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A RADIOCARBON-DATED (WISCONSINAN) MOLLUSCAN FAUNA FROM SOUTHEASTERN KANSAS

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ABSTRACT—A Wisconsinan molluscan fauna of 39 species is reported from a 5 m thick section of fluvial sediments exposed along Fall River in Wilson County, southeastern Kansas. All but two of the species are still living in the general area today. The molluscs occur in three distinct lithologic units. The lowest unit is poorly sorted, lenticular gravel and sand that contains a molluscan fauna dominated by unionids, sphaeriids and aquatic gastropods. Units 2 and 3 are finer sand and silt with a predominantly terrestrial molluscan faunule. Both the vertical changes in lithology and changes in faunal composition suggest lateral stream migration by a precursor of the modern Fall River.

The absence of many of the woodland species that now live in this area of Kansas strongly suggest the absence of a forest in the vicinity of the fossil locality and a drier climate at the time the fossil assemblage lived.

A valve of *Lasmigona complanata* Barnes, collected in 1947, provided a radiocarbon age of 31,000 ± years B.P. for unit 1. A statement accompanying the published date places the shell in association with *Bison alleni*. This 31,000-year date has become established in the literature as the terminal date for the extinction of *B. alleni*. Although the clam and the bison may have come from the same stratigraphic unit, they were collected several miles apart and there is no known physical evidence which connects the two localities.

INTRODUCTION

(1939) described the horn-cores and bison that had been collected by Mr. Stroud of Fredonia, Wilson County, Hibbard provided no locality information in this report other than a statement that the skull came from near the base of a gravel deposit exposed along the banks River, Wilson County, Kansas. This was subsequently assigned to *Bison* Skinner and Kaisen (1947). On July C. Carpenter and C. W. Hibbard, of Paleontology, University of Mich- collected fossils from near the base of a exposed along the southeast bank of River, just upstream from the Wilson crossing, in the SE¼ NE¼ Sec. 18, R14E, Wilson County, Kansas. A valve *Lasmigona complanata* from this 1947 col- provided a radiocarbon age (M-997) of ± 6,000 years B.P. which Crane and (1962:186) state ". . . was in associa- with *Bison alleni* (late Pleistocene), at of ca. 16 ft at base of terrace exposed in of Fall River . . ." This 31,000-year has become established in the literature terminal date for the extinction of *Bison* e.g., Hester, 1967). Hibbard (pers. September 1972) indicated that although the dated clam shell and the bison appeared to be from the same gravel unit exposed near the base of the terrace, the 1947 collection, which included no bison, was actually made several miles upstream from the site at which Mr. Stroud had collected the horn-core and skull of *Bison alleni* (Text-fig. 1).

Although the association of the dated clam and bison may be in question, the radiocarbon date appears to be valid for the molluscs that were collected with the valve of *L. complanata*. This paper is based on the molluscs collected by Carpenter and Hibbard in 1947, and on the collections made by the author in October 1968 from terrace deposits along Fall River, in the SW¼ NE¼ Sec. 18, T29S, R14E, Wilson County, Kansas (Text-fig. 1). Its purpose is to report the molluscan fauna found at these localities and to provide an environmental and climatic interpretation for this assemblage. The 1947 collections consist of individual unionids handpicked from unit 1 (Table 1). All of the sphaeriid and gastropod material listed in Table 2 under the 1947 collections were recovered from matrix trapped in the unionid valves. These materials plus three pounds of matrix collected in 1968 (Table 2, sample 1) constitute the Wilson Ford local fauna. The fossils from unit 2 (Table 2, samples 2, 3, 4, 5) and unit 3 (Table 2, sample

