposited by the ancestral Smoky Hill River in Ellis County, Kansas.

The presence of *Pisidium compressum* and *Sphaerium striatinum* within cross-bedded sands indicates a perennial stream with some current action, while the abundance of *Valvata tricarinata* suggests the stream was lake-like in places. The abundance of several strictly woodland species, such as *Cionella lubrica*, suggests that a continuous stand of trees bordered the stream, while valley slopes were possibly covered with grasses and scattered trees. Likewise, cooler summers and winters than at present are indicated for Ellis County at the time these taxa lived by the predominance of species with a northern distribution.

The climatic implications of the molluscs, faunal comparisons with other molluscan faunas, and the topographic position of the deposits suggest an Illinoian age for the fauna. *Trans. Kans. Acad. Sci.*, Vol. 78 (1-2), 1975.

Introduction

In the spring of 1970, two students found some fossil molluscs in a gravel pit in the NE $\frac{1}{4}$ sec. 33, T. 15 S. R. 16 W. of Ellis County, Kansas (Fig. 1). These molluscs were brought to Zakrzewski, who, accompanied by the late Dr. Claude W. Hibbard and a field party from the University of Michigan, returned to the site in search of vertebrate fossils. The party discovered additional molluscs and some vertebrates, including the red-backed vole, *Clethrionomys* (Zakrzewski and Maxfield, 1971).

In May of 1972, a field party from Fort Hays Kansas State College returned to the gravel pit. Two tons of matrix were sacked and washed using the method described by Hibbard (1949). Along with molluscs, fish, amphibians, reptiles, and mammals were also collected. The mammals subsequently were described by McMullen (1974) who named the fauna the Duck Creek local fauna.

In the fall of 1973 we began describing the molluscs, of which only 577 were sorted, which culminated in this report. Specimens described in this report are stored in the Sternberg Memorial Museum, Fort Hays Kansas State College (FHSM accession numbers 13914-1 to 13914-35).

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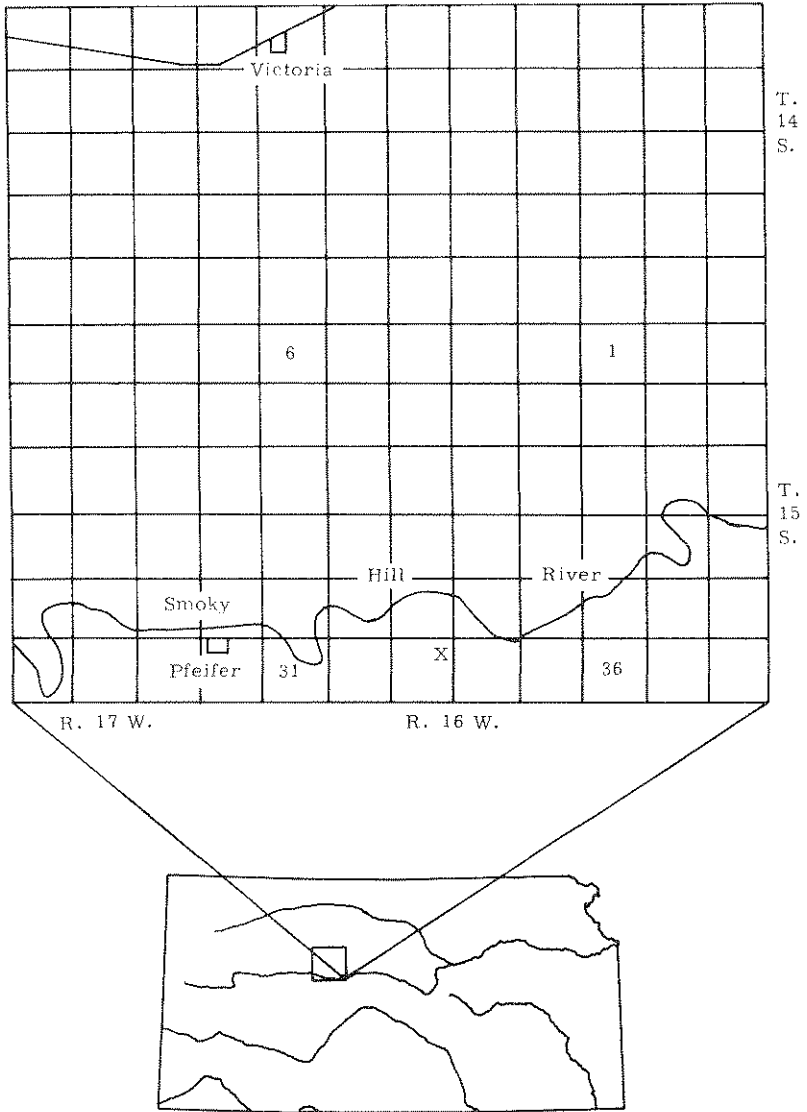


