LATE CENOZOIC NON-MARINE MOLLUSCAN ASSOCIATIONS IN EASTERN NORTH AMERICA

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INTRODUCTION

The significance of fossil assemblages must be evaluated by comparison with living associations. In the case of Pleistocene assemblages, there is an abundance of data of this nature in the literature but they are not easily accessible for two reasons: first, they are widely scattered, and second, their nomenclature has varied enormously over the last hundred years. During the course of several investigations by the writer and his colleagues the need for making such comparisons has led to the preparation of data from many scattered sources, both published and unpublished, which are presented here. The lists in this report are given in a uniform classification which follows as closely as possible the currently accepted pattern.

These lists will permit the paleoecologist to locate with little effort assemblages recorded for a variety of environments; to ascertain the recorded frequency of a given species in these assemblages; and to see at a glance the frequency of association of a given molluscan species with others.

Examination of the lists will show how very diverse the elements of a Pleistocene assemblage can be. Taylor (1960: 22 et seq.) has brought this out by grouping species according to provenance and his lists (e. g. PLI. 1-4) have been cited here in the order originally given. An assemblage may include representatives of five main groups: (a) Naiades, (b) Sphaeriidae, (c) freshwater gill-breathing snails, (d) freshwater lung-breathing snails, and (e) land snails. It is immediately evident that not all these elements are present in each assemblage, either because of insufficient collecting or unavailability of one or more of the groups. It is equally evident that once the ecological preferences of particular species are understood, an assemblage can be analyzed in detail, its elements isolated, and the nature of the habitats in which they lived can be recognized with considerable accuracy.

Percentages of total individuals have been given wherever such data were available and statements on frequency or rarity of species have also been added even though they are not as useful as percentages.

This paper is divided into three main parts: first, a review of the basic assumptions on which the paleoecologic interpretation of molluscan assemblages rests; second, the lists which constitute the data to be interpreted; and third, a review of the elements of the faunas listed, species by species, with information on frequency of association with other species, preferences as to habitat, and tentative conclusions on the

significance of the species from a paleoecological standpoint. Finally, the papers cited briefly in the text will be listed in full under References Cited. Since this paper is much too long for a single number of STERKIANA, it will appear in several parts, as space and the urgency of other manuscripts will permit. A table of contents will be included with the last part of the paper to appear and special pagination will permit reference to the paper as a whole.

BASIC ASSUMPTIONS IN PALEOECOLOGIC INTERPRETATION OF MOLLUSCAN ASSEMBLAGES

PRIMARY DATA. The significance of a given Pleistocene molluscan assemblage, from the standpoint of environment, is derived from the composition of the assemblage and the lithologic nature of the deposit in which it was preserved. The geographic location of the deposit is an important factor also, in comparison with the known present distribution of the species involved. Most of the species studied are still living, so that there is no doubt about their environmental preferences at present. Transposition of such data to a fossil assemblage nevertheless involves a measure of uncertainty which stems from the validity of a number of assumptions. The investigator who wishes to present as accurate a picture as he can of the fossil assemblages he studies must be constantly aware of these assumptions and from time to time he must review their validity. In the following paragraphs, these assumptions are reviewed and the writer's present evaluation - subject to change as new data become available - is summarized.

IDENTIFICATION OF SPECIES. All the Mollusca involved in this study must of necessity be identified by shell alone. Such a procedure is theoretically unsound for living species, since specific criteria are found mainly in the soft parts of the animal. At first sight, this would cast some doubt on the validity of the identification of ALL Pleistocene species and this point must be kept in mind for several groups whose shell characteristics are undiagnostic. On the other hand, malacologists have long ago established a relationship between diagnostic criteria in many species and inconspicuous but valid shell characteristics on which specific identifications can reasonably be established. In practice, few malacologists hesitate to identify a Recent shell to species without checking the soft parts. In doing so, they rely on experience and knowledge of the range of variability within groups that have long been familiar to them. Within limits, the same thing can be done with Pleistocene shells by comparing them with those of living Mollusca. For supraspecific groups, the shell of Pleistocene forms can yield little that is of diagnostic value as subgenera and genera rest almost entirely on characters of the soft parts of the animal although, ironically enough, most of the genera were originally described on the basis of shell characters alone.

The basic assumption here is that identification of the shell is equivalent to identification to species. With some exceptions (e. g. the Succineidae), this assumption appears to be valid and has been accepted throughout this report. Its acceptance may lead to error in isolated cases but in the great majority of instances there is such a wealth of corroborating detail to support it that it seems inevitable to do so.

CONSTANCY OF ENVIRONMENTAL PREFERENCES. It seems reasonable to assume that a species living in a given environment now must have preferred the same environment in the past. As long as this concept is applied to Pleistocene assemblages of species still living, there seems to be little likelihood of error in accepting this assumption. It may be more hazardous to extend the concept to extinct species belonging to living genera, especially when the identification to genus rests on shell characters, and to extrapolate from living species of one genus to extinct species assumed to belong to the same genus. Happily for Pleistocene paleoecologists, the

majority of the species they deal with are still living and the enigmas presented by the few extinct species (e. g. Anisus pattersoni and some species of Discus) can be solved by the association of these species with others, still living, whose environmental preferences are well known.

BIOCOENOSE AND THANATOCOENOSE. A given Pleistocene molluscan assemblage may be composed (a) exclusively of species that lived in the area where they are preserved (biocoenose) or (b) of species that lived in the area where they are preserved plus others which have been brought to the same area after death (thanatocoenose). Analysis of the composition of numerous Pleistocene assemblages (Taylor, 1960; La Rocque, 1952; Reynolds, 1959; Zimmerman, 1960; Mowery, 1961; Clark, 1961; Cornejo, 1961; Aukeman, 1960; Sheatsley, 1960; and others) shows that most of them are thanatocoenoses in which land snails have been mixed with freshwater snails, bottom-living forms with those living in waterweed above the bottom. In some of these assemblages it is even possible to detect admixture of aquatic environments (e. g. creek species in a lacustrine assemblage). Faced with such diversity in the assemblages he studies, the Pleistocene paleontologist must either (a) accept all, or most, of them as biocoenoses in the widest sense and radically revise his ideas concerning the validity of his assumption on constancy of environmental preferences, or (b) accept the idea that he is dealing with thanatocoenoses containing a variety of elements from various environments, brought together in one place by natural agents (sheet-wash, rills, streams, and currents) and look to other data than the total assemblage for the nature of the actual environment of deposition. In the majority of cases, assumption (b) seems to be preferable to assumption (a), especially where unquestioned land snails are found in the same deposit with unquestioned freshwater forms. It is most reasonable to assume that the land area surrounding a lake or stream will be populated by land snails and that their shells will be carried after death down slope to the bed of the lake or stream where they will be preserved, intimately mixed with freshwater species. The assumption is confirmed if quantitative methods (see below) are accepted as valid.

RULE OF RELATIVE ABUNDANCE. In a given environment, the native species (autochthones) should be more abundant than those brought in from other environments (allochthones). This is a summary statement of what may be called the rule of relative abundance. The rule is based on the relative productivity of each species involved, not on the numerical abundance of the species within a given assemblage, although, in practice, the two are almost identical for the majority of cases. This concept is exemplified in the composition of the molluscan fauna of a lake or stream at the present time: on the bottom of any body of water, living animals and shells of freshwater forms far outnumber shells of land snails washed into the water. The comparison is even more striking when large collections of beach drift are studied. Numerous counts have been made by the writer and his students on collections from the shores of Lake Erie in Ohio. Such collections contain a surprising variety of land snails yet the proportion between freshwater forms and land forms is always heavily in favor of the former. In one collection from the mouth of Sandusky Bay, only 12 species of freshwater snails and clams were represented and 15 of land snails. In spite of the greater number of land species, the total number of individuals of freshwater snails alone was 20 times greater than that of land snails. Such a large disproportion is accounted for in part by the much greater productivity of freshwater forms but even if a correcting factor is applied for this discrepancy, the proportion of freshwater forms is still significantly greater.

It seems safe to assume, therefore, that in a given assemblage of some size (hundreds of individuals), the most abundant forms are native to the environment and the rarer forms are intruders from another environment.

The rule of relative abundance is not invariable.

It is conceivable that land snails could be washed into an aquatic environment unsuitable for the existence of freshwater Mollusca. Unusual environments, such as woods pools, may contain a greater proportion of land snail shells than of freshwater shells, since the pool may be dry most of the year but moist enough to support a large land snail population, whereas the freshwater forms have only a limited period of time to live, feed, and reproduce, and must estivate in the mud of the pool during dry periods. Another possible exception arises from the fact that when the paleontologist is speaking of assemblages he is extrapolating from a relatively small sample of that assemblage to the assemblage as a whole. It is conceivable that a sample, obtained near the margin of a very shallow lake subject to seasonal fluctuations of water level, would contain more autochthonous land snails than freshwater snails and clams; yet the natural inclination would be to interpret the sample as representing a freshwater environment because of the presence of clams.

The rule of relative abundance should be applied with great caution in the interpretation of freshwater assemblages. It is a well-known fact that some freshwater forms enjoy high productivity (*Valvata tricarinata*, *Gyraulus*, *Lymnaea stagnalis*, *Fossaria*, among others) whereas others are invariably scarce, even in favorable present-day environments (e. g. *Acella haldemani*). Proportionally scarce freshwater snails are not necessarily intruders from a nearby but different environment; too many factors influence the relative abundance of such organisms to permit definite conclusions.

In the final analysis, the rule of relative abundance seems to be a valuable tool in the interpretation of Pleistocene environments in spite of the uncertainties which it implies for finer detail. The many deposits studied in detail which are discussed in this report seem to bear out its usefulness and to justify the painstaking collecting and counting methods which are a necessary prerequisite for its use.

RELATION OF ENCLOSING SEDIMENTS TO MOLLUSCAN ASSEMBLAGES. It is assumed throughout this study that the sediments within a given deposit reflect the conditions under which the Mollusca existed. The assumption has been accepted implicitly by the investigators concerned, possibly because of their geological background, but it is worth emphasizing that the assumption has validity. For example, there is a close relationship between the pH of a given body of water and the precipitation of marl; between the presence of peat in a given bed and the presence of vegetation on the lake bottom which it represents; between the proportion of clastics to precipitates and the distance from shore in a lacustrine environment. The data from sedimentation and those from molluscan assemblages are in remarkable agreement for lacustrine and fluviatile environments. The few puzzling cases may be due to the commonly observed gradation between two arbitrarily defined environments which is discussed in the next two sections.

VARIABILITY OF STREAM ENVIRONMENTS AND ASSEMBLAGES. Flowing-water environments support a distinctive molluscan assemblage which is easily recognizable; likewise, their sediments have a character which is easily separated by the sedimentologist from lacustrine sediments. On the other hand, many areas within a stream take on a lacustrine characteristic because the flow of water is impeded for one reason or another. The extreme example is the oxbow lake, once part of the main stream, then cut off from it and filled with stagnant water. None of the deposits in this study is of this nature, so far as I know, but it is conceivable that they might be recognized in the multitude of Pleistocene deposits as yet unstudied. Ponded areas of streams, caused by some form of damming, present apparently incongruous relationships between lacustrine sediments and a stream molluscan fauna. The Humboldt deposit (Reynolds, 1959) may be of this nature. Unfortunately, the surviving deposit is not extensive enough to prove the point as most of it has been eroded away. Nevertheless,

the geologic situation and the molluscan assemblages favor this interpretation.

In summary, when a deposit has been recognized as one that was laid down in a stream, it should be assumed that many variations are possible in its history; such variations should be looked for in the stratigraphic changes in sediments and molluscan faunas rather than excluded on the grounds that streams always yield typically running-water assemblages.

VARIABILITY OF LACUSTRINE ASSEMBLAGES. The nature of the bottom of a lake and the sediments accumulated on it are factors that influence the composition of a lacustrine molluscan assemblage. Theoretically, a Pleistocene lake may go through three main stages from its inception to its extinction in a glaciated region. In the first stage, clays, silts, and gravel, derived from the till surface, accumulate on a bottom relatively devoid of vegetation. In the second stage, marl accumulates by precipitation, either chemical or through the agency of such plants as Chara. In the third stage, the lake bed fills up, water becomes shallower, more and more vegetation invades it, and peat accumulates. Wherever the auger or the measured section penetrate to till, the first stage is represented in a lake deposit. The second stage may be represented by thick, pure marl, but many variations have been observed in which the marl gradually supplants clay or silt as the dominant sediment and where it is interrupted by beds of peat or peaty marl. In some cases, the third stage is not represented at all in measured sections, either because the overlying peat has been eroded away or the lake never reached the stage in which peat could be formed. In studying lacustrine deposits, therefore, it is assumed that lithologic changes have significance; in several cases, there is close correlation between lithologic change, even gradual, and change in composition of the molluscan fauna.

Another factor in the variability of lacustrine assemblages is the result of proximity of the section studied to inlets or outlets. The running-water environment of the inlet persists to some distance into a lake. This influence is reflected in differences in the sediments and a greater influx of stream species into the molluscan fauna. Likewise, the area in the immediate vicinity of the outlet of the lake - if it has one - presents minor differences when compared with an area away from the outlet.

It is assumed that most, if not all, of these factors are reflected in the sediments and the molluscan fauna of a given sample. The assumption can be correct only insofar as the data on which it rests are correct. Some success in interpretation has been achieved in this respect but other interpretations have been suggested which were thought to be too inconclusive to include in this report.

CHANGING COMPOSITION OF THE LIVING FAUNA. Maps showing distribution of living species have an air of static finality which is quite artificial. It should be pointed out that they are based on records accumulated in less than two centuries and that they portray a situation at a moment in time based on incomplete data. Two examples, Bulimnea megasoma and Acella haldemani, will suffice to demonstrate the point. These two species were unrecorded as fossils in Ohio until 1960. Their presence here demonstrates how normal spread may expand the range of a given species on our maps and how local extinctions - both species are most probably extinct in Ohio - may restrict ranges. The assumption which should be made, in my opinion, concerning living molluscan assemblages is that they are not fixed and that they are subject to addition and subtraction in a given area by normal agencies without human interference.

On the other hand, the effect of human interference on the composition of living assemblages must not be neglected. In Ohio, there is scarcely a body of water whose molluscan fauna has remained untouched. Pollution of streams and lakes has brought about local extinction or near-extinction of many species formerly common. Local extinctions may be temporary, but their effect on distribution records must not be overlooked. Native American species have been

introduced into areas formerly denied to them by the building of canals in the first half of the nineteenth century. In addition, European species have been introduced into most areas of North America.

In studying a fossil assemblage, therefore, we should be prepared to observe changes by natural introduction, independent of physical environmental conditions, and to observe extinctions, possibly more closely related to physican environmental conditions than introductions.

In comparing a given Pleistocene assemblage with the living fauna of the same region, the assumption should be that the living fauna is made up of several elements some of which, particularly the introductions and extinctions due to human influence, have little or nothing to do with the interpretation of the fossil assemblage.