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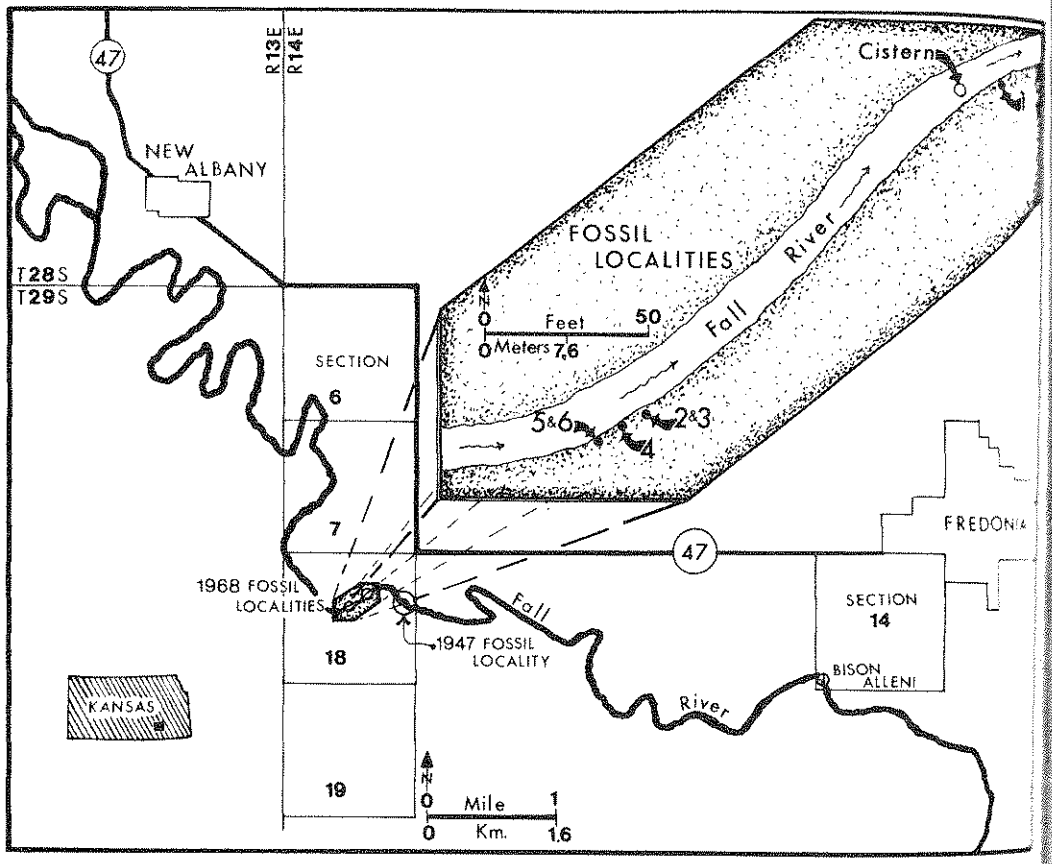


TEXT-FIG. 1—Map showing location of the 1947, 1968 fossil localities and collection site of *Bison alle*
Insert shows location of 1968 samples 1–6.

6) were picked from 78 pounds and 25 pounds of matrix.

STRATIGRAPHY

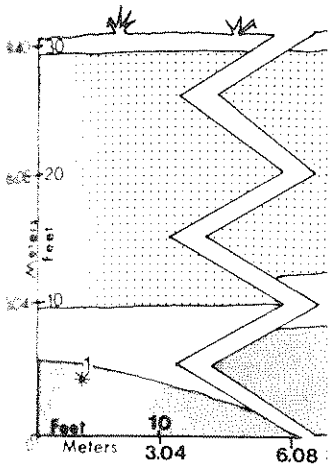
The fauna was recovered from the lower 3.65 m of a bluff exposed along the southeast bank of Fall River (Text-fig. 1). The sediments are part of a terrace deposit that was mapped as Quaternary gravel and alluvium by Wagner (1954). In 1968, six samples were collected along an approximately 55-m linear segment of the bluff (Text-fig. 2). A composite description of the stratigraphic section exposed along this section of the bluff is provided in Table 1.

The precise location from which the 1947 materials were collected is uncertain, but the matrix contained within the valves of the clams collected at that time is identical to the iron-stained, cherty gravel and sand of unit 1 (Table 1). Unionid shells were observed in [illegible] in unit 1 when the locality was visited in [illegible] but were too badly weathered to be recovered. If the 1947 collections were not made from the same locality, they were almost certainly obtained from another nearby locality in which unit 1 was exposed.

FAUNAL COMPOSITION AND ANALYSIS

Thirty-nine species of molluscs have been identified from the three lithologic units exposed at the Wilson Ford locality (Table 1). This assemblage includes nine species of unionid clams, five species of sphaeriid clams, nine species of aquatic gastropods and [illegible] cies of terrestrial snails.

Personal collections made in the [illegible] County area in 1968, together with records published in Leonard and Leonard [illegible] Leonard (1959), Murray and Leonard [illegible]

