

An Ecological Comparison of the Ben Franklin and Clear Creek Local Molluscan Faunas in Texas

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Radiocarbon tests date the Ben Franklin local fauna as Wisconsin, and the Clear Creek local fauna as Sangamon. The contrast between the mollusks of these two faunas is remarkable, as shown by the following table.

Table 1.—Comparative Lists of the Clear Creek and Sulphur River Molluscan Assemblages. The abundance of each species is indicated as follows: A, abundant; C, common; S, sparse; and R, rare.

Aquatic Species	
Clear Creek Assemblage	Ben Franklin Assemblage
Family PHYSIDAE	Family PHYSIDAE
<i>Physa anatina</i> Lea—S	<i>Physa anatina</i> Lea—S
	<i>Physa gyrina</i> Lea—S
Family PLANORBIDAE	Family PLANORBIDAE
<i>Gyraulus parvus</i> (Say)—C	<i>Gyraulus parvus</i> (Say)—A
<i>Helisoma anceps</i> (Menke)—C	<i>Planorbula armigera</i> (Say)—C
	<i>Helisoma anceps</i> (Menke)—A
	<i>Helisoma trivolvis</i> (Say)—S
Family LYMNAEIDAE	Family LYMNAEIDAE
<i>Lymnaea dalli</i> Baker—R	<i>Lymnaea dalli</i> Baker—S
<i>Lymnaea bulimoides</i> Lea—R	<i>Lymnaea caperata</i> Say—R
	<i>Lymnaea reflexa</i> (Say)—S
Family AMNICOLIDAE	Family AMNICOLIDAE
<i>Amnicola integra</i> (Say)—C	<i>Amnicola integra</i> (Say)—A
	<i>Amnicola</i> sp. ?—A
	<i>Somatogyryus depressus</i> (Tryon)—A
	A
Family VALVATIDAE	Family VALVATIDAE
<i>Valvata tricarinata</i> (Say)—R	<i>Valvata tricarinata</i> (Say)—A
	Family PLEUROCERIDAE
	<i>Goniobasis</i> —R
Family POMATIOPSIDAE	
<i>Pomatiopsis lapidaria</i> (Say)—A	

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- Family SPHAERIDAE
Sphaerium striatinum (Lamarck)
 —C
Pisidium nitidum Jenyns—S
- Family FERRISSIIDAE
Ferrissiana meekiana (Stimpson)
 —R
Ferrissiana rivularis (Say)—R
- Family SPHAERIDAE
Sphaerium striatinum (Lamarck)
 —C
Sphaerium partumeium (Say)—S
Pisidium nitidum Jenyns—S
Pisidium walkeri Sterki—S
Pisidium compressum Prime—S
- Land Species
- Family PUPILLIDAE
Gastrocopta armifera (Say)—A
Gastrocopta procera sterkiana Pilsbry—A
Gastrocopta pellucida bordeacella Pilsbry—A
Vertigo ovata (Gould)—C
Pupoides albilabris (C. B. Adams)
 —A
- Family PUPILLIDAE
Gastrocopta armifera (Say)—S
Gastrocopta procera (Gould)—S
Gastrocopta pentodon (Say)—C
Gastrocopta procera mcclungi (Hanna & Johnston)—R
Pupoides albilabris (C. B. Adams)
 —S
- Family ENDODONTIDAE
Helicodiscus parallelus (Say)—C
Helicodiscus singleyanus (Pilsbry)—C
Anguispira alternata (Say)—R
- Family ENDODONTIDAE
Helicodiscus parallelus (Say)—R
Helicodiscus singleyanus (Pilsbry)
 —C
Discus cronkbitae (Newcomb)—R
- Family STROBILOPSIDAE
Strobilops texasiana (Pilsbry & Ferris)—A
- Family STROBILOPSIDAE
Strobilops texasiana (Pilsbry & Ferris)—A
- Family VALONIIDAE
Vallonia gracilicosta Reinhardt—R
- Family CARYCHIIDAE
Carychium exiguum (Say)—R
- Family CARYCHIIDAE
Carychium exiguum (Say)—R
- Family BULIMULIDAE
Bulimulus dealbatus (Say)—C
- Family HELICINIDAE
Helicina orbiculata tropica Pfeiffer—S
- Family HELICINIDAE
Helicina orbiculata tropica Pfeiffer—S
- Family ZONITIDAE
Hawaiiia minuscula (Binney)—S
Euconulus fulvus (Müller)—R
Zonitoides arboreus (Say)—R
Retinella indentata (Say)—S
- Family ZONITIDAE
Hawaiiia minuscula (Binney)—R
Euconulus fulvus (Müller)—R
Zonitoides arboreus (Say)—R
Retinella indentata (Say)—R