CONCLUSIONS. The assumptions and limitations just outlined have led to the adoption of collecting and laboratory techniques which yield more exact results than more or less indiscriminate sampling. These methods did not evolve all at once and some of the earlier work I have done on the subject would be undertaken quite differently now. The methods, outlined elsewhere (La Rocque, 1960) rest on the assumptions just stated and discussed.

It is assumed that the collecting, to be significant, must be done from successive, relatively thin units, of equal volume, from a single measured section at a time. In practice, the unit adopted was two inches thick but variation of the lithologic units and the field situation led to some variation.

It is assumed that valid comparisons can be made between units of one section and separate deposits on the basis of relative abundance, expressed as percentages of the total number of individuals. Such comparisons can only be rough measures because of the variation in size of the species involved. I have tried (La Rocque, 1952) to compute volume percentages for one deposit but the differences between volume percentages and total individual percentages are not significant enough to warrant such computations in each case.

PLIOCENE ASSEMBLAGES

PLI - 1. KANSAS: Saw Rock Canyon local fauna: near the center of the west line of sec. 36, T. 34 S., R. 31 W., Seward County. (Taylor, 1960: 22). Explanation of abbreviations: A, abundant >1,000; C, common (101-1,000); S, scarce (21-100); R, rare (1-20).

Permanent water, pond or stream:	
Helisoma anceps (Menke)	R
Marstonia crybetes (Leonard)	C
M. decepta (Baker)	R
Sphaerium striatinum (Lamarck)	R
Permanent water, stream:	
Ferrissia rivularis (Say)	C
Permanent to temporary water:	
Permanent or subpermanent:	
Promenetus kansasensis (Baker)	A
Physa anatina Lea	A
Permanent or temporary:	
Gyraulus parvus (Say)	A
Stagnicola sp.	R
Temporary pond or marginal pool:	
Promenetus umbilicatellus (Ckll.)	C
Pisidium casertanum (Poli)	C
Temporary pond or stream:	
Stagnicola bulimoides techella (Hald.)	R
Marginal pools or wet mud:	
Fossaria dalli (Baker)	C
Moister humus:	
Vertigo milium (Gould)	R
Damp humus or grass:	
Gastrocopta holzingeri (Sterki)	R
G. tappaniana (Adams)	S
Damp humus of wooded area:	
Nesovitrea? sp.	R
Strobilops labyrinthica (Say)	S

PLI - 1. KANSAS (cont.)

Damp to dry ground:	
Hawaiia minuscula (Binney)	S
Helicodiscus singleyanus (Pilsbry)	R
Pupoides albilabris (Adams)	R
Uncertain:	
Deroceras aenigma Leonard	C
Gastrocopta franzenae Taylor	R
G. paracristata Franzen & Leonard	S
G. rexroadensis Franzen & Leonard	R
Sphaerium sp.	R
cf. Succinea	C
Vallonia perspectiva Sterki	R
Vertigo hibbardi Baker	C

PLI - 2. TEXAS: Red Corral local fauna: northern Oldham County. (Taylor, 1960: 25). Explanation of abbreviations: A, abundant (>100); C, common (21-100); S, scarce (6-20); R, rare (1-5).

Permanent stream:	
Ferrissia rivularis (Say)	R
Permanent to temporary water:	
Permanent or subpermanent:	
Physa anatina Lea	A
Promenetus kansasensis (Baker)	S
Permanent or temporary:	
Gyraulus parvus (Say)	A
Temporary water:	
Temporary pool or marginal pool:	
Pisidium casertanum (Poli)	C
Promenetus umbilicatellus (Ckll.)	A
Temporary pond or stream:	
Stagnicola bulimoides techella (Hald.)	A
Moister humus:	
Vertigo milium (Gould)	C
Damp humus of wooded area:	
Strobilops sparsicostata Baker	R
Damp to dry ground:	
Hawaiia minuscula (Binney)	R
Uncertain:	
Deroceras aenigma Leonard	C
Gastrocopta paracristata Fr. & Leonard	R
G. pellucida hordeacella (Pilsbry)	R
G. rexroadensis Franzen & Leonard	R
G. franzenae Taylor	C
Pupoides inornatus Vanatta	R
cf. Succinea	R
Pupillid?	R

PLI - 3. KANSAS: Rexroad local fauna: Meade County. (Taylor, 1960: 27). Explanation of abbreviations: A, abundant (>225); C, common (41-225); S, scarce (8-40). Four assemblages compared (1-4).

	1	2	3	4a	4b
Permanent water, stream:					
Ferrissia rivularis (Say)	-	-	S	-	-
Permanent water, pond or stream:					
Marstonia crybetes (Leonard)	R	-	-	-	R
?Ligumia subrostrata (Say)	-	-	R	-	-
Permanent to temporary water:					
Permanent or subpermanent:					
Physa anatina Lea	S	R	C	-	A
Promenetus kansasensis (Baker)	R	-	S	-	-
Permanent or temporary:					
Stagnicola exilis (Lea)	C	-	R	-	A
Temporary water:					
Temporary pond or marginal pool:					
Pisidium casertanum (Poli)	-	R	R	-	-
Promenetus umbilicatellus (Ckll.)	A	-	-	-	-
Temporary pond or stream:					
Stagnicola bulim. techella (Hald.)	A	R	-	-	-
Marginal pools and wet mud:					
Fossaria dalli Baker	R	R	R	A	-
Moister humus:					
Carychium exiguum (Say)	-	-	C	-	-
Vertigo milium (Gould)	-	S	C	-	R
Damp humus or grass:					
Gastrocopta holzingeri (Sterki)	R	S	C	-	-
G. tappaniana (Adams)	-	S	S	-	R
Vallonia gracilicosta Reinhardt	-	-	A	-	-
Damp humus of wooded area:					
Nesovitrea electrina (Gould)	-	-	C	-	-
Strobilops sparsicostata Baker	R	-	A	-	R
Damp to dry ground:					
Hawaiia minuscula (Binney)	S	C	A	-	A
Helicodiscus singleyanus (Pilsbry)	-	C	A	-	S
Pupoides albilabris (Adams)	S	C	C	S	C
Uncertain:					
Deroceras aenigma Leonard	S	R	A	A	R
Gastrocopta franzenae Taylor	-	A	A	-	A
G. paracristata Fr. & Leonard	R	S	S	-	C
G. pellucida hordeacella (Pils.)	-	-	R	-	-
Polygyra rexroadensis Taylor	-	S	C	-	R
Pupoides inornatus Vanatta	-	S	C	-	-
cf. Succinea	C	S	A	-	R
Vallonia perspectiva Sterki	-	S	C	-	-
Vertigo hibbardi Baker	-	R	S	-	-

PLI - 4. KANSAS: Bender local fauna. 1. Three sites (1a, 1b, 1c) at the same stratigraphic level, in exposures within about an eighth of a mile along the banks of a tributary of Stump Arroyo, SE 1/4 SW 1/4 sec. 22, T. 33 S., R. 29 W., Meade Co. 2: Seward County, Wolf Canyon, in approximately the center of W 1/2 sec. 12, T. 35 S., R. 31 W., uppermost part of the Rexroad formation, above massive caliche bed. (Taylor, 1960: 31-32). A, abundant (>250); C, common (41-250); S, scarce (8-40); R, rare (1-7).

	1a	1b	1c	2
Permanent to subpermanent water:				
Physa anatina Lea	R	R	-	C
Permanent or temporary water:				
Stagnicola sp.	R	--	-	S
Temporary pond or marginal pool:				
S. caperata (Say)	S	-	R	C
Promenetus umbilicatellus (Cockerell)	S	-	S	C
Temporary pond or stream:				
Stagnicola bulimoides techella (Hald.)	S	-	S	C
Marginal pools and wet mud:				
Fossaria dalli (Baker)	-	S	R	R
Moister humus:				
Vertigo milium (Gould)	C	R	C	-
Damp humus or grass:				
Gastrocopta tappaniana (Adams)	R	S	-	-
Vallonia parvula Sterki	S	-	R	-
Damp to dry ground:				
Gastrocopta cristata (Pilsbry & Vanatta)	A	-	A	-
Hawaiia minuscula (Binney)	A	C	A	C
Helicodiscus singleyanus (Pilsbry)	S	A	C	R
Pupoides albilabris (Adams)	C	C	C	S
Uncertain:				
Deroceras aenigma Leonard	C	-	C	-
Gastrocopta franzenae Taylor	-	S	-	C
G. paracristata Fr. & Leonard	A	A	C	C
G. scaevoscala Taylor	S	-	S	-
Polygyra rexroadensis Taylor	-	S	-	-
cf. Succinea	S	-	S	C

NEBRASKAN OR AFTONIAN ASSEMBLAGES

N - 1. NEBRASKA: Sand Draw local fauna: northern Brown County. (Taylor, 1960: 32). Seven localities, three levels. A: 1; B: 2-3; C: 4-7. A, abundant (>200); C, common (41-200); S, scarce (16-40); R, rare (1-15).

	1	2	3	4	5	6	7
Permanent water, pond:							
Acroloxus coloradensis (Henderson)	-	-	S	-	-	-	-
Bulimnea megasoma (Say)	S	R	C	R	-	R	-
Valvata lewisi Currier	-	-	-	-	C	A	-
Permanent water, pond or stream:							
Helisoma anceps (Menke)	C	R	A	-	-	R	-
Pisidium compressum Prime	A	-	A	-	-	R	-
P. nitidum Jenyns	-	-	C	-	-	-	R
Sphaerium partumeium (Say)	C	-	-	-	-	-	-
S. striatinum (Lamarck)	R	-	R	-	-	-	-
S. sulcatum (Lamarck)	R	-	-	-	-	-	-
S. transversum (Say)	-	S	-	-	-	-	-
Valvata tricarinata (Say)	-	C	A	-	-	-	-
?Anodonta grandis Say	-	R	-	-	-	-	-
Permanent water, stream:							
Ferrissia rivularis (Say)	C	R	A	-	-	-	-

N-1, NEBRASKA (cont.)	1	2	3	4	5	6	7
Permanent to temporary water:							
Permanent or subpermanent:							
Planorbula armigera (Say)	C	-	-	R	-	-	-
Physa anatina Lea	-	R	C	R	S	R	-
Promenetus kansasensis (Baker)	C	C	A	C	A	A	C
Permanent or temporary:							
Gyraulus parvus (Say)	A	C	A	A	A	A	C
Physa gyrina Say	R	R	-	-	-	-	-
Stagnicola cf. S. reflexa (Say)	C	S	A	C	A	A	C
Temporary pond or marginal pool:							
Aplexa hypnorum (Linnaeus)	-	-	R	R	A	R	-
Pisidium casertanum (Poli)	-	-	R	S	S	R	R
Promenetus umbilicatellus (Ckll.)	R	S	A	C	A	A	A
Stagnicola caperata (Say)	-	S	S	R	A	A	S
Marginal pools and wet mud:							
Fossaria dalli (Baker)	-	R	-	-	-	R	-
F. obrussa (Say)	-	-	C	-	-	-	-
Moister humus:							
Carychium sp.	-	-	R	-	-	-	-
Vertigo milium (Gould)	-	R	R	R	S	S	-
V. ovata Say	-	R	S	S	C	S	R
Damp humus or grass:							
Gastrocopta tappaniana (Adams)	-	-	R	-	R	S	-
Vallonia pulchella (Müller)	-	-	R	-	-	R	-
Damp to dry ground:							
Gastrocopta cristata (P. & V.)	-	-	-	-	R	R	-
Hawaiia minuscula (Binney)	R	R	R	-	-	R	R
Helicodiscus singleyanus (Pilsbry)	-	R	-	-	-	-	-
Pupoides albilabris (Adams)	-	R	-	-	-	S	-
Uncertain:							
Anisus pattersoni (Baker)	-	R	C	R	R	A	C
Deroceras aenigma Leonard	R	-	R	C	-	R	R
Ferrissia meekiana (Stimpson)	R	-	R	-	-	-	-
Gastrocopta chauliodonta Taylor	-	S	R	-	-	R	R
Physa skinneri Taylor	-	R	C	R	C	C	S
Pupoides inornatus Vanatta	-	R	-	-	-	-	-
Strobilops sparsicostata Baker	-	R	R	-	-	-	-
cf. Succinea	R	R	S	R	C	S	S

N - 2. KANSAS: Dixon local fauna: Kingman County, south-central Kansas. Two localities: 1. S 1/2 sec. 12, T. 29 S., R. 8 W. -- 2. SE 1/4 NE 1/4 sec. 23, T. 30 S., R. 5 W. (Taylor, 1960: 39). A, abundant (>250); C, common (41-250); S, scarce (8-40); R, rare (1-71).

	1	2
Permanent water, pond:		
Acroloxus coloradensis (Henderson)	R	R
Bulimnea megasoma (Say)	C	S
Sphaerium lacustre (Müller)	S	-
Permanent water, pond or stream:		
Helisoma anceps (Menke)	C	R
Marstonia crybetes (Leonard)	R	-
Pisidium compressum Prime	C	-
P. nitidum Jenyns	R	-
Sphaerium partumeium (Say)	-	C
S. transversum (Say)	R	-
Valvata tricarinata (Say)	-	S
Viviparidae, indet.	R	R
Hydrobiidae, indet.	R	-

N-2. KANSAS (cont.)	1	2
Permanent water, stream:		
Ferrissia rivularis (Say)	C	-
Permanent to temporary water:		
Permanent or subpermanent:		
Helisoma trivolvis (Say)	R	C
Physa anatina Lea	C	-
Planorbula armigera (Say)	R	C
Promenetus kansasensis (Baker)	A	C
Permanent or temporary:		
Gyraulus parvus (Say)	A	A
Physa gyrina (Say)	C	C
Temporary pond or marginal pool:		
Pisidium casertanum (Poli)	R	-
Promenetus umbilicatellus (Ckll.)	S	R
Stagnicola caperata (Say)	S	C
S. reflexa (Say)	A	A
Marginal pools and wet mud:		
Fossaria dalli (Baker)	S	R
Semiaquatic, riparian habitat:		
Oxyloma retusa (Lea)	S	S
Moister humus:		
Carychium exiguum (Say)	R	-
Vertigo ovata Say	C	R
V. milium (Gould)	C	S

N-2. KANSAS (cont.)	1	2
Damp humus or grass:		
Gastrocopta tappaniana (Adams)	C	S
Damp humus of wooded area:		
Helicodiscus parallelus (Say)	-	S
Nesovitrea electrina (Gould)	R	-
Strobilops sparsicostata Baker	R	-
Zonitoides arboreus (Say)	R	-
Damp to dry ground:		
Gastrocopta armifera (Say)	S	-
G. cristata (Pilsbry & Vanatta)	S	R
G. procera (Gould)	R	S
Hawaiia minuscula (Binney)	C	C
Helicodiscus singleyanus (Pilsbry)	R	A
Pupoides albilabris (Adams)	S	S
Uncertain:		
Anisus pattersoni (Baker)	S	-
Deroceras aenigma Leonard	C	R
Ferrissia meekiana (Stimpson)	R	C
Gastrocopta chauliodonta Taylor	S	-
G. pellucida hordeacella (Pilsbry)	-	R
G. scaevoscala Taylor	-	R
Physa skinneri Taylor	S	S
cf. Succinea	R	S
Vallonia perspectiva Sterki	R	-

AFTONIAN ASSEMBLAGE

A - 1. KANSAS: Sanders local fauna. Meade County, Kansas. (Taylor, 1960: 40). A, abundant (251); C, common (41-250); S, scarce (8-40); R, rare (1-7). Three localities.