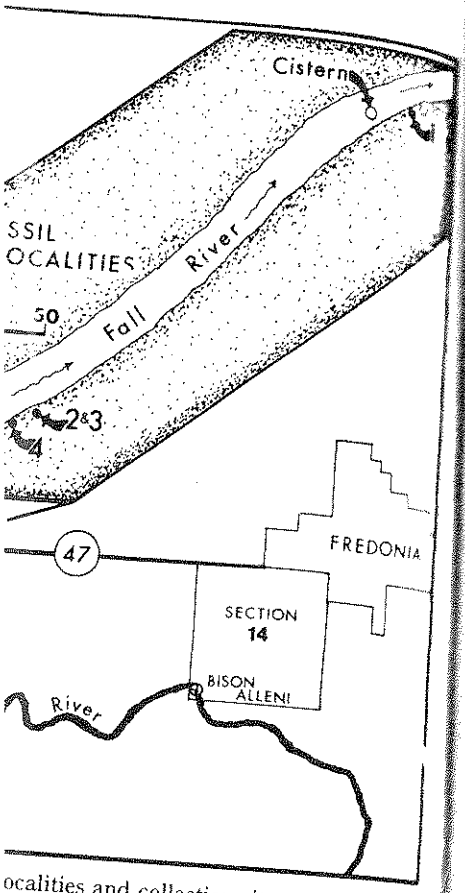


TEXT-FIG. 2—Schematic of stratig[illegible] by stratigraphic unit.

Burch (1975), and Miller (197[illegible] of the 39 species are extan[illegible] eastern Kansas area. All of the [illegible] modern distributions in Kansas [illegible] the Fall River or Verdigris R[illegible] Murray and Leonard, 1962; [illegible] Two of the species, *Valvata t[illegible] Probythinella lacustris,* are no[illegible] Kansas. Two of the unionids, *A[illegible]* and *Obliquaria reflexa,* repr[illegible] records for the Pleistocene of K[illegible] Much of the fossil material s[illegible] of fragmentation and abrasion [illegible] considerable transportation o[illegible] burial. By contrast, the articu[illegible] of *Lasmigona complanata* and [illegible] *Amblema plicata* imply tha[illegible] lived at or near the site of depo[illegible] The molluscs from unit 1 (Wi[illegible] fauna) are predominantly aqua[illegible] taxa. Both the abundance of a[illegible] the abundance of individuals [illegible] aquatic species diminish from [illegible] unit. The most significant fau[illegible] ences between unit 1 and unit 2, [illegible] the disappearance of all of t[illegible] taxa, one sphaeriid, *Sphaerium* [illegible] and four aquatic snails, *Helis[illegible] Physa anatina, Probythinella [illegible] Lymnaea limosa.*

DISCUSSION

The vertical sequence of len[illegible] sorted coarse sand and gravel (



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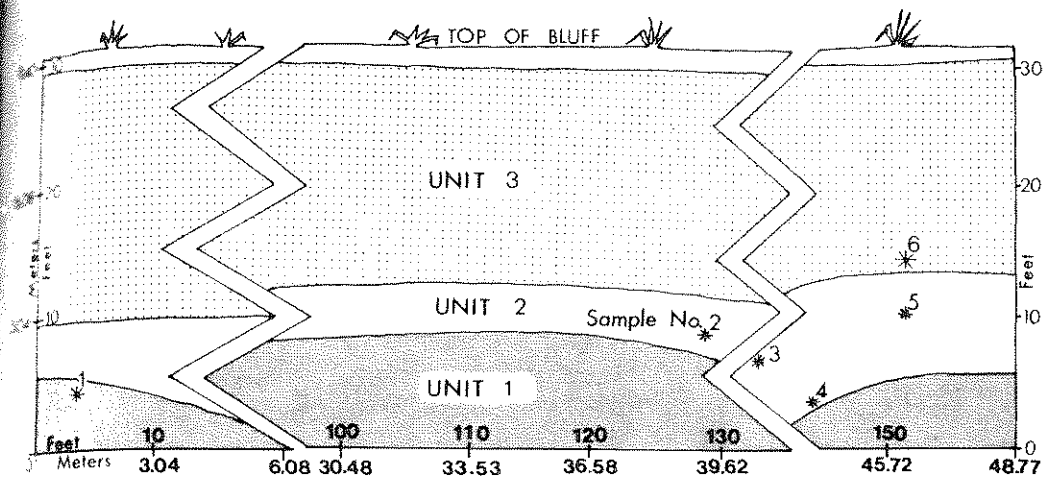
AL COMPOSITION AND ANALYSIS

ine species of molluscs have been from the three lithologic units ex- he Wilson Ford locality (Table 2) mblage includes nine species of ms, five species of sphaeriid clams, s of aquatic gastropods and 16 spe- estrial snails.

collections made in the Wilson a in 1968, together with records n Leonard and Leonard (1946), 959), Murray and Leonard (1962),



TEXT-FIG. 2—Schematic of stratigraphic section at Wilson Ford locality showing distribution of samples 1–6 by stratigraphic unit.