Family POLYGYRIDAE

- Stenotrema leai* (Binney)—R
Polygyra texasiana (Moricand)—
 R
Praticolella berlandieriana (Mori-
 cand)—R

Family SUCCINEIDAE

- Succinea* sp.

Family POLYGYRIDAE

- Mesodon thyrooidus* (Say)—R
Stenotrema leai (Binney)—S

Family SUCCINEIDAE

- Succinea ovalis* Say—A
Succinea sp.

Among the Ben Franklin mollusks, *Valvata tricarinata* (Say) is by far the most abundant. This is a branchiate form requiring perennial water and thriving only in cool or cold water. Another abundant branchiate snail requiring a habitat similar to *Valvata* is *Amnicola integra* (Say). Other branchiate mollusks which support the inference that the Ben Franklin fauna flourished during an interval of cool and moist climate are the gill-breathing sphaerids: *Sphaerium striatinum* (Lamarck), *Sphaerium partumeium* (Say), *Pisidium compressum* Prime, *P. walkeri* Sterki, and *P. nitidum* Jenyns. With the exception of *Pisidium walkeri*, the distributional ranges of the sphaerids include this area today. Two species, *Sphaerium partumeium* and *Pisidium nitidum*, prefer the soft muddy bottoms of lakes and rivers. *Sphaerium striatinum*, *Pisidium walkeri* and *P. compressum* are usually not found in ponds, swamps, lagoons, or bogs, but they do occur in perennial lakes and rivers where the bottoms are compact. However, considerable marshy or low moist land must have existed because of the abundance of *Pomatiopsis lapidaria* (Say). *Gyraulus parvus* (Say) and *Planorbula armigera* (Say) indicate standing waters rich in vegetation. *Somatogyrus depressus* (Tryon), which occurs in abundance, would indicate shallow water and mud bottoms.

Planorbula armigera, *Somatogyrus depressus*, *Lymnaea reflexa* (Say), *Ferrissiana meekinana* (Stimpson), and *Valvata tricarinata* are aquatic species which are not known to occur in Texas today. With the exception of *Somatogyrus depressus* (here reported for the first time in Texas), these species are present in several Sangamon assemblages which have been examined in Texas. Their present ranges are more northerly, following either much cooler climates, greater moisture or combinations of the two. In the Ben Franklin fauna these species are all listed as either common or abundant. A pleurocerid species also occurs in the Sulphur River assemblage, but not in the Clear Creek. Because of the eroded condition of the few mature shells recovered, it is difficult to place the genus, but the sculpturing of immature shells suggests *Goniobasis*. If the genus is indeed *Goniobasis*, this is

the first Pleistocene report for this genus in Texas. Among the land species present in the Sulphur River deposit but not occurring in the Clear Creek assemblage are *Gastrocopta pentodon* (Say), *G. procera mcclungi* (Hanna and Johnston), *Discus cronkbitei* (Newcomb), and *Vallonia gracilicosta* Reinhardt. To our knowledge, *Discus cronkbitei* (Newcomb) and *Vallonia gracilicosta* Reinhardt do not occur in Texas today. Indicative of moist woodlands in the Sulphur River locality are *Mesodon thyroidus* (Say) and the unusually large shells of *Succinea ovalis* Say.