Permanent to temporary water:	1	2	3
Permanent or subpermanent:			
Physa anatina Lea	S	R	R
Promenetus kansasensis (Baker)	-	R	R
Permanent or temporary:			
Gyraulus parvus (Say)	R	-	R
Stagnicola sp.	R	R	R
Temporary water; pond or marginal pool:			
Aplexa hypnorum (Linnaeus)	S	-	-
Stagnicola caperata (Say)	C	S	C
Promenetus umbilicatellus (Ckll.)	A	R	S
Temporary pond or stream:			
Stagnicola bulimoides techella (Hald.)	S	R	C
Marginal pools and wet mud:			
Fossaria dalli (Baker)	-	-	R

Moister humus:	1	2	3
Vertigo milium (Gould)	A	R	A
Vertigo ovata (Say)	R	-	-
Damp humus or grass:			
Gastrocopta tappaniana (Adams)	C	R	S
Damp to dry ground:			
Gastrocopta cristata (Pils. & Van.)	A	C	A
Hawaiia minuscula (Binney)	A	S	A
Helicodiscus singleyanus (Pilsbry)	-	S	R
Pupoides albilabris (Adams)	A	S	S
Uncertain:			
Deroceras aenigma Leonard	C	R	S
Gastrocopta chauliodonta Taylor	S	-	-
G. paracristata Fr. & Leonard	S	R	-
Physa skinneri Taylor	R	-	R
Pupillid, n. gen.?	-	-	R
cf. Succinea	C	S	C
Vallonia perspectiva (Sterki)	C	R	R

KANSAN ASSEMBLAGES

K - 1. KANSAS: NW 1/4 sec. 19, T. 5 S., R. 22 W., Norton County. Meade formation, Grand Island member. (Frye and Leonard, 1954: 45). No abundance data.

Sphaeriidae
Pisidium compressum

Freshwater gill-breathing Gastropods:
Valvata lewisi
V. tricarinata

Freshwater lung-breathing Gastropods:
Anisus pattersoni
Gyraulus similaris
Menetus pearlettei
Promenetus umbilicatellus
Stagnicola caperata

Land Gastropods:
Carychium perexiguum
Deroceras aenigma
Discus cronkhitei
Gastrocopta proarmifera
Hawaiia minuscula
Stenotrema leaii
Vallonia gracilicosta
Vertigo milium
V. ovata.

K - 2. KANSAS: NW 1/4 sec. 11, T. 6 S., R. 13 W., Osborne County. Meade formation, Sappa member. (Frye and Leonard, 1954: 45). No abundance data.

Sphaeriidae
Pisidium compressum

Freshwater gill-breathing Gastropods:
Amnicola limosa parva
Valvata tricarinata

Freshwater lung-breathing Gastropods:
Anisus pattersoni
Gyraulus similaris
Helisoma trivolvis
Menetus pearlettei
Physa anatina
Stagnicola palustris

Land Gastropods:
Carychium perexiguum
Deroceras aenigma
Discus cronkhitei
Gastrocopta contracta
Helicodiscus parallelus
Hendersonia occulta
Nesovitrea electrina
Pupilla muscorum
Succinea grosvenori
Zonitoides arboreus

K - 3. KANSAS: SE 1/4 sec. 29, T. 4 S., R. 16 W., Phillips County. Meade formation, Grand Island member. (Frye and Leonard, 1954: 45). No abundance data.

Land Gastropods:
Gastrocopta armifera
G. cf. G. falcis
G. mcclungi
G. proarmifera
G. procera
Helicodiscus parallelus
H. singleyanus
Pupoides albilabris
Stenotrema leaii
Vallonia gracilicosta
V. pulchella

K - 4. KANSAS: SE 1/4 sec. 29, T. 4 S., R. 16 W., Phillips County. Meade formation, Sappa member. (Frye and Leonard, 1954: 45). No abundance data.

Freshwater gill-breathing Gastropods:
Valvata tricarinata

Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Armiger crista
Gyraulus labiatus
G. similaris
Helisoma trivolvis
Menetus pearlettei
Physa anatina
Promenetus umbilicatellus
Stagnicola bulimoides
S. caperata
S. palustris

Land Gastropods:
Hawaiia minuscula
Hendersonia occulta

K-4. KANSAS (cont.)
Pupilla muscorum
Succinea grosvenori
Vallonia gracilicosta
Vertigo modesta
V. ovata

K - 5. TEXAS: Cuts on north side of Texas Highway 256, 15 miles east of Silverton, Briscoe County. (Frye and Leonard, 1957: 41, their section No. 3, Tule formation, unit 3, sand, fine, and silt, massive, dark gray). No abundance data.

Sphaeriidae:
Pisidium sp.

Freshwater lung-breathing Gastropods:
Fossaria parva
Gyraulus labiatus
G. similaris
Physa anatina
Stagnicola bulimoides
S. caperata
S. palustris

Land Gastropods:
Discus cronkhitei
Gastrocopta proarmifera
Oxyloma sp. (?)
Pupoides albilabris
Vertigo milium
V. ovata

K - 6. INDIANA: Cagles Mill Reservoir section: SE 1/4 NW 1/4 sec. 13, T. 12 N., R. 5 E., Putnam County (Poland Quadrangle), emergency spillway for Cataract Lake, a flood control reservoir on Mill Creek (Thornbury and Wayne, 1957: 13-15; Wayne, 1958: 10). A highly fossiliferous, massive silt about a meter thick lies at the base of a Pleistocene section that includes tills of Kansan age and of Illinoian age. The silt bed is named the Cagle Silt and is a proglacial loess of Kansan age. Wayne (1959: 13-16), his assemblage A, 591 specimens.

Freshwater lung-breathing Gastropods:	Percent Total Individuals
Fossaria parva	0.3

Land Gastropods	P.T.I.[1]
Carychium exile canadense	9.3
Catinella gelida var.	8.9
Cionella lubrica	0.9
Columella edentula	1.6
Discus cronkhitei	6.6
Euconulus fulvus	1.9
Gastrocopta armifera	1.8
Hendersonia occulta	9.7
Nesovitrea electrina	1.6
Oxyloma decampi gouldi	6.2
Punctum minutissimum	3.2
Pupilla muscorum	1.6
Stenotrema leaii	4.6
Strobilops labyrinthica	34.7
Vallonia cf. V. excentrica	0.1
Vertigo alpestris oughtoni	0.3
V. elatior	4.3
V. gouldi hubrichti	1.9
V. modesta	0.5

K - 7. INDIANA: Happy Hollow Section: NE 1/4 SE 1/4 sec. 2, T. 14 N., R. 7 W., Parke County (Catlin Quadrangle), 3 miles northeast of Bridgeton along a small creek. Pebbly calcareous gray silt with humus stains at top, containing wood fragments and snail shells 0.30 m. thick, overlies 1.0 m. or more of very hard sandy gray till and is overlain by more than 2 m. of calcareous gray till. Entire section is considered to be of Kansan age on the basis of adjacent exposures. Wayne (1959: 13, 16), his assemblage B, 189 specimens.

Freshwater gill-breathing Gastropods:	P.T.I.
Valvata tricarinata	0.5
Freshwater lung-breathing Gastropods:	
Fossaria parva	1.5
Land Gastropods:	
Catinella gelida var.	12.0
Deroceras laeve	2.0
Gastrocopta armifera	3.0
Punctum minutissimum	36.0
Pupilla muscorum	2.5
Vallonia gracilicosta	19.5
Vertigo elatior	18.5
V. gouldi hannai	4.0

[1] Percent Total Individuals.

YARMOUTH ASSEMBLAGES

Y - 1. IOWA: Deposits exposed in road cut on the north side of U. S. Highway 18, Lyons County, Iowa, 2.5 miles east of Canton, South Dakota. Age determined on stratigraphic relations and characteristics of molluscan fauna. (Leonard, 1950: 6, 41; his locality 2). The fauna is entirely freshwater and includes quiet water, shallow, and moderately deep water species. Abbreviations: A, abundant; C, common; R, rare.

Sphaeriidae:	
Pisidium compressum	C
Freshwater gill-breathing Gastropods:	
Amnicola limosa parva	C
Valvata tricarinata	C
Freshwater lung-breathing Gastropods:	
Gyraulus labiatus	C
Helisoma cf. H. campanulatum wisconsinense	C
Menetus pearlettei	R
Planorbula nebraskensis	C
Stagnicola palustris	A

Y - 2. IOWA: Silts below Pearlette volcanic ash, exposed in Sec. 6, T. 81 N., R. 44 W., Harrison County, and in Sec. 36, T. 82 N., R. 44 W., Monona County, 1/2 mile east and 5 to 6 miles north of Little Sioux. Mollusca from stratified silts 0 to 5 feet below the Pearlette ash, which was apparently deposited in a shallow pond, probably a meander scar of the Missouri River or a tributary. Two localities are combined in the list, but exposures were practically continuous. (Leonard, 1950: 6, 41, his locality 3). Abbreviations as for Y - 1.

Sphaeriidae:	
Pisidium compressum	C
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	R
Ferrissia parallela	R
Promenetus umbilicatellus	C
Stagnicola palustris	C
Land Gastropods:	
Cionella lubrica	R
Deroceras aenigma	R
Discus cronkhitei	R
Euconulus fulvus	R
Gastrocopta cristata	R
G. proarmifera	R
G. tappaniana	R
Hawaiia minuscula	R
Hendersonia occulta	R
Nesovitrea electrina	R
Pupilla muscorum	C
Strobilops sparsicosta	R
Succinea grosvenori	R
Vallonia gracilicosta	R
V. pulchella	R
Vertigo milium	R
V. modesta	R
V. ovata	R

Y - 3. NEBRASKA: Center N line, NW 1/4, Sec. 34, T. 33 N., R. 4 W., approximately 6 miles southeast of Santee, Knox County. The fauna is found in gray silts below the Pearlette volcanic ash. (Leonard, 1950: 7, 41, his locality 5). Abbreviations as for Y - 1.

Freshwater lung-breathing Gastropods:	
Anisus pattersoni	R
Gyraulus labiatus	C
G. similaris	R.
Helisoma cf. H. campanulatum wisconsinense	R
Menetus pearlettei	R
Physa, indet.	R
Planorbula nebraskensis	C
Promenetus umbilicatellus	R
Stagnicola palustris	C
Land Gastropods:	
Carychium perexiguum	R
Deroceras aenigma	R
Gastrocopta armifera	R
G. tappaniana	R
Hawaiia minuscula	R
Pupoides albilabris	R
Succinea grosvenori	R
Vertigo ovata	R

Y - 4. NEBRASKA: An abandoned open-pit ash mine, formerly operated by the Cudahy Packing Co., SE 1/4, Sec. 11, T. 2 N., R. 20 W., approximately 5 miles northwest of Orleans, Harlan County. The mollusks occur here in sands and silts above the ash, and below a section of Loveland and Peoria silt. (Leonard, 1950: 7, 41, his locality 9). Abbreviations as for Y-1.

Sphaeriidae:	
Pisidium compressum	C
Freshwater lung-breathing Gastropods:	
Ferrissia parallela	C
Gyraulus labiatus	C
Helisoma cf. H. campanulatum wisconsinense	R
Menetus pearlettei	R
Physa, indet.	R
Planorbula nebraskensis	R
P. vulcanata	C
Stagnicola palustris	C
Land Gastropods:	
Carychium perexiguum	R
Discus cronkhitei	R
Gastrocopta tappaniana	R
Hawaiia minuscula	C
Pupoides albilabris	R
Succinea grosvenori	C
Vertigo milium	R

Y - 5. KANSAS: Road ditch, center N. line, SW 1/4, Sec. 33, T. 1 S., R. 9 W., 3 miles north and 1.8 miles west of Burr Oak, Jewell County. The fauna is found in 3 feet of coarse to fine sand below 3 feet of ash; the Pleistocene section rests on Niobrara chalk. Some mollusks are scattered through the fine sand; most of them are terrestrial species washed in from surrounding slopes. (Leonard, 1950: 7, 41, his locality 13). Abbreviations as for Y-1.

Freshwater lung-breathing Gastropods:	
Gyraulus similaris	R
Planorbula vulcanata	R
Land Gastropods:	
Carychium perexiguum	R
Deroceras aenigma	R
Discus cronkhitei	R

Y-5. KANSAS (cont.)

Euconulus fulvus	R
Gastrocopta tappaniana	C
Pupilla muscorum	R
Stenotrema leaii	R
Strobilops sparsicosta	C
Succinea grosvenori	C
Vallonia gracilicosta	C
Vertigo ovata	R

Y - 6. KANSAS: Exposure in ravine, NE 1/4, SW 1/4, Sec. 21, T. 13 S., R. 26 W., 11 miles south and 1.5 miles east of Quinter, Gove County. Mollusks occur in 6 feet of silt, sand, and pebbles of reworked Niobrara chalk below 13 feet of ash; the Pleistocene section rests on Niobrara chalk. The molluscan fauna is predominantly terrestrial, but there are a few species of aquatic habit. Plant remains, suggesting Typha, were found in the ash and in the gray silts immediately below. (Leonard, 1950: 7, 41, his locality 20). Abbreviations as for Y-1.

Freshwater lung-breathing Gastropods:	
Fossaria parva	C
Gyraulus labiatus	A
Land Gastropods:	
Carychium perexiguum	C
Cionella lubrica	C
Deroceras aenigma	R
Discus cronkhitei	R
Euconulus fulvus	R
Gastrocopta holzingeri	R
G. proarmifera	R
G. tappaniana	C
Hawaiia minuscula	C
Nesovitrea electrina	R
Pupilla muscorum	C
P. muscorum sinistra	R
Pupoides albilabris	C
Strobilops sparsicosta	A
Succinea grosvenori	C
Vallonia gracilicosta	C
Vertigo gouldi	R
V. milium	R

Y - 7. KANSAS: Road cut exposure, W line, Sec. 36, T. 14 S., R. 11 W., approximately 7

Y-7. KANSAS (cont.)
miles southeast of Dorrance, Russell County. The molluscan fauna occurs in stratified silt and fine sand below 0.7 foot of ash; the fauna is composed of aquatic and terrestrial species. The fauna from this locality has been listed as the Tobin faunule (Frye, Leonard, and Hibbard, 1943: 40-41). (Leonard, 1950: 7, 41, his locality 22). Abbreviations as for Y-1.