Burch (1975), and Miller (1970), indicate that 31 of the 39 species are extant in the southeastern Kansas area. All of the unionids have southeastern distributions in Kansas that include the Fall River or Verdigris River drainages (Murray and Leonard, 1962; Miller, 1970). Two of the species, *Valvata tricarinata* and *Probythinella lacustris*, are now extirpated in Kansas. Two of the unionids, *Amblema plicata* and cf. *Obliquaria reflexa*, represent new fossil records for the Pleistocene of Kansas.

Much of the fossil material shows evidence of fragmentation and abrasion suggesting that considerable transportation occurred before burial. By contrast, the articulated condition of *Lasmigona complanata* and nine specimens of *Amblema plicata* imply that these species lived at or near the site of deposition.

The molluscs from unit 1 (Wilson Ford local fauna) are predominantly aquatic species (Table 3). Both the abundance of aquatic taxa and the abundance of individuals belonging to aquatic species diminish from unit 1 through unit 3. The most significant faunal change occurs between unit 1 and unit 2, and is marked by the disappearance of all of the unionid species; one sphaeriid, *Sphaerium transversum;* and four aquatic snails, *Helisoma trivolvis, Physa anatina, Probythinella lacustris* and *Amnicola limosa.*

DISCUSSION

The vertical sequence of lenticular, poorly sorted, coarse sand and gravel (unit 1) grading upward into laminated, fine sand and silt (unit 3) suggests the model of a changing fluvial depositional environment in response to lateral migration of a stream channel (Visher, 1965). In general, the change from channel to floodplain deposition implied by the stratigraphic sequence corresponds to the environmental changes inferred from the fauna. Unit 1,

TABLE 1—Description of composite stratigraphic section measured at the Wilson Ford local fauna collection locality.

Unit	Description	Thickness (meters)
	Top of Bluff	
3	Sand; fine; buff to light brown; calcareous; layered toward base. Upper 0.5 m soil zone. Sample 6 from near base of unit	6.4
2	Sand; fine; with clay; 15-cm-thick gravel lens near top of unit; olive-brown, with limonite mottling; lenticular; samples 2, 3, 4, and 5 from this unit	1.2
1	Gravel; in brown sand matrix; gravel stained orange-brown; of subangular clasts of poorly sorted brown chert and gray sandstone up to 5 cm long. Locally upper 1.8 m of 5–8 cm thick lenses of silt, sand or fine gravel. (Wilson Ford local fauna) Sample 1, 1947 collections; radiocarbon date from shell of *Lasmigona complanata*, (M-997) 31,000 ± 6,000 yrs. B.P. from this unit	2.0
	High water level of Fall River	

TABLE 2—Fossil molluscs from the Wilson Ford locality collected in 1947 and 1968. The 1968 collections are num[illegible] 1–6. Number of specimens is indicated by notation in numerator. KSU catalog number is shown as denomin[illegible] Number of individual valves counted shown as a fraction for sphaeriid clams. L and R refer to left and right va[illegible] and whole number indicates both valves present in unionid clams. Taxa present but not counted indicated by a[illegible]

Species	1947	1968				
		1	2	3	4	5
	Unit 1	Unit 1		Unit 2		Unit 3
Aquatic unionid bivalves						
Amblema plicata	$\frac{9 + 24R + 5L}{3249}$	—	—	—	—	—
Lampsilis anodontoides	$\frac{1R}{3253}$	—	—	—	—	—
L. ovata ventricosa	$\frac{1L}{3740}$	—	—	—	—	—
L. siliquoidea	$\frac{2L + 1R}{3251}$	—	—	—	—	—
Lasmigona complanata	$\frac{1}{3236}$	—	—	—	—	—
cf. *Obliquaria reflexa*	$\frac{1L}{3255}$	—	—	—	—	—
Pleurobema cordatum catillus	$\frac{5L + 1L}{3254}$	—	—	—	—	—
Quadrula pustulosa	$\frac{2R}{3252}$	—	—	—	—	—
Quadrula quadrula	$\frac{5L + 3R}{3250}$	—	—	—	—	—
Aquatic sphaeriid bivalves						
G* *Pisidium casertanum*	—	—	—	—	—	$\frac{1/2}{3207}$
G *P. compressum*	$\frac{8/2}{1879}$	—	$\frac{4/2}{3158}$	$\frac{2/2}{3187}$	$\frac{7/2}{3177}$	$\frac{2/2}{3199}$
N* *Sphaerium simile*	—	—	—	$\frac{12/2}{3186}$	—	—
G *S. striatinum*	$\frac{11/2}{1880}$	—	—	—	—	—
G *S. transversum*	$\frac{2/2}{3236}$	—	—	—	—	—
S. sp	—	—	x	x	x	—
Aquatic gastropods						
N *Amnicola integra*	$\frac{14}{1878}$	$\frac{5}{3240}$	$\frac{5}{3167}$	$\frac{14}{3140}$	$\frac{12}{3176}$	—
E *A. limosa*	$\frac{4}{1883}$	—	—	—	—	—
G *Ferrissia rivularis*	—	—	$\frac{7}{3149}$	$\frac{1}{3191}$	—	—
G *Gyraulus parvus*	—	$\frac{2}{3246}$	$\frac{2}{3162}$	—	$\frac{3}{3171}$	$\frac{2}{3202}$
G *Helisoma anceps*	—	—	$\frac{1}{3151}$	—	$\frac{3}{3180}$	—
G *H. trivolvis*	$\frac{2}{1888}$	—	—	—	—	—
S* *Physa anatina*	$\frac{3}{1885}$	—	—	—	—	—
G *Probythinella lacustris*	$\frac{8}{3248}$	—	—	—	—	—