In the Clear Creek habitat some perennial water was present, as indicated by the presence of *Valvata tricarinata*, *Amnicola integra*, *Sphaerium striatinum* and *Pisidium nitidum*. Shells of *Valvata* are rare, and shells of the other three species are sparse. The surrounding countryside must have been well-drained with sparse woodlands. Key species for this type of habitat are *Gastrocopta pellucida hordeacella* (Pilsbry), *G. contracta* (Say), *G. armifera* (Say) and *Pupoides albilabris* (C. B. Adams). Sparse numbers of *Physa anatina* Lea, *Lymnaea bulimoides* Lea and *L. dalli* (Baker) indicate quiet shallow waters in which the principal aquatic pulmonate resident was *Gyraulus parvus* (Say).

Helisoma anceps (Menke) is common at the Clear Creek locality and abundant at the Ben Franklin locality. This species favors streams with currents, apparently requiring well-oxygenated water. We presume that abundant perennial waters of the North Sulphur River provided a favorable habitat for this species, and that a limited local area of running perennial water in the Clear Creek locality was adequate for the propagation of *H. anceps*.

Among the 27 species of land and fresh-water gastropods occurring in the Clear Creek deposit, 17 were reported by Hibbard and Taylor (1960) in the Jinglebob fauna (Sangamon) of Meade County, Kansas (See Table II, in pocket.). Lending support to the Sangamon age of this deposit is *Helicina orbiculata tropica* Pfr., which occurs in Sangamon deposits of north-central Texas (Allen and Cheatum, 1961), but has not been found in older deposits. That the average size of this species is less in the fossil than in the modern shells may reflect changes of climate.

That moist woodlands were present in Clear Creek is evidenced by *Anguispira alternata* (Say), *Stenotrema leai* (Binney), and *Praticolella berlandieriana* (Morciand). All of these species live in this area at the present time. *Bulimulus dealbatus* (Say) also suggests that the Clear Creek fauna lived in an environment similar to that which prevails in this area today. It is interesting to note

that *Praticolella berlandieriana* is a species more commonly associated with the warmer sections of central and southern Texas, its range extending into Mexico.

One might conclude that the environment during Clear Creek time was similar to that which occurs in the same area today. This would support Hibbard and Taylor's (1960) interpretation of a semiarid climate for the early Sangamon. Climatic differences between early and later Sangamon are well developed by Hibbard and Taylor (1960) in their use of the Cragin Quarry local fauna as illustrative of early Sangamon, and the Jinglebob local fauna as indicative of a later Sangamon stage. In the Clear Creek assemblage the presence of such genera as *Bulimulus* and *Helicina*, both of which indicate semiarid conditions, could support an early Sangamon age for this deposit.

Hibbard (1960) concluded that the fossil remains of the giant land tortoises belonging to the genus *Geochelone* indicate that winter temperatures were above freezing in the High Plains region of North America where these tortoises lived during the Pleistocene and Pliocene. According to Hibbard (1960), winters—as we now know them—did not become so severe until the final glacial (Wisconsin) period, at which time the giant *Geochelone* became extinct.

The Texas Pleistocene molluscan faunas recorded to date seem to support Hibbard's interpretations. Until the discovery of the Sulphur River (Wisconsin) deposit in Texas, only data from deposits of Kansan, Illinoian and Sangamon ages were available for reconstruction of Pleistocene climates in Texas. The Sulphur River molluscan fauna—with its assemblage of species able to withstand, at least for the most part, winter temperatures as severe and sustained as occur in northern Texas today—supports Hibbard's theory. The Wisconsin molluscan fauna contrasts markedly with those of Texas Illinoian and Kansan faunas which contain more southern species. Wisconsin faunas could be confused with those determined to be Kansan or Illinoian, for all of these assemblages might contain lingering species living in an unusual situation where southern species could exist. But early Wisconsin faunas will, in all probability, contain the fewest southern species as compared with other Pleistocene faunas. The presence of extinct species will more than likely be the major evidence in establishing the age of the earlier glacial faunas which are beyond the range of carbon dating.