Sphaeriidae:	
Pisidium compressum	C
Freshwater gill-breathing Gastropods:	
Pomatiopsis cincinnatiensis	R
Valvata tricarinata	R
Freshwater lung-breathing Gastropods:	
Aplexa hypnorum	R
Ferrissia parallela	R
Fossaria parva	R
Helisoma trivolvis	C
Stagnicola caperata	C
S. palustris	R
Land Gastropods:	
Carychium perexiguum	R
Cionella lubrica	C
Deroceras aenigma	R
Discus cronkhitei	C
Euconulus fulvus	R
Gastrocopta proarmifera	C
G. tridentata	R
Hawaiia minuscula	C
Helicodiscus parallelus	C
Hendersonia occulta	C
Nesovitrea electrina	R
Pupilla muscorum	C
P. muscorum sinistra	R
Stenotrema leaii	C
Succinea grosvenori	C
Vallonia gracilicosta	C
Vertigo modesta	R
Zonitoides arboreus	C

Y - 8. KANSAS: Road cut, Sec. 28, T. 13 S., R. 10 W., approximately 9 miles south of Sylvan Grove, Lincoln County. The molluscan fauna was taken from stratified silts and sand below 7 feet of Pearlette ash. The exposure is situated in the abandoned Wilson Valley; the fauna has been previously reported (Frye, Leonard, and Hibbard, 1943: 41). (Leonard, 1950: 7, 41, his locality 23). Abbreviations as for Y-1.

Sphaeriidae:	
Pisidium compressum	C
Sphaerium sp.	C
Freshwater gill-breathing Gastropods:	
Valvata lewisi	R
V. tricarinata	R
Freshwater lung-breathing Gastropods:	
Fossaria parva	R
Gyraulus labiatus	A
Helisoma trivolvis	C
Lymnaea, indet.	R
Land Gastropods:	
Discus cronkhitei	C
Euconulus fulvus	R
Gastrocopta contracta	R
G. proarmifera	C
G. procera	C
G. tappaniana	C
Helicodiscus parallelus	C
Nesovitrea electrina	R
Pupilla muscorum	R
Stenotrema leaii	R
Succinea grosvenori	C
Vallonia gracilicosta	C
V. pulchella	C
Vertigo gouldi	R
V. milium	R
Zonitoides arboreus	C

Y - 9. KANSAS: Exposure in cut bank of small creek, NE 1/4 NW 1/4 Sec. 29, T. 10 S., R. 5 W., 10 miles northwest of Minneapolis, Ottawa County. The mollusks occur in limonite-infiltrated silts below 5 feet of Pearlette ash; both aquatic and terrestrial species are found. (Leonard, 1950: 7, 41, his locality 24). Abbreviations as for Y-1.

Sphaeriidae:	
Sphaerium sp.	C
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	C
Gyraulus labiatus	A
G. similaris	R

Y-9. KANSAS (cont.)

Helisoma cf. H. campanulatum wisconsinense	R
Menetus pearlettei	C
Physa elliptica	C
Planorbula vulcanata	C
Stagnicola palustris	A
S. reflexa	C
Land Gastropods:	
Oxyloma navarrei	C

Y - 10. KANSAS: Road cut exposure, SW 1/4, Sec. 35, T. 15 S., R. 2 E., 4 miles west of Navarre, Dickinson County. The molluscan fauna occurs in silty clay both above and below 1 foot of Pearlette ash; both terrestrial and aquatic species are found. (Leonard, 1950: 7, 41, his locality 25).

Freshwater gill-breathing Gastropods:	
Pomatiopsis cincinnatiensis	R
Freshwater lung-breathing Gastropods:	
Gyraulus labiatus	C
Helisoma trivolvis	C
Menetus pearlettei	C
Physa, indet.	R
Planorbula vulcanata	A
Promenetus umbilicatellus	C
Stagnicola palustris	A
Land Gastropods:	
Carychium perexiguum	R
Euconulus fulvus	R
Gastrocopta armifera	R
G. contracta	R
G. tappaniana	C
Hawaiia minuscula	A
Helicodiscus parallelus	C
Oxyloma navarrei	C
Vallonia gracilicosta	C
V. pulchella	C
Vertigo milium	R
V. ovata	C
V. tridentata	R
Zonitoides arboreus	C

Y - 11. KANSAS: Canyon exposure, Sec. 13, T. 30 S., R. 23 W., 13 miles east and 1/2 mile south of Minneola, Clark County. The molluscan fauna, composed of both aquatic and terrestrial species, occurs in sandy silt below 4 feet of Pearlette ash. (Leonard, 1950: 7, 41, his locality 33). Abbreviations as for Y - 1.

Sphaeriidae:	
Pisidium compressum	C
Sphaerium sp.	C
Freshwater gill-breathing Gastropods:	
Valvata tricarinata	R
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	R
Aplexa hypnorum	R
Fossaria parva	R
Gyraulus labiatus	A
Helisoma trivolvis	C
Lymnaea, ind.	R
Stagnicola bulimoides	C
Stagnicola palustris	C
Land Gastropods:	
Cionella lubrica	C
Deroceras aenigma	C
Gastrocopta falcis	R
G. proarmifera	A
G. tappaniana	C
Hawaiia minuscula	C
Helicodiscus parallelus	C
Nesovitrea electrina	R
Oxyloma navarrei	R
Pupilla muscorum sinistra	C
Pupoides albilabris	C
Stenotrema leaii	A
Succinea grosvenori	A
S. ovalis	C
Vallonia gracilicosta	A
V. pulchella	C
Vertigo ovata	A
Zonitoides arboreus	C

Y - 12. KANSAS: Exposure in abandoned open-pit ash mine, sec. 2, T. 31 S., R. 28 W., 6 miles north of Meade, Meade County. Mollusks occur in silts below 17 feet of Pearlette volcanic ash; the fauna is varied and the population is a dense one. Fossil vertebrates from these silts have been reported by Hibbard (1944: 719-740). (Leonard, 1950: 7, 41, his locality 34).

Y-12. KANSAS (cont.)

Sphaeriidae:	
Pisidium compressum	C
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	R
Aplexa hypnorum	R
Gyraulus similaris	C
Lymnaea, ind.	R
Planorbula vulcanata occidentalis	C
Promenetus umbilicatellus	C
Stagnicola reflexa	C
Land Gastropods:	
Carychium perexiguum	R
Cionella lubrica	C
Deroceras aenigma	C
Discus cronkhitei	C
Euconulus fulvus	R
Gastrocopta proarmifera	A
G. tappaniana	C
Hawaiia minuscula	C
Nesovitrea electrina	R
Pupilla muscorum	A
P. muscorum sinistra	A
Stenotrema leaii	A
Strobilops sparsicosta	C
Succinea avara	C
S. grosvenori	A
Vallonia gracilicosta	A
V. pulchella	C
Vertigo gouldii	R
V. milium	R
V. ovata	A
Zonitoides arboreus	C

Y - 13. KANSAS: Exposure in abandoned open-pit ash mine, SE 1/4, SE 1/4, sec. 35, T. 31 S., R. 28 W., 1 mile west and 1/2 mile north of Meade, Meade County. A molluscan fauna occurs in silts below 8 to 10 feet of Pearlette volcanic ash. (Leonard, 1950: 7, 41, his locality 35).

Sphaeriidae:	
Pisidium compressum	C
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	R
Aplexa hypnorum	R
Fossaria parva	C

Y-13. KANSAS (cont.)

Land Gastropods:	
Carychium perexiguum	C
Cionella lubrica	C
Deroceras aenigma	C
Discus cronkhitei	C
Euconulus fulvus	R
Gastrocopta cristata	A
G. falcis	R
G. proarmifera	A
Hawaiia minuscula	A
Nesovitrea electrina	R
Pupilla muscorum	A
Stenotrema leaii	C
Succinea grosvenori	A
Vallonia gracilicosta	A
Vertigo ovata	A

Y - 14. KANSAS: Exposure in open-pit ash mine, NE 1/4, sec. 26, T. 32 S., R. 28 W., 3 miles south of the east edge of Meade, Meade County. The molluscan fauna occurs in stratified silts below 18 feet of Pearlette volcanic ash; the pit has been worked commercially until recent years. (Leonard, 1950: 7, 41, his locality 36).

Sphaeriidae:	
Pisidium compressum	C
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	C
Aplexa hypnorum	R
Ferrissia parallela	C
Fossaria parva	R
Gyraulus labiatus	A
G. similaris	C
Helisoma trivolvis	C
Menetus pearlettei	C
Physa elliptica	C
Planorbula vulcanata occidentalis	C
Promenetus umbilicatellus	C
Stagnicola caperata	C
S. palustris	C
S. reflexa	C
Land Gastropods:	
Discus cronkhitei	C
Euconulus fulvus	R
Gastrocopta armifera	R

Y-14: KANSAS (cont.)

G. proarmifera	A
G. tappaniana	C
Hawaiia minuscula	A
Nesovitrea electrina	R
Pupilla muscorum	A
Succinea grosvenori	A
Vallonia gracilicosta	C
Vertigo gouldi	R
V. milium	R
V. ovata	A

Y - 15. KANSAS: Canyon exposure, NW 1/4, NW 1/4, sec. 35, T. 33 S., R. 32 W., approximately 2 miles east of Arkalon, Seward County. At this place the disposition of the fossil mollusks is unusual, since they occur in the upper few feet of the Pearlette volcanic ash deposit, which is, however, more or less contaminated with silt. The fauna is a mixture of aquatic and terrestrial species. (Leonard, 1950: 7, 41, his locality 37).

Sphaeriidae:

Pisidium compressum	C

Freshwater lung-breathing Gastropods:

Fossaria parva	R
Gyraulus labiatus	C
G. similaris	R
Helisoma trivolvis	C
Menetus pearlettei	C
Physa anatina	R
Stagnicola bulimoides	R

Land Gastropods:

Gastrocopta cristata	A
G. proarmifera	C
G. tappaniana	C
Hawaiia minuscula	C
Pupoides albilabris	C
Succinea avara	C
S. grosvenori	C
Vallonia gracilicosta	C
V. pulchella	C
Vertigo ovata	C

Y - 16. OKLAHOMA: Open-pit mine, sec. 8, T. 5 N., R. 28 E., near the north border of Gate, Beaver County. The molluscan fauna occurs in silts below 30 feet of Pearlette volcanic ash; both terrestrial and aquatic species are found. (Leonard, 1950: 7, 41, his locality 38).

Y-16: OKLAHOMA (cont.)

Sphaeriidae:

Pisidium compressum	C
Sphaerium sp.	A

Freshwater gill-breathing Gastropods:

Amnicola limosa parva	R
Valvata tricarinata	R

Freshwater lung-breathing Gastropods:

Gyraulus labiatus	C
G. similaris	C
Helisoma anceps	C
H. trivolvis	C
Menetus pearlettei	C
Physa elliptica	A
Planorbula vulcanata occidentalis	R
Stagnicola palustris	C

Land Gastropods:

Deroceras aenigma	R
Discus cronkhitei	C
Gastrocopta proarmifera	R
G. procera	C
Hawaiia minuscula	C
Helicodiscus parallelus	C
Nesovitrea electrina	R
Pomatiopsis cincinnatiensis	R
Pupilla muscorum	A
Stenotrema leaii	R
Succinea grosvenori	C
S. ovalis	R
Vallonia gracilicosta	C
Zonitoides arboreus	C

Y - 17. OKLAHOMA: Canyon exposure, NW 1/4, sec. 23, T. 23 N., R. 18 W., 2 1/2 miles west and 3/4 mile north of Quinlan, Woodward County. The molluscan fauna is in silts below 8 feet of Pearlette ash; both terrestrial and aquatic species are found. (Leonard, 1950: 7, 41, his locality 39).

Sphaeriidae:

Pisidium compressum	C

Freshwater lung-breathing Gastropods:

Gyraulus labiatus	C
Lymnaea, ind.	R.
Physa elliptica	C
Promenetus umbilicatellus	R
Stagnicola palustris	C

Y-17: OKLAHOMA (cont.)

Land Gastropods:

Carychium perexiguum	R
Deroceras aenigma	R
Discus cronkhitei	C
Euconulus fulvus	R
Gastrocopta cristata	C
G. holzingeri	R
G. proarmifera	C
G. procera	C
G. tappaniana	C
Hawaiia minuscula	C
Helicodiscus parallelus	C
Nesovitrea electrina	R
Polygyra texasiana	R
Pupilla blandi	R
P. muscorum	C
Pupoides albilabris	C
Strobilops sparsicosta	C
Succinea grosvenori	C
Vallonia gracilicosta	C
Vertigo milium	R
V. ovata	R

Y - 18. OKLAHOMA: Road cut, center N line sec. 16, T. 8 N., R. 17 W., 9.5 miles east and 1 mile north of Rocky, Washita County. A sample of Pearlette volcanic ash was collected at or near this locality by the Oklahoma Geological Survey, but I was unable to find the ash exposure. However, the exposure indicated is typical of the Grand Island-Sappa succession and the silts and fine sands in the upper part of the section contain a molluscan fauna which is typical of that elsewhere associated with the Pearlette volcanic ash. (Leonard, 1950: 7, 9, 41; his locality 43).

Sphaeriidae:

Pisidium compressum	C

Freshwater lung-breathing Gastropods:

Ferrissia parallela	R
Gyraulus labiatus	R
G. similaris	R
Physa anatina	R
Promenetus umbilicatellus	R

Land Gastropods:

Carychium perexiguum	R
Deroceras aenigma	R
Gastrocopta contracta	R

Y-18: OKLAHOMA (cont.)

G. cristata	C
G. procera	R
G. tappaniana	C
Hawaiia minuscula	C
Helicodiscus parallelus	C
Pupoides albilabris	R
Strobilops sparsicosta	R
Succinea grosvenori	C
Vallonia gracilicosta	C
Vertigo milium	R
V. ovata	R

Y - 19. TEXAS: Canyon exposure, NW 1/4, sec. 14, Block 1, 5 miles north and 7 miles west of Miami, Roberts County. Mollusks occur below 8 feet of Pearlette ash; the silts below the ash are not generally fossiliferous; a small but significant molluscan assemblage was obtained from a small lentil of sandy silt. (Leonard, 1950: 9, 41, his locality 45).

Sphaeriidae:

Pisidium compressum	R
Sphaerium sp.	R

Freshwater lung-breathing Gastropods:

Anisus pattersoni	R
Ferrissia parallela	R
Gyraulus labiatus	R
G. similaris	R
Menetus pearlettei	R
Promenetus umbilicatellus	R
Stagnicola caperata	R

Land Gastropods:

Carychium perexiguum	R
Deroceras aenigma	R
Gastrocopta armifera	R
G. cristata	R
G. proarmifera	R
G. tappaniana	R
Hawaiia minuscula	R
Nesovitrea electrina	R
Pupilla muscorum	R
Pupoides albilabris	R
Strobilops sparsicosta	R
Succinea grosvenori	R
Vallonia gracilicosta	R
V. pulchella	R
Vertigo ovata	R

Y - 20. TEXAS: One-half mile north of road, 6 miles west of Channing, Hartley County. Mollusks occur in gray silt below 12 feet of Pearlette volcanic ash; the fauna contains both terrestrial and aquatic species. This section is discussed briefly by Evans and Meade (1945: 493). (Leonard, 1950: 9, 41, his locality 46).