Figure 1. Map showing location on Duck Creek Pit (at X) in the NE¹/₄ sec. 33, T. 15 S., R. 16 W., Ellis County, Kansas.

Stratigraphy

The stratigraphy of the area consists of the Cretaceous Greenhorn and Carlile Formations unconformably overlain by Pleistocene deposits. The fine silt to coarse gravel of Pleistocene age are considered alluvial fill deposited by the ancestral Smoky Hill River. Leonard and Berry (1961) designated the terrace formed on the fill that contains the fossils the Pfeifer terrace and assigned a late Pleistocene (Illinoian) age to it. Recent fossil finds that include the red-backed vole (*Clethrionomys*) and the gastropod *Pupilla muscorum* support a glacial stage designation. *P. muscorum* is characteristic of glacial faunas in the southern High Plains (Hibbard and Taylor, 1960).

Faunal List

A faunal list of the molluscs from the Duck Creek local fauna as well as the quantity of each species, is listed in Table 1. Quantities of individual species in excess of 300 have been volumetrically estimated. Separate pelecypod valves are listed as fractions.

Paleoecology

Ecological interpretations of molluscan assemblages are based on the assumption that fossil shells identical to shells of living species occupied the same habitat in the past. A summary of inferred local habitats represented by the molluscs from the Duck Creek local fauna is presented in Table 2.

The abundance of *Pisidium compressum* and *Sphaerium striatinum* within cross-bedded sands suggests a perennial, medium-sized stream, with some current action. A stable substrate is indicated by *Anodonta grandis*. Further support for a perennial water supply is the presence of the northern water shrew, *Sorex palustris*, (McMullen, 1975), which is associated with swamps or marshy areas near streams. The articulated condition of some specimens of *Sphaerium striatinum* suggests that they were buried near the site of the stream in which they lived.

The abundance of *Valvata tricarinata* indicates that portions of the stream were lake-like and contained beds of aquatic vegetation. The presence of *Fossaria dalli* suggests marshy areas grew along the edge. Temporary water bodies on the floodplain are indicated by *Stagnicola exilis*, *S. caperata*, *Gyraulus circumstriatus* and *Physa gyrina*.

Of the terrestrial forms, the strictly woodland species comprise a larger element of the fauna than those species which can tolerate open, drier conditions. The abundance of the woodland forms, *Cionella lubrica*, *Discus cronkhitei*, *Zonitoides arboreus*, *Nesoritrea electrina*, *Euconulus fulvus*, *Helicodiscus parallelus*, suggests a continuous stand of trees along this segment of the river. The species needing less shade *Pupilla blandi*, *P. muscorum*, *Pupoides albilabris*, *Vallonia cyclophorella*, *V. gracilicosta*, *Hauaia minuscula*, probably lived around shrubs and among grass slopes and upland areas.