The mollusks of the Ben Franklin local fauna, together with those of other Wisconsin deposits suggest that the final glaciation of the Pleistocene brought with it much moisture, and provided many

lakes and streams of cool or cold running water in Texas. The fauna contains several species indicative of such an environment. Increasing aridity, the high summer temperatures of the sub-Recent, and the continued seasonably severe winters must have eliminated from the local scene those species which now persist in more northern localities.

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Table 2.—Comparative distributional data of the Ben Franklin and Clear Creek assemblages with other assemblages in Wisconsin, Sangamon and Illinoian deposits.

	Wisconsin				Sangamon				Illinoian	
	BEN FRANKLIN Monahans (Wendorf, 1961) Lubbock Lake (Wendorf, 1961) Jones Sink (Hibbard, 1940; Goodrich, 1940; Hibbard and Taylor, 1960) Grain Quarry (Hibbard, 1939; Hibbard and Taylor, 1960)				Good Creek (Dalquest, 1961) Jinglebob (Hibbard, 1955; Hibbard and Taylor, 1960) T-2 Terrace (Slaughter, et al., 1961)				CLEAR CREEK Byers (Allen and Cheatum, 1961) Behrens (Hibbard, 1956; Taylor, 1954; Hibbard and Taylor, 1960) Butler Springs (Franzen and Leonard, 1947; Hibbard and Taylor, 1960) Bar-M (Taylor and Hibbard, 1955; Hibbard and Taylor, 1960)	
Family SPHAERIDE										
<i>Sphaerium transversum</i>			x							x
" <i>striatum</i>	x				x	x	x	x		x x
" <i>partumeium</i>	x			x		x				
" <i>lacustre</i>										x
" <i>sulcatum</i>			x			x				x
" <i>occidentale</i>						x				
<i>Pisidium nitidum</i>	x		x		x		x		x	/x x
" <i>walkeri</i>	x					x				
" <i>ferrungineum</i>				x						
" <i>lilyborgi</i>				x						
" <i>casertanum</i>		x	x	x		x			x	x x
" <i>obtusale?</i>						x				x
Family AMNICOLIDAE										
<i>Ammicola integra</i>	x						x	x		
<i>Somatogyrus depressus</i>	x									
Family VALVATIDAE										
<i>Valvata tricarinata</i>	x	x	x		x		x		x	x
Family PLEUROCERIDAE										
<i>Goniobasis?</i>	x									
Family HYDROBIDAE										
<i>Probythinella lacustris</i>										x
Family POMATIOPSISIDAE										
<i>Pomatiopsis lapidaria</i>	x							x		
Family FERRISSIIDAE										
<i>Ferrissiana meekiana</i>				x		x				x
<i>Laevapex fuscus</i>						x				
" <i>kirklandi</i>						x				
Family PHYSIDAE										
<i>Physa antina</i>	x	x	x	x	x	x		x		x
" <i>gyrina</i>	x			x	x					x
" <i>skinneri</i>										x
" <i>humerosa</i>						x				
<i>Aplexia hypnorum</i>			x			x	x		x	x
Family LYMNAEIDAE										
<i>Lymnaea dalli</i>	x		x	x	x	x	x	x	x	x
" <i>caperata</i>	x	x	x	x	x	x	x	x	x	x
" <i>obrussa</i>		x			x	x	x		x	
" <i>bulimoides</i>	x	x			x		x			
" <i>modicella</i>					x		x			
" <i>cockerelli</i>										x
" <i>palustris</i>				x	x	x				x
" <i>exilis</i>				x				x	x	
" <i>reflexa</i>	x									
" <i>stagnalis jugularis</i>				x						x