Sphaeriidae:	
Pisidium compressum	R
Sphaerium sp.	A
Freshwater lung-breathing Gastropods:	
Anisus pattersoni	R
Ferrissia parallela	C
Gyraulus labiatus	R
Helisoma anceps	R
Menetus pearlettei	C
Promenetus umbilicatellus	R
Stagnicola caperata	C
Land Gastropods:	
Carychium perexiguum	R
Deroceras aenigma	C
Gastrocopta armifera	R
G. cristata	C
G. proarmifera	R
G. tappaniana	C
Hawaiia minuscula	C
Nesovitrea electrina	R
Pupilla muscorum	C
Pupoides albilabris	R
Strobilops sparsicosta	R
Succinea grosvenori	R
Vallonia gracilicosta	C
V. pulchella	R
Vertigo ovata	C

Y - 21. INDIANA: Section at Bean Blossom Reservoir, center S. edge NE 1/4 sec. 28, T. 10 N., R. 1 E., Monroe County. Mollusca in upper 0.5 foot of late Yarmouth silt 2.5 feet thick. Wayne (1958: 11, 12). Percentages based on 361 specimens.

Freshwater lung-breathing Gastropods	Percent
Fossaria galbana	34.6
Land Gastropods:	
Carychium exile canadense	10.2
Cionella lubrica	0.3
Columella edentula	0.6
Deroceras sp.	1.1
Discus cronkhitei	2.8
Euconulus fulvus	1.4
Gastrocopta proarmifera	0.6
Hendersonia occulta	3.9
Nesovitrea electrina	0.8
Oxyloma decampi gouldi	1.4
Punctum minutissimum	0.3
Stenotrema hirsutum	0.3
S. leaii	0.8
Strobilops labyrinthica	5.5
Succinea avara, var.	13.3
Vertigo elatior	21.0
V. cf. V. modesta	1.1

ILLINOIAN ASSEMBLAGES

I - 1. TEXAS: Cuts on north side of Texas Highway 256, 15 miles east of Silverton, Briscoe County. "Illinoian (?) deposits" (Frye and Leonard, 1957: 41, sec. 3, unit 8, silt and sand with a few shells. No abundance data.

Land Gastropod:

Succinea grosvenori

I - 2. TEXAS: Same locality as I-1. Unit 6, sand, fine to medium, with silt and clay, massive, tan to pale reddish tan. No abundance data. (Frye and Leonard, 1957: 41).

Land Gastropods:

Columella sp.

Succinea grosvenori

I - 3. TEXAS: Same locality as I-1. Unit 5, sand, medium, well bedded, tan; snails were collected "2.1 miles west from beds judged to be in this stratigraphic position." (Frye and Leonard, 1957: 41, sec. No. 3, unit 5). No abundance data.

I-3: TEXAS (cont.)

Freshwater lung-breathing Gastropods:
- Gyraulus similaris (?)
- Helisoma anceps
- Stagnicola caperata

Land Gastropods:
- Discus cronkhitei
- Gastrocopta armifera (?)
- G. riograndensis (?)
- G. tappaniana
- Hawaiia minuscula
- Helicodiscus parallelus
- Nesovitrea electrina
- Pupilla blandi
- Pupoides albilabris
- Succinea grosvenori (?)
- Vallonia gracilicosta

I - 4. KANSAS: SE 1/4, sec. 29, T. 4 S., R. 16 W., Phillips County. Sanborn formation, Crete-Loveland member. (Frye and Leonard, 1954: 45). No abundance data.

Land Gastropods:
- Gastrocopta armifera
- G. mcclungi
- G. procera
- Pupoides albilabris
- Stenotrema leaii
- Succinea grosvenori

I - 5. INDIANA: Bean Blossom Reservoir Section: center of south edge NE 1/4 sec. 28, T. 10 N., R. 1 E., Monroe County (Hindustan Quadrangle), along the outlet trench below the spillway for a water supply reservoir on Bean Blossom Creek. A fossiliferous layer - or "forest bed" - caps a massive silt and floodplain sediment of Yarmouth age and underlies proglacial laminated (or varved?) clayey silts of Illinoian age. (Thornbury and Wayne, 1957: 18-20; Wayne, 1958: 10-13). Wayne (1959: 13, 16), his assemblage C. (361 specimens).

Freshwater lung-breathing Gastropods:	Percent
Fossaria galbana	34.6
Land Gastropods:	
Carychium exile canadense	10.2
Catinella gelida, var.	13.3
Cionella lubrica	0.3
Columella edentula	0.6
Deroceras laeve	1.1
Discus cronkhitei	2.8
Euconulus fulvus	1.4
Gastrocopta armifera	0.6
Hendersonia occulta	3.9
Nesovitrea electrina	0.8
Oxyloma decampi gouldi	1.4
Punctum minutissimum	0.3
Stenotrema hirsutum	0.3
S. leaii	0.8
Strobilops labyrinthica	5.5
Vertigo elatior	21.0
V. modesta	1.1

I - 6. INDIANA: Raccoon Creek Section: center SW1/4 NW 1/4 sec. 18, T. 14 N., R. 6 W., Parke County (Mansfield Quadrangle) about 1.5 miles southwest of Mansfield, along the south bank of Raccoon Creek (Thornbury and Wayne, 1957: 11-12). Mollusks, many of which have been crushed beyond recognition are in the top few centimeters of a group of nonglacial sediments that are rich in organic matter. The base of the section is weathered gravel, perhaps of glacial origin, and the peaty sediments are overlain by about 75 feet of glacial sediments, mostly sand and gravel but capped by till of Illinoian age. (66 specimens, mostly fragmentary). Wayne (1959: 14, 16), his assemblage D.

Land Gastropods:	Percent
Carychium exile canadense	5
Deroceras sp.	30
Stenotrema sp.	8
Succinea ovalis	48

I - 7. INDIANA: Centerville section: NE 1/4 sec. 33, T. 16 N., R. 14 E., Wayne County, 2 miles southeast of Centerville (Wayne, Thornbury, and Goldthwait, 1955: 30-31; Gamble, 1958: 12-18). The fossiliferous silt separates the two till beds, both of which are interpreted to be of Illinoian age because of their relationship to a distinctive paleosol developed on a gravelly sand higher in the section. (305 specimens). Wayne (1959: 14, 16), his assemblage E.

I-7: INDIANA (cont.)	
Freshwater lung-breathing Gastropods:	Percent
Fossaria parva	21.2
Land Gastropods:	
Catinella gelida	16.7
Gastrocopta tappaniana	9.2
Punctum minutissimum	1.6

I-7: INDIANA (cont.)	Percent
Stenotrema leaii	1.3
Vallonia albula	1.0
Vallonia cf. V. excentrica	0.6
Vertigo elatior	38.3
V. modesta	1.0
V. nylanderi	3.0

SANGAMON ASSEMBLAGES

S - 1. KANSAS: Jinglebob local fauna, Meade County. (Van der Schalie, 1953: 82, ff.). Percentages calculated from author's data, based on a total of 3,888 specimens.

Sphaeriidae:	Percent
Pisidium casertanum	12.86
P. compressum	1.28
P. nitidum contortum	0.36
P. obtusale	0.51
Sphaerium occidentale	0.20
S. sulcatum	0.77
Freshwater gill-breathing Gastropods:	
Valvata tricarinata	0.02
Freshwater lung-breathing Gastropods:	
Aplexa hypnorum	0.38
Ferrissia parallela	0.12
F. rivularis	0.07
Fossaria cf. F. galbana	0.51
F. humilis modicella	1.28
Gyraulus similaris	12.86
Helisoma anceps	1.28
H. trivolvis	0.77
Physa cf. P. anatina	0.77
P. cf. P. elliptica	2.57
Promenetus exacuous	1.28
Stagnicola bulimoides	1.28
S. caperata	1.28
S. cf. S. palustris	0.38
Land Gastropods:	
Carychium cf. C. exiguum	7.71
Deroceras cf. D. aenigma	0.77
Euconulus fulvus	0.51
Gastrocopta armifera	5.14
G. contracta	2.57
G. cristata	5.14
G. holzingeri	1.28

S-1: KANSAS (cont.)	Percent
Gastrocopta pentodon	7.71
G. procera	0.12
G. cf. G. tappaniana	0.02
Gastrocopta sp.	0.02
Hawaiia minuscula	5.14
Helicodiscus parallelus	1.28
Nesovitrea electrina	0.20
Punctum minutissimum	0.90
Pupilla blandi	0.05
Pupoides albilabris	2.57
Retinella cf. R. rhoadsi	0.20
Stenotrema leaii	0.02
Strobilops texasiana	1.80
Succinea cf. S. avara	0.51
S. grosvenori	2.57
S. ovalis	0.15
Vallonia gracilicosta	3.85
V. parvula	1.28
Vertigo milium	2.57
V. ovata	3.85
Zonitoides arboreus	1.02

S - 2. KANSAS: Cragin Quarry local fauna, SW 1/4 sec. 17, T. 32 S., R. 28 W., Meade County, Kansas. Locality 1, 10 feet below caliche. Kansas University locality 6 and USGS Cenozoic locality 21274. (Hibbard and Taylor 1960: 25-39).

	Percent
Shallow, quiet water bodies, fluctuating seasonally: pools or marginal situations with slight current at the edge of a stream:	
Sphaerium partumeium	0.1
Pisidium casertanum	2.2

S-2: KANSAS (cont.)	Percent
Stagnicola caperata	1.8
Gyraulus circumstriatus	7.2
Helisoma trivolvis	<0.1
Promenetus kansasensis	11.5
P. umbilicatellus	7.2
Ferrissia meekiana	<0.1
Physa anatina	0.5
P. gyrina	0.2
Marginal situation; wet mud; debris edge of water; shallow pools, protected spots.	
Fossaria dalli	0.4
Moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water.	
Carychium exiguum	16.2
Gastrocopta tappaniana	10.0
Vertigo milium	<0.1
V. ovata	1.8
Deroceras aenigma	11.5
Wooded area: in leaf litter or under logs and bark in wooded spots.	
Euconulus fulvus	0.7
Nesovitrea electrina	0.1
Zonitoides arboreus	0.1
Stenotrema leaii	2.1
Protected situations among vegetation: grass, shrubs, or wooded area.	
Gastrocopta armifera	<0.1
G. contracta	0.8
G. holzingeri	0.3
Damp to dry habitat: damp, protected places or relatively dry, exposed habitats. These species are more tolerant of drouth than others, and require little cover.	
Gastrocopta cristata	0.3
G. pellucida hordeacella	<0.1
Pupoides albilabris	<0.1
Vallonia gracilicosta	<0.1
V. parvula	4.3
Helicodiscus parallelus	<0.1
H. singleyanus	<0.1
Hawaiia minuscula	17.4

S - 3. KANSAS: Cragin Quarry local fauna. Locality 2, 25 feet below caliche. USGS Cenozoic locality 21277. SE 1/4 sec. 18, T. 32 S., R. 28 W., Meade County, Kansas. (Hibbard and Taylor 1960: 25-39).

Shallow quiet water bodies, fluctuating seasonally: pools or marginal situations with slight current at the edge of a stream.	Percent
Stagnicola caperata	0.8
Gyraulus circumstriatus	0.5
Physa anatina	0.1
Marginal situation: wet mud; debris edge of water; shallow pools, protected spots.	
Fossaria dalli	0.2
Moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water.	
Carychium exiguum	26.5
Gastrocopta tappaniana	16.6
Vertigo milium	<0.1
V. ovata	0.4
Deroceras aenigma	0.3
Wooded area: in leaf litter or under logs and bark in wooded spots.	
Euconulus fulvus	0.4
Nesovitrea electrina	<0.1
Zonitoides arboreus	0.1
Stenotrema leaii	1.8
Protected situations among vegetation: grass, shrubs, or wooded area.	
Gastrocopta armifera	3.3
G. contracta	2.1
G. holzingeri	8.3
Damp to dry habitat: damp, protected places or relatively dry, exposed habitats. These species are more tolerant of drouth than others, and require little cover.	
Gastrocopta cristata	8.3
G. pellucida hordeacella	<0.1
Pupoides albilabris	<0.1
Vallonia parvula	12.4
Helicodiscus parallelus	<0.1
Hawaiia minuscula	16.6

S - 4. KANSAS: Cragin Quarry local fauna. Locality 3, 0-2 feet below caliche. USGS Cenozoic locality 21276. SE 1/4 sec. 18, T. 32 S., R. 28 W., Meade County. (Hibbard and Taylor, 1960: 25-39).

Shallow, quiet water bodies, fluctuating seasonally: pools or marginal situations with slight current at the edge of a stream.	Percent
Pisidium casertanum	<0.1
Stagnicola caperata	0.4
Gyraulus circumstriatus	0.8
Armiger crista	<0.1
Promenetus kansasensis	0.1
Physa anatina	<0.1
Moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water.	
Carychium exiguum	<0.1
Gastrocopta tappaniana	1.0
Vertigo milium	<0.1
V. ovata	<0.1
Deroceras aenigma	0.1
Wooded area: in leaf litter or under logs and bark in wooded spots.	
Euconulus fulvus	<0.1
Nesovitrea electrina	<0.1
Zonitoides arboreus	<0.1
Stenotrema leaii	<0.1
Protected situations among vegetation: grass, shrubs, or wooded area.	
Gastrocopta armifera	0.9
G. contracta	<0.1
G. holzingeri	1.6
Damp to dry habitat: damp, protected places or relatively dry, exposed habitats. These species are more tolerant of drouth than others, and require little cover.	
Gastrocopta cristata	21.1
G. pellucida hordeacella	12.7
Pupoides albilabris	3.4
Pupilla blandi	0.2
Vallonia gracilicosta	12.7
V. parvula	3.8
Helicodiscus parallelus	12.7
Helicodiscus singleyanus	19.1
Hawaiia minuscula	8.5

S - 5. KANSAS: Cragin Quarry local fauna. Locality 4, 10 feet below caliche. USGS Cenozoic locality 21275. SE 1/4 sec. 18, T. 32 S., R. 28 W., Meade County. (Hibbard and Taylor, 1960: 25-39).

Shallow, quiet water bodies, fluctuating seasonally: pools or marginal situations with slight current at the edge of a stream.	Percent
Pisidium casertanum	0.9
Stagnicola caperata	1.9
Gyraulus circumstriatus	0.9
Moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or grass in moist situations not far from water.	
Gastrocopta tappaniana	3.7
Vertigo ovata	2.8
Deroceras aenigma	0.9
Wooded area: in leaf litter or under logs and bark in wooded spots.	
Zonitoides arboreus	0.9
Stenotrema leaii	27.0
Protected situations among vegetation: grass, shrubs, or wooded area.	
Gastrocopta armifera	21.5
G. contracta	0.9
Damp to dry habitat: damp, protected places or relatively dry, exposed habitats. These species are more tolerant of drouth than others, and require little cover.	
Gastrocopta cristata	3.7
Pupoides albilabris	1.9
Vallonia parvula	2.8
Helicodiscus parallelus	1.9
H. singleyanus	0.9
Hawaiia minuscula	23.4

S - 6. KANSAS: Butler Springs local fauna. E 1/2 sec. 32 and W 1/2 sec. 33, T. 34 S., R. 29 W., Meade County. Fossils from coarse limonitic sand, conspicuously cross-bedded, which

S-6: KANSAS (cont.)

may have been deposited by the ancestral Cimarron River or Crooked Creek. Hibbard and Taylor, 1960: 39-55). Percentages calculated on authors' data for 138,411 specimens.