Table 1. Molluscs of the Duck Creek Local Fauna

<u>Name</u>	<u>Quantity</u>	<u>Quantity in each Order</u>	<u>% in each Order</u>
Class Pelecypoda			
Order Prionodesmacea			
<i>Anodonta grandis</i>	1/2	1/2	1
Order Teleodesmacea			
<i>Pisidium compressum</i>	1000/2	1550/2	39
<i>Sphaerium striatinum</i>	550/2		
Class Gastropoda			
Order Mesogastropoda			
<i>Valvata lewisi</i>	2	262	14
<i>Valvata tricarinata</i>	260		
Order Basommatophora			
<i>Carychium exiguum</i>	5	294	16
<i>Fossaria dalli</i>	43		
<i>Stagnicola caperata</i>	3		
<i>Stagnicola exilis</i>	11		
<i>Physa anatina</i>	80		
<i>Physa gyrina</i>	1		
<i>Gyraulus circumstriatus</i>	26		
<i>Gyraulus parvus</i>	95		
<i>Helisoma anceps</i>	7		
<i>Helisoma trivolvis</i>	2		
<i>Promenetus exacuus</i>	21		
Order Stylommatophora			
<i>Cionella lubrica</i>	22	601	31
<i>Discus cronkhitei</i>	250		
<i>Helicodiscus parallelus</i>	10		
<i>Gastrocopta armifera</i>	14		
<i>Gastrocopta tappaniana</i>	2		
<i>Pupilla blandi</i>	5		
<i>Pupilla muscorum</i>	6		
<i>Pupoides albilabris</i>	1		
<i>Vertigo elatior</i>	3		
<i>Vertigo modesta</i>	1		
<i>Vertigo ovata</i>	5		
<i>Oxyloma sp.</i>	1		
cf. <i>Succinea</i>	106		
<i>Vallonia cyclophorella</i>	2		
<i>Vallonia gracilicosta</i>	105		
<i>Euconulus fulvus</i>	16		
<i>Hawaiiia minuscula</i>	7		
<i>Nesovitretea electrina</i>	20		
<i>Zonitoides arboreus</i>	25		

Quantities of individual species in excess of 300 have been volumetrically estimated.

Table 2. Summary of the Local Habitats Represented by the Molluscs of the Duck Creek Local Fauna

Habitat*	Species	Percentage by habitat group
Woodland; moist areas under leaf litter, down timber, among tall marsh grass.	<i>Cionella lubrica</i> <i>Discus cronkbitiei</i> <i>Zonitoides arboreus</i> <i>Nesovitrea electrina</i> <i>Euconulus fulvus</i> <i>Helicodiscus parallelus</i>	18
Sheltered situations; these species are not restricted to a woodland habitat and can tolerate drier conditions.	<i>Pupilla blandi</i> <i>Pupilla muscorum</i> <i>Pupoides albilabris</i> <i>Vallonia cyclophorella</i> <i>Vallonia gracilicosta</i> <i>Hawatia minuscula</i>	7
Sheltered areas; among rocks, shrubs, grass, or in timbered situations.	<i>Gastrocopta armifera</i>	1
Hygrophilic; moist situations under leaf mold, under sticks and debris; shaded areas, not far from water.	<i>Carychium exiguum</i> <i>Vertigo elatior</i> <i>Vertigo ovata</i> <i>Vertigo modesta</i> <i>Gastrocopta tappaniana</i>	1
Semiaquatic; among vegetation and debris near water's edge.	<i>Oxyloma</i> sp.	1
Marginal situations; wet mud, sticks, stones, or any other debris along water's edge, shallow pools and protected spots.	<i>Fossaria dalli</i>	2
Shallow quiet water; small streams, ponds, sloughs or marsh, that may become dry part of the year.	<i>Stagnicola exilis</i> <i>Stagnicola caperata</i> <i>Gyraulus circumstriatus</i> <i>Physa gyrina</i>	2
Shallow quiet water; small ponds, streams sloughs, or marsh, with no current or areas of rooted vegetation with little current; soft sand or mud bottoms; not subject to significant seasonal drying.	<i>Gyraulus parvus</i> <i>Helisoma trivolvis</i> <i>Promenetus exacoccus</i> <i>Physa anatina</i>	11
Perennial water; stream of lake with slow to moderate current; areas of still water; shallow spots with soft sand or mud substrate, not affected by seasonal drying.	<i>Anodonta grandis</i> <i>Valvata lewisi</i> <i>Valvata tricarinata</i> <i>Pisidium compressum</i> <i>Sphaerium striatulum</i> <i>Helisoma anceps</i>	53
Uncertain; material not identified satisfactorily to specific level.	cf. <i>Succinea</i>	6

*Miller, 1966

Mammals such as the prairie vole (*Microtus ochrogaster*), Richardson's ground squirrel (*Spermophilus richardsoni*), plains pocket gopher (*Geomys bursarius*), and northern pocket gopher (*Thomomys talpoides*) found in the fauna also indicate grass cover on the upland slopes.