Family PLANORBIDAE										
<i>Gyraulus circumstriatus</i>		x	x	x	x	x	x	x	x	x
" <i>parvus</i>	x	x	x	x	x	x	x	x	x	x
" <i>crista</i>				x					x	
" <i>labiatus</i>		x	x							
" <i>similaris</i>		x	x							
<i>Menetus dilatatus</i>							x			
<i>Promenetus kansasensis</i> (M. <i>pearletti</i>)		x	x			x				
" <i>bavasensis</i>										x
" <i>umblicatellus</i>		x		x						
" <i>exacuus</i>			x			x				
<i>Armigera crista</i>			x	x					x	x
<i>Planorbula armigera</i>	x						x	x	x	
<i>Helisoma trivolvis</i>	x	x	x	x	x	x	x	x	x	x
" <i>anceps</i>	x	x			x	x	x	x		
Family ZONITIDAE										
<i>Hawaia minuscula</i>	x	x	x	x	x	x	x	x	x	x
<i>Euconulus fulvus</i>	x			x	x	x		x		x
<i>Zonitoides arboreus</i>	x			x	x	x	x			x
<i>Retinella indentata</i>	x						x	x		
" <i>roemeri</i>						x				
" <i>electrina</i>				x	x	x		x		x
Family POLYGYRIDAE										
<i>Stenotrema leai</i>				x	x	x	x	x	x	x
<i>Mesodon thyroidus</i>	x						x			
" <i>indianorum</i>					x					
<i>Polygyra texasiana</i>							x	x		
<i>Praticolella berlandieriana</i>								x		
Family SUCCINEIDAE										
<i>Succinea avara</i>										x
" <i>ovalis</i>	x	x	x							x
" <i>luteola</i>					x					
<i>Oxyloma retusa</i>									x	x
Family BULIMULIDAE										
<i>Bulimulus dealbatus</i>							x	x		
Family HELICINIDAE										
<i>Helicina orbiculata tropica</i>	x						x	x		
Family LIMACIDAE										
<i>Deroceras laeve</i>							x			x
" <i>aenigma</i>							x			
Family ENDODONTIDAE										
<i>Helicodiscus parallelus</i>	x	x	x	x	x	x	x	x	x	x
" <i>singleyanus</i>	x				x			x		x
<i>Discus cronkbiti</i>	x	x	x				x			x
<i>Anguispira alternata</i>								x		
<i>Punctum minutissimum</i>							x			
Family STROBILOPSIDAE										
<i>Strobilops texasiana</i>	x						x	x		
" <i>labyrinthica</i>							x			x
" <i>sparsicosta</i>										x
Family VALONIIDAE										
<i>Vallonia gracilicosta</i>	x			x	x	x				x
" <i>parvula</i>							x			
" <i>costa</i>		x	x							
Family CARYCHIIDAE										
<i>Carychium exile</i>								x		
" <i>exiguum</i>	x	x					x	x		x
Family CIONELLIDAE										
<i>Cionella lubrica</i>								x		x
Family PUPILLIDAE										
<i>Gastrocopta armifera</i>	x	x	x	x	x	x	x	x	x	x
" <i>proarmifera</i>				x						
" <i>contracta</i>				x			x			x
" <i>cristata</i>		x	x	x	x	x				x
" <i>bolzingeri</i>				x			x			
" <i>procera</i>	x	x	x	x	x	x	x			x
" <i>procera sterckiana</i>	x							x		
" <i>procera mcclungi</i>	x									
" <i>tappaniana</i>				x	x	x		x	x	x
" <i>pentodon</i>	x						x	x		
" <i>corticaria</i>							x			
" <i>pellucida bordeacella</i>				x	x			x		
<i>Pupilla blandi</i>	x			x	x	*				x
" <i>muscorum</i>		x	x		x					x
<i>Pupoides bordaceus</i>		x								x
<i>Vertigo milium</i>		x	x	x	x	x		x	x	x
" <i>ovata</i>								x		
" <i>goldi</i>				x						
<i>Pupoides inornatus</i>				x						
" <i>albilabris</i>	x	x	x	x	x	x	x	x	x	x