Aquatic Mollusks	Percent
Marginal situations: wet mud; debris at edge of water; shallow pools and protected spots.	
Fossaria dalli	0.01
F. obrussa	0.10
Shallow, quiet water; sloughs and backwaters, probably subject to seasonal drying: water depth perhaps less than 1 foot.	
Pisidium casertanum	0.01
Stagnicola caperata	0.21
S. reflexa	0.17
Anisus pattersoni	0.02
Gyraulus circumstriatus	0.43
Promenetus umbilicatellus	0.04
Physa gyrina	0.23
Aplexa hypnorum	<0.01
Ferrissia meekiana	<0.01
Shallow, quiet water: backwaters with no current, or protected places exposed to only a slight current; not subject to significant seasonal drying; water depth perhaps 1 to 3 feet.	
Sphaerium transversum	<0.01
Lymnaea stagnalis jugularis	<0.01
Gyraulus parvus	35.76
Helisoma trivolvis	0.03
Promenetus kansasensis	0.86
Physa anatina	5.41
P. skinneri	0.01
Laevapex kirklandi	0.15
Perennial stream: slow current, or moderate current in protection of vegetation; not affected by seasonal drying; water depth probably more than 1 foot.	
Anodonta grandis?	<0.01
Sphaerium striatinum	0.01
Pisidium compressum	0.26
P. nitidum	0.08
Valvata tricarinata	53.46
Helisoma anceps	<0.01

S-6: KANSAS (cont.)

Perennial, medium-sized stream; slow to moderate current; water depth several feet.	Percent
Quadrula quadrula	<0.01
Probythinella lacustris	<0.01
Land Snails	
Semiaquatic, riparian: among sedges, watercress, and other plants at the water's edge, or in debris and vegetation in marshy places.	
Oxyloma retusa	0.01
Moist leaf mold and plant debris: under logs and bark, or among leaves, moss, or in grass in moist situations not far from water.	
Carychium exiguum	0.05
Gastrocopta tappaniana	0.21
Vertigo gouldi	<0.01
V. milium	0.08
V. ovata	0.21
Woodland habitat: in moist, protected spots among plant debris in wooded area, or associated with dead wood on the flood plain.	
Discus cronkhitei	<0.01
Zonitoides arboreus	0.03
Stenotrema leaii	0.04
Protected places in vegetation: grass, shrubs, or woodland. These species vary as to habitat, but do not require woods.	
Gastrocopta armifera	0.14
G. contracta	0.01
G. holzingeri	0.03
G. cristata	0.57
G. procera	0.01
Pupoides albilabris	0.14
P. inornatus	0.03
Pupilla muscorum	0.05
P. blandi	0.02
P. sinistra	<0.01
Vallonia cyclophorella	0.28
V. gracilicosta	0.13
V. parvula	0.14
Helicodiscus singleyanus	0.05
Hawaiia minuscula	0.28

S - 7. OHIO: Cleveland loess. Loess exposed above gravels in large pit of the Cleveland Sand and Gravel Co., just south of Garfield Park, at the southeast margin of Cleveland, Cuyahoga County. (Leonard, 1953: 372). His sample 1, species in four inches of colluvium(?) associated with Sangamon soil. No abundance data.
Freshwater lung-breathing Gastropods:
Anisus pattersoni
Gyraulus parvus

S-7: OHIO (cont.)
Land Gastropods:
Cionella lubrica
Euconulus fulvus
Hendersonia occulta
Pupilla muscorum
Succinea grosvenori
Vertigo alpestris oughtoni
V. pygmaea

WISCONSIN ASSEMBLAGES

W - 1. KANSAS: SE 1/4 sec. 29, T. 4 S., R. 16 W., Phillips County. Peoria loess, lower part. (Frye and Leonard, 1954: 45). No abundance data.
Land Gastropods:
Gastrocopta armifera
Pupilla blandi
P. muscorum
Succinea avara
Vallonia gracilicosta

W - 2. KANSAS: SE sec. 6, T. 2 S., R. 20 E., Doniphan County. Peoria loess. (Leonard, 1952: 12, table; his locality 1). No abundance data.
Land Gastropods:
Deroceras laeve
Discus cronkhitei
D. shimeki
Euconulus fulvus
Hawaiia minuscula
Nesovitrea electrina
Pupilla blandi
Succinea avara
S. grosvenori
S. ovalis
Vallonia gracilicosta
Vertigo coloradensis
V. tridentata

W - 3. KANSAS: NE sec. 8, T. 1 S., R. 19 E., Doniphan County. Peoria loess. (Leonard, 1952: 12, his locality 2). No abundance data.

W-3: KANSAS (cont.)
Land Gastropods:
Deroceras laeve
Discus cronkhitei
D. shimeki
Hawaiia minuscula
Helicodiscus singleyanus
Pupilla muscorum
Succinea avara
Vallonia gracilicosta
Vertigo milium

W - 4. KANSAS: NW sec. 5, T. 3 S., R. 4 W., Republic County. Peoria loess. (Leonard, 1952: 12, his locality 3). No abundance data.
Land Gastropods:
Deroceras laeve
Discus cronkhitei
D. shimeki
Euconulus fulvus
Hawaiia minuscula
Hendersonia occulta
Nesovitrea electrina
Pupilla blandi
P. muscorum
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta

W - 5. KANSAS: SE sec. 4, T. 1 S., R. 7 W., Jewell County. Peoria loess. (Leonard, 1952: 12,

W-5: KANSAS (cont.)
his locality 4). No abundance data.
Land Gastropods:
Cionella lubrica
Columella alticola
Discus cronkhitei
D. shimeki
Euconulus fulvus
Hawaiia minuscula
Hendersonia occulta
Nesovitrea electrina
Pupilla blandi
P. muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta

W - 6. KANSAS: SE sec. 28, T. 1 S., R. 13 W., Smith County. Peoria loess. (Leonard, 1952: 12, his locality 7). No abundance data.
Freshwater lung-breathing Gastropods:
Fossaria parva
Land Gastropods:
Carychium exiguum
Cionella lubrica
Columella alticola
Discus cronkhitei
D. shimeki
Euconulus fulvus
Gastrocopta holzingeri
Nesovitrea electrina
Pupilla muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta
Zonitoides arboreus

W - 7. KANSAS: SE sec. 5, T. 2 S., R. 17 W., Phillips County. Peoria loess. (Leonard, 1952: 12, his locality 8). No abundance data.

W-7: KANSAS (cont.)
Land Gastropods:
Discus cronkhitei
D. shimeki
Pupilla muscorum
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
Zonitoides arboreus

W - 8. KANSAS: NW sec. 23, T. 2 S., R. 18 W., Phillips County. Peoria loess. (Leonard, 1952: 12, his locality 9). No abundance data.
Land Gastropods:
Discus cronkhitei
Hawaiia minuscula
Helicodiscus parallelus
Pupilla muscorum
Succinea avara
Vallonia gracilicosta

W - 9. KANSAS: NE sec. 25, T. 1 S., R. 20 W., Phillips County. Peoria loess. (Leonard, 1952: 12, his locality 10). No abundance data.
Freshwater lung-breathing Gastropods:
Fossaria parva
Land Gastropods:
Cionella lubrica
Columella alticola
Discus shimeki
Euconulus fulvus
Gastrocopta armifera
Hawaiia minuscula
Helicodiscus parallelus
H. singleyanus
Pupilla blandi
P. muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta
Zonitoides arboreus

W - 10. KANSAS: NW sec. 26, T. 2 S., R. 23 W., Norton County. Peoria loess. (Leonard, 1952: 12, his locality 11). No abundance data.
Freshwater lung-breathing Gastropods:
Fossaria parva
Land Gastropods:
Euconulus fulvus
Pupilla muscorum
Succinea avara
Vallonia gracilicosta

W - 11. KANSAS: NW sec. 11, T. 3 S., R. 23 W., Norton County. Peoria loess. (Leonard, 1952: 12, his locality 12). No abundance data.
Land Gastropods:
Discus cronkhitei
D. shimeki
Pupilla blandi
P. muscorum
Succinea avara
Vallonia gracilicosta

W - 12. KANSAS: NE sec. 10, T. 4 S., R. 23 W., Norton County. Peoria loess. (Leonard, 1952: 12, his locality 13). No abundance data.
Land Gastropods:
Columella alticola
Deroceras laeve
Discus cronkhitei
D. shimeki
Euconulus fulvus
Nesovitrea electrina
Pupilla blandi
P. muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta

W - 13. KANSAS: NE sec. 7, T. 5 S., R. 24 W., Norton County. Peoria loess. (Leonard, 1952: 12, his locality 14). No abundance data.
Land Gastropods:
Discus cronkhitei
D. shimeki
Pupilla muscorum

W-13: KANSAS (cont.)
Succinea avara
Succinea grosvenori
Vallonia gracilicosta
Vertigo milium
V. modesta

W - 14. KANSAS: SE sec. 13, T. 1 S., R. 24 W., Norton County. Peoria loess. (Leonard, 1952, p. 12, his locality 15). No abundance data.
Land Gastropods:
Helicodiscus parallelus
Pupilla muscorum
Succinea avara
Vallonia gracilicosta

W - 15. KANSAS: NE sec. 3, T. 3 S., R. 27 W., Decatur County. Peoria loess. (Leonard, 1952, p. 12, his locality 16). No abundance data.
Land Gastropods:
Columella alticola
Discus shimeki
Euconulus fulvus
Hawaiia minuscula
Helicodiscus parallelus
Pupilla blandi
P. muscorum
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta

W - 16. KANSAS: NE sec. 6, T. 3 S., R. 27 W., Decatur County. Peoria loess. (Leonard, 1952: 12, his locality 17). No abundance data.
Land Gastropods:
Carychium exiguum
Euconulus fulvus
Pupilla blandi
P. muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo modesta

W - 17. KANSAS: NE sec. 1, T. 3 S., R. 28 W., Decatur County. Peoria loess. (Leonard, 1952: 12, his locality 18). No abundance data.
Land Gastropods:
Columella alticola
Discus cronkhitei
D. shimeki
Euconulus fulvus
Hawaiia minuscula
Helicodiscus singleyanus
Pupilla blandi
P. muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta
Zonitoides arboreus

W - 18. KANSAS: SW sec. 23, T. 4 S., R. 27 W., Decatur County. Peoria loess. (Leonard, 1952: 12, his locality 19). No abundance data.
Land Gastropods:
Discus cronkhitei
D. shimeki
Pupilla muscorum
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo modesta

W - 19. KANSAS: NE sec. 2, T. 3 S., R. 31 W., Rawlins County. Peoria loess. (Leonard, 1952: 12, his locality 20). No abundance data.
Land Gastropods:
Discus shimeki
Euconulus fulvus
Pupilla blandi
P. muscorum
Striatura milium
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo gouldi paradoxa
V. modesta

W - 20. KANSAS: SW sec. 2, T. 3 S., R. 33 W., Rawlins County. Peoria loess. (Leonard, 1952: 12, his locality 21). No abundance data.
Land Gastropods:
Discus shimeki
Euconulus fulvus
Hawaiia minuscula
Pupilla blandi
P. muscorum
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo modesta

W - 21. KANSAS: NE sec. 9, T. 3 S., R. 33 W., Rawlins County. Peoria loess. (Leonard, 1952: 12, his locality 22). No abundance data.
Land Gastropods:
Discus shimeki
Euconulus fulvus
Hawaiia minuscula
Helicodiscus parallelus
H. singleyanus
Pupilla blandi
P. muscorum
Succinea avara
S. grosvenori
Vallonia gracilicosta
Vertigo modesta

W - 22. KANSAS: NW sec. 20, T. 4 S., R. 33 W., Rawlins County. Peoria loess. (Leonard, 1952: 12, his locality 23). No abundance data.
Land Gastropods:
Discus cronkhitei
D. shimeki
Euconulus fulvus
Hawaiia minuscula
Helicodiscus parallelus
Pupilla blandi
P. muscorum
Succinea avara
Vallonia gracilicosta
Vertigo modesta

W - 23. KANSAS: NE sec. 29, T. 3 S., R. 36 W., Rawlins County. Peoria loess. (Leonard, 1952: 12, his locality 24). No abundance data.

W-23: KANSAS (cont.)
Land Gastropods:
Hawaiia minuscula
Pupilla blandi
P. muscorum
Succinea avara
Vallonia gracilicosta

W - 24. OHIO-INDIANA: Old Forest bed of the Ohio River. "Near Lawrenceburg, Indiana." (Billups, 1902: 50-52). From Billups' statements it appears that the "Old Forest bed" is somewhere within the immediate vicinity of the Miami and Ohio rivers either in Dearborn County, Indiana or in Miami Township, Hamilton County, Ohio. The area is shown on the Lawrenceburg Quadrangle, Indiana-Kentucky-Ohio (U.S. Geological Survey, 1932, scale 1 : 62,500).

The "Old Forest bed" lies 6 to 8 feet below the present surface of the "bottom lands of the Ohio" and is several feet in depth. It contains "well-preserved remains of mammoth trees; these are covered with a thick layer of yellow clay of an exceedingly hard and solid texture, which renders very difficult the extraction of fossils ..." Billups' list is appended, the nomenclature revised to conform to that used in this paper. The aspect of the molluscan fauna is very modern and the "Old Forest bed" is thought to be Wisconsin in age, perhaps interstadial, but not certainly so. Whether Billups' specimens were collected in Indiana or Ohio has not been determined. No abundance data are given.
Freshwater gill-breathing Gastropods:
Pomatiopsis lapidaria
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Cionella lubrica
Discus cronkhitei
D. patulus
Gastrocopta armifera
G. contracta
Haplotrema concavum
Helicodiscus parallelus
Mesodon appressus

W-24: OHIO-INDIANA (cont.)
Mesodon elevatus
M. inflectus
M. mitchellianus
M. pennsylvanicus
M. thyroidus
M. zaletus
Nesovitrea cf. N. binneyana
Pupoides albilabris
Stenotrema leaii
S. stenotrema
?Succinea ovalis
Triodopsis albolabris
T. denotata
T. multilineata
T. tridentata
Vallonia pulchella
Ventridens ligerus

W - 25. OHIO: Middletown pre-glacial deposits. "Near Middletown, first bottoms of the Miami River." (Sterki 1907: 401). No discussion of age is given, but the reader is referred to "Geological Survey of Ohio, Vol. III, Warren and Butler Counties" which is not especially helpful. The revised list follows. No abundance data.
Freshwater gill-breathing Gastropods:
Goniobasis depygis
Pomatiopsis lapidaria
Freshwater lung-breathing Gastropods:
Helisoma trivolvis
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Haplotrema concavum
Mesodon elevatus
M. thyroidus
Stenotrema hirsutum
S. leaii
Succinea sp.
Triodopsis tridentata.