Climate

Molluscs of the Duck Creek local fauna represent at least three different distributional patterns. A northern distribution is represented by *Valvata lewisi*, *V. tricarinata*, *Pupilla muscorum*, *Vertigo modesta*, *Stagnicola caperata*, *Gyraulus circumstriatus*, *Vallonia gracilicosta*. These species presently live north of Kansas in the Great Plains. The southern limit of this group is regulated by high summer temperatures (Taylor, 1960; Miller, 1966).

A mountain or western distribution is represented by *Discus cronkbittei*, *Vallonia cyclophorella* and *Pupilla blandi*. *P. blandi* is found primarily in the Rocky Mountains and Black Hills, although there are reports of a few scattered records in the Great Plains to the northwest of Kansas (Hibbard and Taylor, 1960).

A southern affinity is represented by *Physa anatina*. However, problems have resulted because of the confused taxonomic state of *Physa*. Until the entire family is revised, the geographic distribution, ecology, life history, and fossil records of members of this family will remain unclear (Miller, 1966).

The climate implied by the molluscs of the Duck Creek local fauna differs from the present climate in Ellis County. The predominantly northern molluscs of the fauna indicate cool, moist conditions. The Duck Creek local fauna lived when summer conditions in Ellis County were similar to the conditions found in North Dakota and Minnesota today, which is the southern limit of *Vertigo modesta* and *Pupilla muscorum* (excluding the mountain areas). Normal summer temperatures in northeastern North Dakota range between 65-70 F. (Visher, 1954).

The winters in Ellis County were probably like those found in northeastern South Dakota-southeastern North Dakota today, an area in which many of the molluscs and mammals (McMullen, 1974) present as fossils in the Duck Creek local fauna are extant. Longer and more severe winters than exist in Ellis County today is further supported by the absence of *Gastrocopta procera* and *G. cristata*. The present distribution of *G. procera* and *G. cristata* is restricted by the severity of winters (Miller, 1970) and these species range only as far north as southern South Dakota and northern Nebraska (Hibbard and Taylor, 1960).

The ability of molluscs with boreal and temperate affinities to live compatibly suggest that seasonal extremes were not of the same magnitude as found in Ellis County today. The inferred climate in Ellis County, Kansas, at the time the Duck Creek local fauna lived, combined cooler summers with slightly cooler and longer winters than at present.

Table 3 cont.

	Duck Creek	Sandahl†	Williams‡‡	Adams*	Butler Spring*	Mr. Scott*	Berends*	Doby Springs*	Casados Ranch‡
<i>Pupilla blandi</i>	X	X	X	X	X	X		X	X
<i>P. muscorum</i>	X			X	X			X	X
<i>P. sinistra</i>				X	X				
<i>Pupoides albilabris</i>	X	X	X		X	X	X	X	
<i>P. inornatus</i>		X			X				
<i>Vallonia cyclophorella</i>	X			X	X				X
<i>V. gracilicosta</i>	X	X	X	X	X	X	X	X	X
<i>V. parvula</i>		X	X		X	X	X	X	
<i>V. pulchella</i>			X						
<i>Oxyloma</i> sp.	X								
cf. <i>Succinea</i>	X	X	X	X	X	X	X	X	X
<i>Discus cronkhitei</i>	X		X	X	X	X		X	
<i>Helicodiscus parallelus</i>	X	X	X			X	X	X	
<i>H. singleyanus</i>		X		X	X	X			
<i>Punctum minutissimum</i>		X				X			
<i>Deroceras aenigma</i>		X				X	X	X	
<i>D. sp. cf. D. laeve</i>			X						
<i>Euconulus fulvus</i>	X	X	X			X	X	X	X
<i>Nesovitrea electrina</i>	X	X	X			X		X	X
<i>Hawaii minuscula</i>	X	X	X	X	X	X	X	X	
<i>Zonitoides arboreus</i>	X	X	X		X	X		X	
<i>Z. nitidus</i>						X			
<i>Stenotrema barbatum</i>			X						
<i>S. leai</i>		X	X		X	X	X	X	
<i>Ferrissia meekiana</i>			X						
Total number of species	35	63	52	22	53	63	45	59	20