TA[illegible]

Species	19[illegible]
	Uni[illegible]
Valvata tricarinata	—
[illegible] gastropods	
[illegible]	—
Gastrocopta armifera	$\frac{3}{187}$
G. contracta	$\frac{1}{187}$
G. cristata	$\frac{1}{187}$
G. holzingeri	$\frac{2}{189}$
G. procera	$\frac{7}{187}$
G. tappaniana	$\frac{1}{188}$
Hawaiia minuscula	$\frac{9}{188}$
Helicodiscus parallelus	$\frac{1}{188}$
H. singleyanus	$\frac{3}{188}$
Punctum minutissimum	—
Pupoides albilabris	$\frac{1}{188}$
Stenotrema leai	—
Strobilops labyrinthica	—
Succinea	—
[illegible] *parvula*	$\frac{1}{1890}$
[illegible] *milium*	$\frac{1}{1886}$

Northern
Southern
Eastern
General

[illegible] dominated by unionids, sphaeri[illegible] aquatic snails, was probably deposited [illegible] bar in the stream channel. The ar[illegible] addition of nine of the at least 33 sp[illegible] *Amblema plicata*, the domin[illegible] species recovered from unit 1, sugg[illegible] species lived at or near the dep[illegible] *Amblema plicata* requires a ri[illegible] at least 0.6 m deep (Murray and Le[illegible]

l in 1947 and 1968. The 1968 collections are ...
ator. KSU catalog number is shown as ... sphaeriid clams. L and R refer to left and ... ams. Taxa present but not counted indicated ...

	1968				
1	2	3	4	5	
it 1		Unit 2		Unit 3	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	1/2 3207	
4/2 3158	2/2 3187	7/2 3177	2/2 3199		
—	12/2 3186	—	—		
—	—	—	—		
—	—	—	—		
x	x	x	—		
5 3167	14 3140	12 3176	—		
—	—	—	—		
7 3149	1 3191	—	—		
2 3162	—	3 3171	2 3202		
1 3151	—	3 3180	—		
—	—	—	—		
—	—	—	—		
—	—	—	—		

TABLE 2—Continued.

	1947	1968					
		1	2	3	4	5	6
Species	Unit 1	Unit 1		Unit 2		Unit 3	
[illegible] tricarinata	—	—	—	—	1 3172	—	—
[illegible] gastropods							
[illegible]ulus dealbatus	—	—	7 3149	1 3191	—	—	1 3215
[illegible]strocopta armifera	3 1877	5 3241	63 3159	1 3185	21 3179	3 3206	5 3210
[illegible] contracta	1 1874	1 3247	21 3156	—	—	—	—
[illegible] cristata	1 1875	—	—	—	—	—	—
[illegible] holzingeri	2 1891	3 3237	166 3161	—	6 3181	2 3201	4 3214
[illegible] procera	7 1876	3 3243	85 3195	—	5 3178	2 3195	9 3208
[illegible] sappaniana	1 1889	—	5 3153	—	—	2 3205	—
Hawaiia minuscula	9 1887	6 3242	105 3165	7 3189	31 3174	28 3204	25 3217
Helicodiscus parallelus	1 1884	—	18 3160	1 3188	3 3175	1 3197	—
H. [illegible]ingleyanus	3 1881	4 3239	3 3168	—	4 3184	1 3202	2 3211
Punctum minutissimum	—	—	—	—	1 3169	—	—
[illegible] Pupoides albilabris	1 1882	1 3238	2 3152	—	—	—	1 3213
[illegible] Stenotrema leai	—	—	4 3150	—	—	—	—
[illegible] Strobilops labyrinthica	—	—	2 3166	—	—	—	—
[illegible] Succinea	—	1 3245	8 3154	2 3193	3 3182	—	—
[illegible] Vallonia parvula	1 1890	6 3244	48 3155	9 3194	14 3183	4 3198	17 3218
[illegible] Vertigo milium	1 1886	—	1 3157	—	—	—	—