W - 26. OHIO: Defiance sandy deposit (loess?), Defiance County, "Four miles east of Defiance, in a sandy deposit (loess?), forming the north bank of the Maumee River, at the state dam. (Sterki, 1907: 402).

W-26: OHIO (cont.)
Naiades:
Unidentifiable fragments.
Sphaeriidae:
Pisidium compressum
P. fallax
Freshwater gill-breathing Gastropods:
Pomatiopsis lapidaria
Freshwater lung-breathing Gastropods:
Physa sp.
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Discus cronkhitei
Gastrocopta contracta
Haplotrema concavum
Helicodiscus singleyanus
Mesodon clausus
M. elevatus
M. inflectus
M. mitchellianus
M. thyroidus
M. zaletus
?Oxyloma retusa
Retinella indentata
Stenotrema hirsutum
Succinea avara
Triodopsis albolabris
T. fraudulenta vulgata
T. multilineata
Ventridens ligerus
Zonitoides arboreus

W - 27. OHIO: Tinkers Creek marl. "Along Tinkers Creek, close to the line of Summit and Portage Counties, south of the station of Moran of the Wheeling & Lake Erie Railroad." The marl is overlain in one place by "one to several feet of sand and gravel, apparently 'glacial drift.'" No mention of age is made by Sterki but the fact that the marl is overlain by sand and gravel, possibly till, may be significant. Sterki's list (1920: 175) has been revised as follows.
Naiades:
Unidentified fragments, frequent in the top layer, below the sand. None identifiable.

W-27: OHIO (cont.)
Sphaeriidae:
Pisidium adamsi
P. adamsi affine
P. casertanum
P. compressum
P. compressum laevigatum
P. fallax
P. ferrugineum
P. lilljeborgi
P. nitidum
P. obtusale
P. ohioense
P. variabile
P. walkeri
Sphaerium partumeium
S. rhomboideum
S. securis
S. striatinum
S. striatinum stamineum
S. sulcatum
Freshwater gill-breathing Gastropods:
Amnicola limosa
A. lacustris
A. lustrica
?Lyogyrus pupoideus
Valvata sincera
V. tricarinata (111)
Freshwater lung-breathing Gastropods:
Acella haldemani
Armiger crista
Ferrissia meekiana
F. parallela
F. pumila
Fossaria humilis modicella
F. humilis rustica
F. obrussa decampi
?Gyraulus "albus (Müller)"
Gyraulus parvus
Helisoma campanulatum
H. trivolvis
Laevapex kirklandi
Lymnaea stagnalis jugularis
Menetus dilatatus
Physa "gyrina"
P. "heterostropha"
P. "integra"
P. "sayi"

W-27: OHIO (cont.)
Promenetus exacuous
Pseudosuccinea columella
Land Gastropods:
Allogona profunda
Carychium exiguum
Discus cronkhitei
Oxyloma retusa
Retinella indentata
Succinea avara
Succinea ovalis
Zonitoides arboreus

W - 28. OHIO: Castalia marl. "West of Castalia and east of Sandusky Bay" (Sterki, 1920: 177-184), thirty feet above the level of Lake Erie, about 10 feet deep when opened, and underlain by clay. Sterki notes that in places there are pockets in which land snails are extremely abundant. He hazards no guess as to the age of the deposit. The locality given by Sterki is either in Sandusky or Erie County, more probably the latter, but could not be located more exactly in an area where excavations for peat and marl have been carried out for over fifty years. Clark (1961) has studied a section of the Castalia marl (see W-56 to W-59) which had a much poorer assortment of fossils but which is probably of the same age as Sterki's deposit. Sterki's list is given in revised form below; he gave no abundance data.
Sphaeriidae:
Pisidium casertanum
P. compressum
P. ferrugineum
P. nitidum
P. obtusale
P. ohioense
Freshwater gill-breathing Gastropods:
Goniobasis livescens
Pomatiopsis lapidaria
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Armiger crista
Ferrissia meekiana
F. pumila
Fossaria dalli
F. humilis modicella

W-28: OHIO (cont.)
Fossaria humilus rustica
F. parva
Gyraulus parvus
Helisoma trivolvis
Laevapex kirklandi
Physa "aplectoides"
P. "elliptica"
P. gyrina
P. "integra"
Planorbula armigera
Promenetus umbilicatellus
Stagnicola caperata
S. "nashotahensis"
S. reflexa
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Carychium exiguum
C. exile
Columella edentula
Deroceras cf. D. aenigma
D. cf. D. laeve
Discus cronkhitei
D. patulus
Euconulus chersinus
E. fulvus
Gastrocopta armifera
G. contracta
G. corticaria
G. pentodon
G. tappaniana
G. sp.
Guppya sterkii
Haplotrema concavum
Hawaiia minuscula
Helicodiscus parallelus
Mesodon pennsylvanicus
M. thyroidus
Nesovitrea electrina
Oxyloma retusa
Punctum minutissimum
Pupoides albilabris
Retinella indentata
R. rhoadsi
R. wheatleyi
Stenotrema hirsutum

W-28: OHIO (cont.)
Stenotrema leaii
Strobilops affinis
S. labyrinthica
Succinea avara
S. ovalis
Triodopsis albolabris
T. denotata
T. fraudulenta vulgata
T. multilineata
T. tridentata
Vallonia pulchella
Ventridens ligera
Vertigo elatior
V. milium
V. morsei
V. ovata
V. tridentata
Zonitoides arboreus

W - 29. OHIO: Rush Lake marl. South end of Rush Lake, Logan County, Ohio, collected by M. M. Leighton, identified by F. C. Baker (1920: 439-457). Leighton described the deposit in Baker's paper (p. 439) and was of the opinion that it is unquestionably post-Wisconsin, but the shells "do not seem to be extremely recent." Baker lists the fauna (pp. 441-442) and discusses the species (pp. 446-450). His revised list follows.
Naiades:
Anodonta sp., rare fragments.
Sphaeriidae:
Pisidium casertanum
P. compressum
P. ferrugineum
P. nitidum
P. variabile
Sphaerium lacustre
S. sulcatum
Freshwater gill-breathing Gastropods:
Amnicola leightoni
A. lustrica
A. walkeri
Valvata sincera
V. tricarinata (111) (101) (100)
Freshwater lung-breathing Gastropods:
Ferrissia parallela
Fossaria obrussa decampi

W-29: OHIO (cont.)
Gyraulus altissimus
G. deflectus
G. hirsutus
Helisoma anceps striatum
H. campanulatum
Physa anatina
Promenetus exacuous
Stagnicola palustris

W - 30. OHIO: Humboldt deposit, 0.4 mile north of BM 798 at Humboldt, Paint Township, Ross County, Ohio. The peat above the section has been dated by C-14 at more than 35,000 years B.P. (W-773). The section, as measured by Reynolds (1959: 154-155) consists of three lithologic units. Reynolds' data have been recalculated here for these three units rather than the smaller samples, 2 inches thick, which he used in his original paper. W-30 is from Reynolds' unit 5, collection 17, lowest fossiliferous unit, silt, buff, clayey, calcareous, slightly fossiliferous, 6 inches thick. Percentages based on 308 specimens.

Sphaeriidae	Percent Total Indiv.
Pisidium compressum	0.32
P. nitidum pauperculum	0.64
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	73.70
Valvata tricarinata	12.01
Freshwater lung-breathing Gastropods:	
Fossaria obrussa decampi	2.27
Gyraulus altissimus	8.11
Helisoma anceps striatum	0.64
Physa gyrina	1.94
Promenetus exacuous	0.32

W - 31. OHIO: Humboldt deposit, same locality as W-30. The following are from Reynolds' unit 6, collections 10-16, middle fossiliferous unit, silt, gray-blue, clayey, calcareous, fossiliferous, 6 inches thick. (Reynolds, 1959: 154-155). Percentages based on 6,318 specimens.

Sphaeriidae:	PTI
Pisidium compressum	4.96
P. nitidum	0.26
P. nitidum pauperculum	4.44
P. obtusale	0.01

W-31: OHIO (cont.)	PTI
Pisidium variabile	0.23
Sphaerium striatinum	0.20
S. sulcatum	0.12
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	26.65
Campeloma cf. C. rufum	0.52
Valvata tricarinata	38.44
Freshwater lung-breathing Gastropods:	
Ferrissia tarda	0.03
Fossaria obrussa decampi	3.56
Gyraulus altissimus	14.64
Helisoma anceps striatum	3.56
Physa gyrina	2.29

W - 32. OHIO: Humboldt deposit, same locality as W-30. The following are from Reynolds' unit 7, collections 2-9, uppermost fossiliferous unit, marl, reddish-brown to buff, calcareous, highly fossiliferous, 17 inches thick. (Reynolds, 1959: 154-155). Percentages based on 8,058 specimens.

Sphaeriidae	PTI
Pisidium compressum	0.09
P. nitidum	0.01
P. nitidum pauperculum	0.08
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	56.36
Campeloma cf. C. rufum	0.01
Valvata tricarinata	4.30
Freshwater lung-breathing Gastropods:	
Ferrissia tarda	0.29
Fossaria obrussa decampi	0.88
Gyraulus altissimus	22.42
Helisoma anceps striatum	13.01
H. trivolvis	0.09
Menetus opercularis multilineatus	0.09
Physa gyrina	2.27
Promenetus exacuous	0.01

W - 33. OHIO: Oakhurst deposit, 2.5 miles south of Galloway, Pleasant Township, Franklin County; section 1, unit 3, marl, gray, fossiliferous, 42 inches thick. (Aukeman, 1960). Percentages based on 21,415 specimens.

Sphaeriidae	PTI
Pisidium compressum	0.28
Pisidium ferrugineum	3.73
P. nitidum	2.19
P. nitidum pauperculum	8.84
P. obtusale ventricosum	0.51
P. variabile	1.14
Sphaerium lacustre	1.56
S. rhomboideum	0.16
S. sulcatum	0.57
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	6.74
A. lustrica	0.03
A. lustrica aff. precursor	2.08
A. precursor	23.18
Valvata sincera	3.24
V. tricarinata	32.18
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.01
Fossaria obrussa decampi	0.97
Gyraulus altissimus	6.70
G. deflectus	0.80
Helisoma anceps striatum	3.28
H. campanulatum	0.37
Lymnaea stagnalis jugularis	0.28
Physa heterostropha	0.78
Promenetus exacuous	0.27

W - 34. OHIO: Oakhurst deposit, 2.5 miles south of Galloway, Pleasant Township, Franklin County; section 1, unit 4, marl, gray, with reddish oxidized streaks, fossiliferous, 29 inches thick, overlain by peat. (Aukeman, 1960). Percentages based on 14,388 specimens.

Sphaeriidae	PTI
Pisidium compressum	1.06
P. ferrugineum	0.22
P. nitidum	1.98
P. nitidum pauperculum	5.74
P. obtusale ventricosum	0.13
P. variabile	1.29
Sphaerium lacustre	0.20
S. rhomboideum	0.02
S. sulcatum	0.06
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	16.27
A. lustrica	7.17
A. lustrica aff. precursor	0.86

W-34: OHIO (cont.)	PTI
A. precursor	16.98
Valvata sincera	3.13
V. tricarinata	26.68
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.05
Ferrissia parallela	0.04
Fossaria obrussa decampi	1.56
Gyraulus altissimus	9.50
G. deflectus	2.78
Helisoma anceps striatum	2.05
H. campanulatum	0.33
Lymnaea stagnalis jugularis	0.01
Physa heterostropha	1.39
Promenetus exacuous	0.31

W - 35. OHIO: Orleton Mastodon site, Somerford Township, Madison County, about 11.5 miles northwest of West Jefferson. Radiocarbon date 8420 ± 400 years B.P. (Thomas, 1952: 5; Goldthwait, 1952: 8). Two layers, lower, 22 inches thick, gray, impure clayey marl; upper, 13 inches thick, black, peat-like muck. Molluscan fauna studied by La Rocque (1952). Percentages based on 12,554 specimens for the lower, gray, layer, and 5,755 specimens for the upper, black, layer. The data for both beds are presented here together for comparison.

	PTI	
Sphaeriidae:	Gray	Black
Pisidium sp.	73.40	2.63
Sphaerium sp.	-	1.51
S. ("Musculium")	0.11	1.02
Naiades:		
Unidentified fragments	trace	trace
Freshwater gill-breathing Gastropods:		
Valvata lewisi	2.23	0.20
Freshwater lung-breathing Gastropods:		
Armiger crista	0.09	-
Ferrissia parallela	-	0.63
Fossaria galbana	13.05	6.90
Gyraulus altissimus	9.93	81.81
Helisoma trivolvis	0.01	0.45
Physa gyrina	1.02	0.97
Planorbula armigera	-	trace
Promenetus exacuous	0.14	3.10
Stagnicola lanceata	0.02	0.22
S. palustris elodes	-	0.41

W-35: OHIO (cont.)	PTI	
Land Gastropods:	Gray	Black
Hawaiia minuscula	-	trace
Mesodon clausus	-	0.02
Oxyloma retusa	-	0.05
Stenotrema leaii	-	0.02
Succinea ovalis	-	0.02
Vertigo ovata	trace	-

W - 36. OHIO: Souder Lake deposit, sec. 3, Jefferson Twp., Franklin County, approximately 2.4 miles southeast of Gahanna. (Cornejo, 1961). Cornejo's section 1, unit 1, coll. 1, clay, blue gray, resting on gravel, 2 inches. Percentages based on 1,023 specimens.

Sphaeriidae:	PTI
Pisidium adamsi	0.19
P. casertanum	0.01
P. compressum	1.56
P. nitidum	2.61
P. variabile	0.48
P. walkeri	0.01
Sphaerium lacustre	0.01
S. rhomboideum	0.09
Freshwater gill-breathing Gastropods:	
Amnicola lustrica	29.32
Valvata tricarinata	49.46
Freshwater lung-breathing Gastropods:	
Ferrissia parallela	0.09
Gyraulus altissimus	11.92
Helisoma anceps striatum	1.46
Physa gyrina	0.68
Promenetus exacuous	1.66

W - 37. OHIO: Souder Lake deposit, sec. 3, Jefferson Twp., Franklin County, approximately 2.4 miles southeast of Gahanna. (Cornejo, 1961). Cornejo's section 1, unit 2, coll. 2, clay, peaty, bluish-gray, with lenses of light brown color, 1.75 inches. Percentages based on 1,012 specimens.