* Based on data from Miller, 1966

† Based on data from Miller, 1970

‡ Based on data from McMullen and Zakrzewski, 1972

‡‡ Based on data from Hall, (personal communication)

Age and Correlation

The Duck Creek local fauna comes from sediments with a topographic position that suggest an Illinoian age (Leonard and Berry, 1961). A study of the mammals by McMullen (1974) and the molluscs (Table 3) supports the topographic evidence. A comparison of taxonomic similarities, using Simpson's (1962) index of faunal resemblance, of the Duck Creek local fauna with

molluscan assemblages from Kansas-Oklahoma-New Mexico indicates a high correlation with other Illinoian local faunas (Table 4). The Mt. Scott local fauna, Meade County, Kansas (82%), the Doby Springs local fauna, Harper County, Oklahoma (86%), have the closest taxonomic similarity with the Duck Creek local fauna.

Table 4. Taxonomic Resemblances of Molluscan Faunas of Illinoian-Age from Kansas, Oklahoma and New Mexico.¹

	Duck Creek (N = 35)	
Sandahl, McPherson Co., Ks.	(N = 63)	75
Williams, Rice Co., Ks.	(N = 52)	80
Adams, Meade Co., Ks.	(N = 22)	64
Butler Spring, Meade Co., Ks.	(N = 53)	77
Mt. Scott, Meade Co., Ks.	(N = 63)	82
Berends, Beaver Co., Okla.	(N = 45)	62
Doby Springs, Harper Co., Okla.	(N = 59)	86
Casados Ranch, Harding Co., N.M.	(N = 20)	70

¹Taxonomic similarities based on Table 3, by $\frac{100C}{N_1}$, where C = number of species shared in common and N_1 , the number of species in smaller fauna.

However, molluscs of the Duck Creek local fauna indicate a climatic condition closer to the Doby Springs local fauna. Miller (1966) suggests that the Mt. Scott is younger than the Doby Springs because a trend toward warming is indicated in the former local fauna, while the latter is indicative of a cooler situation. The predominance of northern molluscs in the Duck Creek local fauna suggests that this local fauna may have lived during a time even cooler than the situation represented by the Doby Springs local fauna. A time of maximum glaciation is suggested by the presence of *Vertigo modesta*, which is absent from other Illinoian faunas in the area (Table 3). Today, *V. modesta* is restricted to the circumpolar and alpine areas of North America (Pilsbry, 1948).

The mammals of Duck Creek local fauna (McMullen, 1974) support the climate indicated by the molluscs. Species characteristic of cooler boreomontane climates are represented in the fauna, including the first occurrence of *Clethrionomys* on the Great Plains (Zakrzewski and Maxfield, 1971). Other species characteristic of cooler conditions, but which were not found previously with southwestern or central Kansas and northwestern Oklahoma faunas, include *Synapomys borealis*, and *Mustela erminea* (McMullen, 1974).

The geographical separation between central Kansas and southwestern Kansas-northwestern Oklahoma makes correlation of faunas between the two

areas difficult. The difference in faunal composition may be attributed to geographic or interstadial-stadial differences within one stage i.e. the Illinoian.

In southwestern Kansas the late Illinoian Mt. Scott local fauna occurs stratigraphically below the Cragin Quarry local fauna of Sangamon age with no evidence of an unconformity or intervening fauna between the two local faunas (Miller, 1966).

McMullen (1974) considered the development of the mammals to be late Illinoian. Thus the Duck Creek local fauna probably belongs to the same stadial which contains the Doby Springs, Adams, Butler Spring, and Mt. Scott local faunas.

Based on the predominance of northern molluscs and the absence of southern molluscs such as *Gastrocopta procera* and *G. cristata* which are present in other Illinoian faunas (Table 3), the Duck Creek local fauna may be equivalent to or slightly older than the Doby Springs local fauna and probably younger than the Berends local fauna.

If the geographic separation between the Doby Springs local fauna and the Duck Creek local fauna is enough to cause a distribution zonation then the Duck Creek local fauna could be temporally equivalent to the Doby Springs local fauna. On the other hand if the geographic separation of the faunas is not enough to produce a zonation as to allow southern species to live in the Doby Springs area and not in the Duck Creek area then the Duck Creek local fauna may be slightly older.

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