[illegible] = Northern
[illegible] = Southern
E = Eastern
G = General

[illegible]ch is dominated by unionids, sphaeriids, [illegible] aquatic snails, was probably deposited as [illegible]point bar in the stream channel. The articulated condition of nine of the at least 33 specimens of *Amblema plicata,* the dominant aquatic species recovered from unit 1, suggests that this species lived at or near the depositional site. *Amblema plicata* requires a river that is at least 0.6 m deep (Murray and Leonard, 1962). The depth requirement of *A. plicata,* taken together with the size of the unionid fauna, indicate that unit 1 was deposited in a stream at least the size of the modern Fall River. The fewer aquatic species in units 2 and 3 is related to the channel migrating away from the fossil locality site. The habitat preferences of the terrestrial species from units 1, 2, and 3 (Table 4) suggest that the floodplain

TABLE 3—Percentage distribution of molluscs by stratigraphic unit. The numbers in parentheses refer to the number of individuals and species.

	Unit 1	Unit 2	Unit 3
Individuals			
Terrestrial	35% (60)	88% (665)	90% (64)
Aquatic	65% (110)	12% (91)	10% (7)
Species			
Terrestrial	40% (12)	65% (15)	72% (8)
Aquatic	60% (18)	35% (8)	28% (3)

and valley slopes were covered primarily with tall grasses and shrubs. The absence of most of the larger species (*Anguispira alternata, Mesodon thyroides* and *Triodopsis albolabris*), as well as many of the smaller forms (*Euconulus chersinus* and *Nesovitrea indentata* which now populate wooded areas in the W son-Greenwood Counties area of southeaster Kansas, suggests that there was little or n forest cover near the Wilson Ford locality dur ing deposition of units 1 through 3.

Certain qualitative climatic interpretation can be made about the Wilson Ford assem blage by contrasting the fossils with the mod ern fauna of the Wilson County area and with other faunas of similar age from the Great Plains and Central Lowlands. For climatic analyses, it is most convenient to group the molluscs on the bases of their modern distribution patterns, which, in a general way, ap pear to be controlled by climate. The rationale

TABLE 4—Percentage distribution of the Wilson Ford molluscs by habitat grouping and stratigraphic unit.

Habitat	Species	Percentage by Ha Group	
		Unit 1	Unit 2
Shaded areas; under moist to wet ground debris; usually near water; on floodplain.	*Vertigo milium* *Gastrocopta tappaniana*	1	0
Woodland, with dense shade, damp areas beneath ground-debris; on floodplain.	*Stenotrema leai* *Punctum minutissimum* *Strobilops labyrinthica* *Helicodiscus parallelus*	1	4
Scattered trees, shrubs, or tall grass on valley slopes and upland; these species not restricted to woodlands.	*Gastrocopta armifera* *G. contracta* *G. cristata* *G. holzingeri* *G. procera* *Pupoides albilabris* *Helicodiscus singleyanus* *Hawaiia minuscula* *Bulimulus dealbatus* *Vallonia parvula*	34	83
Small stream or slough on the floodplain; not subject to severe seasonal drying.	*Gyraulus parvus* *Helisoma trivolvis* *Sphaerium simile* *Physa anatina* *Pisidium casertanum*	4	3
Perennial, medium-sized stream, with pools at least 0.6–2.5 m deep, with areas of stable substrate and rooted aquatic plants.	*Helisoma anceps* *Sphaerium transversum* *S. striatinum* *Pisidium compressum* *Amnicola limosa* *A. integra* *Probythinella lacustris* *Ferrissia rivularis* *Valvata tricarinata* *Amblema plicata* *Lampsilis anodontoides* *L. ovata ventricosa* *L. siliquoidea* *Lasmigona complanata* cf. *Obliquaria reflexa* *Pleurobema cordatum catillus* *Quadrula quadrula* *Q. pustulosa*	61	0

for this approach was discussed by (1975; 1976).

Group I includes northern species th generally distributed in an east-west dir and that have their southern limits Great Plains and Central Lowland appa controlled by high summer tempera Group II includes southerly distributed s that are restricted in their northward ra the length and severity of the winters. III consists of eastern species that range distances westward into the Central and Great Plains primarily in respo available moisture. Group IV contains s for which there are inadequate distri data, are extinct, or are so widely distr that they are not useful for making cl interpretations. Unionid clams, whic strongly influenced in their distributi stream confluence, are not included in groupings.

The most striking and climatically s east contrast between the Wisconsina modern molluscan faunas of the Wilson area (Table 5) are the few eastern s Group III) in the fossil assemblage. All larger (*Stenotrema leai, Mesodon thyr Triodopsis albolabris,* and *Anguispira* as well as many of the smaller terr species (*Euconulus chersinus, Nesovitr Gastrocopta* and *Gastrocopta pentodon*), whi present in the modern fauna, are missin the Wilson Ford local fauna. The distril of these species in Kansas is now restric the eastern third of the state in the Plains. Their absence from the fossil a biotope is considered an indication of les vegetation in this area about 30,000 year

Although no other direct evidence is available locally to corroborate this interpret a general increased aridity event in this p the Interior Plains can be inferred fron presented by Slaughter (1967), Miller (and Davis (1975). Slaughter (1967) cons the fossil occurrence of western and western desertic mammals in the Clear Local fauna (28,840 ± 4,740 years B.P., Jones County, Texas) several hundred k miles east of their modern range indicativ cooler climate in northeastern Texas 30,000 years ago. The Jones (26,700 ± years B.P., 29,000 ± 1,300 years B.P. and Locality (29,300 ± 1,250 years B.

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hich now populate wooded areas in the
n-Greenwood Counties area of southe
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on patterns, which, in a general w
to be controlled by climate. The ra

cs by habitat grouping and stratigraphic unit

Species	Percentage by Group		
	Unit 1	Unit 2	Unit
ilium			
ta tappaniana	1	0	
a leai			
ninutissimum			
labyrinthica	1	4	
us parallelus			
a armifera			
a			
ri			
bilabris	34	8.3	
s singleyanus			
nuscula			
ealbatus			
vula			
rvus			
volvis			
imile			
a	4	3	
ertanum			
eps			
insversum			
pressum			
sa			
lacustris			
aris			
nata	61	9	
ta			
ontoides			
cosa			
planata			
eflexa			
datum catillus			
ula			

the approach was discussed by Miller
1975).

Group I includes northern species that are
distributed in an east-west direction
that have their southern limits in the
Plains and Central Lowland apparently
controlled by high summer temperatures.
II includes southerly distributed species
are restricted in their northward range by
length and severity of the winters. Group
consists of eastern species that range vary-
distances westward into the Central Low-
and Great Plains primarily in response to
available moisture. Group IV contains species
which there are inadequate distribution
, are extinct, or are so widely distributed
they are not useful for making climatic
interpretations. Unionid clams, which are
strongly influenced in their distribution by
stream confluence, are not included in these
groupings.

The most striking and climatically signifi-
cant contrast between the Wisconsinan and
modern molluscan faunas of the Wilson Coun-
area (Table 5) are the few eastern species
(Group III) in the fossil assemblage. All of the
species (*Stenotrema leai, Mesodon thyroides,
Triodopsis albolabris,* and *Anguispira alter-
nata*) as well as many of the smaller terrestrial
species (*Euconulus chersinus, Nesovitrea in-
tersculpta* and *Gastrocopta pentodon*), which are
present in the modern fauna, are missing from
the Wilson Ford local fauna. The distribution
of these species in Kansas is now restricted to
the eastern third of the state in the Osage
Plains. Their absence from the fossil assem-
blage is considered an indication of less pre-
cipitation in this area about 30,000 years ago.

Although no other direct evidence is avail-
able locally to corroborate this interpretation,
a coeval increased aridity event in this part of
the Interior Plains can be inferred from data
presented by Slaughter (1967), Miller (1975),
and Davis (1975). Slaughter (1967) considered
the fossil occurrence of western and south-
western desertic mammals in the Clear Creek
local fauna (28,840 ± 4,740 years B.P., Den-
ton County, Texas) several hundred kilome-
ters east of their modern range indicative of a
drier climate in northeastern Texas about
30,000 years ago. The Jones (26,700 ± 1,500
years B.P.; 29,000 ± 1,300 years B.P.) and
Bird Locality (29,300 ± 1,250 years B.P.) lo-

TABLE 5—Number (within parentheses) and percentage distribution of non-unionid molluscs by climatic groupings for the Holocene of Wilson-Greenwood Counties, Kansas and fossils from the Wilson Ford locality.

	Holocene[1]	Wilson Ford[2]		
		Unit 1	Unit 2	Unit 3
Group I Northern	(4) 13%	(2) 9%	(6) 26%	(1) 9%
Group II Southern	(5) 16%	(4) 18%	(3) 13%	(3) 27%
Group III Eastern	(12) 39%	(5) 23%	(5) 22%	(1) 9%
Group IV General	(10) 32%	(11) 50%	(9) 39%	(6) 55%

[1] Data from Leonard and Leonard, 1946; Leonard, 1959; Murray and Leonard, 1962; Burch, 1975; Miller, 1970; personal collection made in area in 1968.
[2] Data from Table 2.

cal faunas from Meade County in southwestern Kansas contain fewer eastern molluscan species than any of the other Wisconsinan molluscan assemblages or the modern fauna from this area of the state (Miller, 1975). This decrease in eastern species about 30,000 years B.P. is probably also a reflection of lower precipitation rates. Davis (1975) concluded that the mammals and amphibians from the Jones local fauna indicated an interstadial climate that was cooler with less rainfall than now occurs in the Meade County area.

It is difficult to evaluate how significant is the three-fold increase of northern species in unit 2 (Table 5). The number of species in unit 1 (30) is much greater than in unit 2 (23) in spite of the much larger sample size and abundance of individuals in unit 2 (Table 2). On the basis of this, it is tempting to interpret the increase in northern species (e.g., *Valvata tricarinata, Sphaerium simile, Strobilops labyrinthica* and *Punctum minutissimum*) as indicative of slightly cooler summer temperatures and not simply an artifact of collection, even though this group of species only constitutes a small portion (2%) of the total number of individuals in unit 2.

CONCLUSIONS

Molluscs from unit 1 (Wilson Ford local fauna) differ significantly from those in units 2 and 3 in terms of the abundance of terrestrial and aquatic species. Both the faunal changes and associated lithologic changes can be par-

simoniously explained by assuming a fluvial model in which conditions at the depositional site changed from point bar channel deposition (unit 1) to overbank floodplain deposition (unit 3) as the result of lateral stream migration.

The absence in the Wilson Ford local fauna of many of the eastern woodland species that now are living in this area strongly suggests the absence of forest in the vicinity of the fossil locality about 30,000 years ago. The radiocarbon-dated Jones and Bird Locality local faunas from southwestern Kansas, and the Clear Creek local fauna from Denton County, Texas are probably coeval with the Wilson Ford local fauna. Each of these three faunas record a "drier" climate during the time the Wilson Ford local fauna lived, and suggest that increased aridity, rather than a local factor such as fire, may have been responsible for fewer woodland molluscs at the Wilson Ford locality.

The radiocarbon age determination of 31,000 ± 6,000 years B.P., which is based upon a valve of *Lasmigona complanata* collected from unit 1 at the Wilson Ford locality, has become established in the literature as the terminal date for the extinction of *Bison alleni*. The bison, however, was actually collected several miles downstream from the Wilson Ford locality and its stratigraphic position relative to the dated unionid clam is uncertain.

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A SCHOHARIE GRIT (DE[illegible]

ROUS[illegible]
New Mexico Bureau of Mines and[illegible]

ABSTRACT—*Convoluticeras* (?) *schoharie*[illegible] Brief notes are added as to ammonoids be[illegible]

INTRODUCTION

THE WRITER'S first collecting from the S[illegible] Grit in 1933 yielded the specimen [illegible]cribed; it looks very much like a [illegible] *Agoniatites*, a generic assignment w[illegible] seemed dubious as it is materially older [illegible] *Agoniatites*. Preservation is poor, onl[illegible] outer whorl is preserved. It was not unti[illegible] work of Erben (1960, 1964, 1965) that [illegible] goniids broadly of this age were clarified [illegible] chronically, on the basis of much better [illegible] preserved material than ours, mainly f[illegible] Australia, Turkey, Germany and France

SYSTEMATIC PALEONTOLOGY

CONVOLUTICERAS (?) SCHOHARIAE

Flower, n. sp.

Text-fig. 1–3.

Description.—This is known from a s[illegible] form preserving one side probably slig[illegible] flattened. The shell attains a spiral of 64 [illegible] but the anterior portion has the venter inc[illegible] where and it probably attained a spiral c[illegible] more and a radius of 50 mm at least, expan[illegible] from a radius of 14 mm in the prece[illegible] whorl. Sides are flattened, slightly convex [illegible] adapically and centrally, but becoming conc[illegible] near the venter (Text-fig. 2), where sharp [illegible] abdominal angles develop flanking a very [illegible] slightly concave ventral face. Sut[illegible] show prominent lateral lobes and a shal[illegible] lobe on the narrow ventral face. Spacin[illegible] angles is moderate, the last camera 4–5 [illegible] being near the abdominal angles.

One restoration of the cross section assu[illegible] slight flattening of the specimen under con[illegible] weight of the sediments. The dorsal par[illegible] suture pattern (Text-fig. 3) is hypotheti[illegible]

Discussion.—One cannot, without kno[illegible] that the earliest stage of this form is [illegible] to prove that it is not an *Agoniatites*. [illegible] assignment to the Mimoceratidae is based u[illegible]

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