Sphaeriidae:	PTI
Pisidium adamsi	0.09
P. casertanum	0.09
P. compressum	1.08
P. ferrugineum	0.39
P. nitidum	5.92
P. nitidum pauperculum	0.09

W-37: OHIO (cont.)	PTI
P. obtusale ventricosum	0.09
P. variabile	0.39
Sphaerium lacustre	0.59
Freshwater gill-breathing Gastropods:	
Amnicola lustrica	41.10
Valvata tricarinata	27.56
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.09
Ferrissia parallela	0.69
Gyraulus altissimus	16.60
Helisoma anceps striatum	1.67
Physa gyrina	1.97
Promenetus exacuous	1.77

W - 38. OHIO: Souder Lake deposit, sec. 3, Jefferson Twp., Franklin County, approximately 2.4 miles southeast of Gahanna. (Cornejo, 1961). Cornejo's section 1, unit 3, colls. 3-13; peat, clayey, dark brown to black, 22.25 inches. Percentages based on 11,155 specimens.

Sphaeriidae:	PTI
Pisidium adamsi	0.05
P. casertanum	0.01
P. compressum	1.30
P. ferrugineum	0.68
P. nitidum	7.73
P. nitidum pauperculum	0.53
P. obtusale ventricosum	0.55
P. variabile	0.69
P. walkeri	0.02
P. walkeri mainense	0.03
Sphaerium lacustre	0.47
S. rhomboideum	0.27
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	4.52
A. lustrica	45.59
Valvata tricarinata	13.72
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.25
Ferrissia parallela	0.60
Fossaria obrussa	0.04
Gyraulus altissimus	1.55
Helisoma anceps striatum	1.64
H. campanulatum	0.09
Physa gyrina	1.59
Promenetus exacuous	1.55

W - 39. OHIO: Souder Lake deposit, sec. 3, Jefferson Twp., Franklin County, approximately 2.4 miles southeast of Gahanna. (Cornejo, 1961). Cornejo's section 1, unit 4, colls. 14-15; peat, light to dark brown, 4 inches. Percentages based on 1,735 specimens.

Sphaeriidae:	PTI
Pisidium adamsi	0.05
P. compressum	3.45
P. ferrugineum	0.40
P. nitidum	4.61
P. nitidum pauperculum	1.32
P. obtusale ventricosum	0.51
P. variabile	0.80
P. walkeri	0.05
Sphaerium lacustre	0.34
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	20.46
A. lustrica	33.31
Valvata tricarinata	14.35
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.05
Ferrissia parallela	0.28
Fossaria obrussa	0.51
Gyraulus altissimus	17.75
Helisoma anceps striatum	0.97
Physa gyrina	0.17
Promenetus exacuous	1.21

W - 40. OHIO: Souder Lake deposit, sec. 3, Jefferson Twp., Franklin County, approximately 2.4 miles southeast of Gahanna. (Cornejo, 1961). Cornejo's section 1, unit 5, coll. 16; humus, blackish brown, undisturbed, 2 inches. Percentages based on 27 specimens.

Sphaeriidae:	PTI
Pisidium compressum	7.40
P. nitidum pauperculum	7.40
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	7.40
A. lustrica	11.11
Valvata tricarinata	51.85
Freshwater lung-breathing Gastropods:	
Gyraulus altissimus	14.81

W - 41. OHIO: Souder Lake deposit, as above; Cornejo's section 1, unit 6, colls. 17-18, humus,

W-41: OHIO (cont.)
black, undisturbed, 4 inches. Percentages based on 417 specimens.

Sphaeriidae:	PTI
Pisidium compressum	2.63
P. nitidum nitidum	3.59
P. nitidum pauperculum	3.59
P. obtusale ventricosum	0.71
P. variabile	0.23
Sphaerium lacustre	0.23
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	7.67
A. lustrica	16.06
Valvata tricarinata	49.64
Freshwater lung-breathing Gastropods:	
Ferrissia parallela	0.47
Gyraulus altissimus	13.42
Helisoma anceps striatum	0.47
Promenetus exacuous	1.43

W - 42. OHIO: Souder Lake deposit, as above; Cornejo's section 1, unit 7, coll. 19; humus, black, disturbed, 3 inches. Percentages based on 749 specimens.

Sphaeriidae:	PTI
Pisidium adamsi	0.26
P. compressum	2.13
P. ferrugineum	0.93
P. nitidum	4.13
P. nitidum pauperculum	1.73
P. obtusale ventricosum	0.53
P. variabile	0.26
P. walkeri	0.13
Sphaerium lacustre	0.13
S. rhomboideum	0.26
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	9.61
A. lustrica	27.36
Valvata tricarinata	24.56
Freshwater lung-breathing Gastropods:	
Ferrissia parallela	0.53
Gyraulus altissimus	22.42
Helisoma anceps striatum	1.73
Physa gyrina	1.60
Promenetus exacuous	1.73

W - 43. OHIO: Sidney Cut; railroad cut 3 miles due south of Sidney, Clinton Twp., Shelby County. (La Rocque and Forsyth, 1957: 84, 85). Measured section, unit 2, silt, gray, fossiliferous, seeming to grade into underlying till, approximately 6 inches. This unit is about 36 inches below a buried soil from which a log has yielded a date of more than 37,000 years B.P. (W-415) (La Rocque and Forsyth, 1957: 81). Percentages based on 238 specimens.

Freshwater lung-breathing Gastropods:	PTI
Fossaria parva	3.4
Land Gastropods:	
"Carychium exile canadense"	11.4
Cionella lubrica	0.3
Euconulus? sp.	0.3
Helicodiscus sp.	0.8
Helicoid, undetermined fragments	1.7
Stenotrema sp.	3.8
Succinea avara	16.4
S. grosvenori	32.0
Vallonia gracilicosta	3.8
Vertigo alpestris oughtoni	26.1

W - 44. OHIO: Sidney Cut, data as for W-43. Measured section, unit 3, silt, brown, fossiliferous. Percentages based on 286 specimens. Unit 3 is only 6 inches thick and also below the dated log mentioned above (W-43).

Land Gastropods:	PTI
"Carychium exile canadense"	3.8
Cionella lubrica	0.4
Columella alticola	3.8
Deroceras? sp.	0.4
Discus cronkhitei	0.4
Hawaiia minuscula	1.4
Stenotrema sp.	2.8
Succinea avara	20.6
Succinea grosvenori	8.4
Vallonia gracilicosta	26.5
Vertigo alpestris oughtoni	31.5

W - 45. OHIO: Newell Lake deposit, Union Twp., Logan County, sec. 11, R. 13, Twp. 4. Section 1, unit 4 (lowermost unit), marl, fine,

W-45: OHIO (cont.)
porous, slightly coherent, pale yellowish brown, collections 3-23 (Zimmerman, 1960: 17). Percentages based on 20,100 specimens.

Naiades:	PTI
Anodonta marginata	fragments
Lampsilis radiata siliquoidea	0.01
Sphaeriidae:	
Pisidium casertanum	0.02
P. compressum	0.01
P. ferrugineum	2.31
P. nitidum	3.38
P. nitidum pauperculum	0.01
P. obtusale rotundatum	0.01
Sphaerium lacustre	0.01
S. sulcatum	0.05
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	15.57
A. lustrica	22.51
Valvata tricarinata	26.79
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.25
Ferrissia parallela	0.13
Fossaria obrussa	0.01
F. obrussa decampi	5.45
Gyraulus altissimus	14.86
Helisoma anceps striatum	2.54
H. campanulatum	0.73
Lymnaea stagnalis jugularis	0.01
Physa "sayii"	3.74
Promenetus exacuous	1.40
Pseudosuccinea columella	0.01

W-46. OHIO: Newell Lake deposit, Union Twp., Logan County, sec. 11, R. 13, Twp. 4. Section 1, unit 3, marl, fine, porous, moderately coherent, dark yellowish brown, collections 2 and upper half of 3. (Zimmerman, 1960: 17). Percentages based on 949 specimens.

Naiades:	PTI
Anodonta marginata	0.31
Lampsilis radiata siliquoidea	0.01
Sphaeriidae:	
Pisidium compressum	0.84
P. ferrugineum	0.21
P. nitidum	5.69
P. nitidum pauperculum	0.21

W-46: OHIO (cont.)

	PTI
Sphaerium lacustre	0.31
S. sulcatum	0.21
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	17.38
A. lustrica	27.81
Valvata tricarinata	12.22
Freshwater lung-breathing Gastropods:	
Fossaria obrussa	0.01
F. obrussa decampi	5.58
Gyraulus altissimus	23.70
Helisoma anceps striatum	2.10
H. campanulatum	0.21
Physa "sayii"	2.95
Promenetus exacuous	0.10
Pseudosuccinea columella	0.21

W-47. OHIO: Newell Lake deposit, as above. Section 1, unit 2 (uppermost fossiliferous unit), humus, compact, porous, noncalcareous, brownish black; collection 1. (Zimmerman, 1960: 17). Percentages based on 927 specimens.

Naiades:	PTI
Anodonta marginata	0.01
Lampsilis radiata siliquoidea	0.01
Sphaeriidae:	
Pisidium compressum	0.75
P. ferrugineum	0.10
P. nitidum	7.01
P. nitidum pauperculum	0.10
Sphaerium lacustre	0.01
S. sulcatum	0.10
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	15.64
A. lustrica	15.85
Valvata tricarinata	28.26
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.01
Fossaria obrussa	0.01
Gyraulus altissimus	22.86
Helisoma anceps striatum	1.29
H. campanulatum	0.01
Physa "sayii"	1.40
Promenetus exacuous	0.32
Land Gastropods:	
Hawaiia minuscula	0.10

W - 48. OHIO: Jewell Hill deposit, W 1/2, SW 1/4, sec. 31, Liberty Twp., Logan County. Section 1, unit 4, collections 1-6; marl, buff, pure, very fine; the collections are from the uppermost foot of this unit. (Mowery, 1961). Percentages based on 5,968 specimens.

Sphaeriidae	PTI
Pisidium casertanum	0.63
P. nitidum	7.17
P. obtusale rotundatum	0.38
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	6.19
A. lustrica	24.06
Valvata tricarinata	5.01
Freshwater lung-breathing Gastropods:	
Armiger crista	0.30
Fossaria obrussa	10.43
F. obrussa decampi	4.20
Gyraulus altissimus	21.88
Helisoma anceps striatum	2.22
H. campanulatum	0.65
Physa gyrina	14.32
Promenetus exacuous	0.51
Land Gastropods:	
Gastrocopta pentodon	0.31
Succinea ovalis	0.72
Vertigo ovata	0.93

W - 49. OHIO: Jewell Hill deposit, same locality as W-48. Section 1, unit 5, collections 7-8; humus, black, porous, blocky, interstratified with dark gray marl. (Mowery, 1961). Percentages based on 1,011 specimens.

Sphaeriidae	PTI
Pisidium casertanum	4.74
P. nitidum	0.29
P. obtusale rotundatum	1.28
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	1.38
A. lustrica	2.07
Valvata tricarinata	7.12
Freshwater lung-breathing Gastropods:	
Armiger crista	1.78
Fossaria obrussa	16.71
F. obrussa decampi	5.73
Gyraulus altissimus	1.28
Helisoma anceps striatum	0.59
H. campanulatum	0.19
W-49: OHIO (cont.)	
Physa gyrina	1.78
Promenetus exacuous	1.28
Land Gastropods:	
Gastrocopta pentodon	3.85
Succinea ovalis	2.86
Vertigo ovata	3.06

W - 50. OHIO: Jewell Hill deposit, same locality as W-48. Section 1, unit 6, collections 9-22; marl, medium light gray, coarse, silty, interbedded with many thin peat lenses. (Mowery, 1961). Percentages based on 13,898 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	2.53
P. nitidum	1.14
P. obtusale rotundatum	0.89
Sphaerium lacustre	0.46
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	6.00
A. lustrica	1.99
Valvata tricarinata	5.71
Freshwater lung-breathing Gastropods:	
Armiger crista	0.46
Fossaria obrussa	21.44
F. obrussa decampi	2.54
Gyraulus altissimus	44.60
Helisoma anceps striatum	0.71
H. campanulatum	0.33
H. trivolvis	0.46
Physa gyrina	4.09
Promenetus exacuous	2.35
Stagnicola umbrosa	0.40
Land Gastropods:	
Gastrocopta pentodon	0.37
Succinea ovalis	1.97
Vertigo ovata	1.46

W - 51. OHIO: Jewell Hill deposit, same locality as W-48. Section 1, unit 7, collections 23-25; humus, black, porous, blocky, few lenses of gray marl. (Mowery, 1961). Percentages based on 2,465 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	1.13
P. nitidum	0.24
P. obtusale rotundatum	0.16

W-51: OHIO (cont.)	PTI
Sphaerium lacustre	0.08
Freshwater gill-breathing Gastropods:	
Amnicola leightoni	0.24
A. lustrica	0.20
Valvata tricarinata	0.08
Freshwater lung-breathing Gastropods:	
Armiger crista	0.28
Fossaria obrussa	32.29
F. obrussa decampi	8.23
Gyraulus altissimus	30.75
Helisoma anceps striatum	0.04
H. trivolvis	0.12
Physa gyrina	2.39
Planorbula armigera	1.50
Promenetus exacuous	0.64
Stagnicola umbrosa	0.28
Land Gastropods:	
Carychium "exile"	1.33
Gastrocopta pentodon	9.04
Succinea avara	1.66
S. ovalis	5.47
Vertigo ovata	3.77

W - 52. OHIO: Aultman deposit, NW 1/4, sec. 30, R. 8 W., T. 12 N., Lake Twp., Stark County. Section 1, unit 2, coll. 2.1; silt, dark blue gray, sandy, with some fine gravel and plant remains, in small depressions of outwash surface; 2 inches thick. (Sheatsley, 1960). Percentages based on 667 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	7.64
P. ferrugineum	0.29
P. nitidum	1.34
P. obtusale rotundatum	0.14
P. obtusale ventricosum	0.14
P. variabile	0.14
Freshwater lung-breathing Gastropods:	
Fossaria obrussa decampi	71.36
Gyraulus altissimus	0.59
Land Gastropods:	
Retinella sp.	0.14
Succinea avara	16.49
Vertigo morsei	1.64

W - 53. OHIO: Aultman deposit; same locality as W-52. Section 1, unit 3, colls. 3.1-3.4; peat, light gray brown, marly, grading into unit 4 above, 8 inches thick. (Sheatsley, 1960). Percentages based on 4,149 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	0.04
P. compressum	0.02
P. ferrugineum	1.71
P. nitidum	11.08
P. nitidum contortum	2.53
P. nitidum pauperculum	1.39
P. obtusale rotundatum	2.91
P. obtusale ventricosum	0.79
P. variabile	0.41
P. walkeri	0.07
Sphaerium lacustre	0.07
S. rhomboideum	0.04
S. sulcatum	0.04
Freshwater gill-breathing Gastropods:	
Amnicola walkeri	0.24
Valvata lewisi	0.62
Freshwater lung-breathing Gastropods:	
Armiger crista	0.04
Fossaria obrussa decampi	46.54
Gyraulus deflectus	0.61
Helisoma anceps striatum	0.72
H. campanulatum	0.09
Land Gastropods:	
Retinella sp.	0.57
Succinea avara	4.72
Vertigo morsei	0.38

W - 54. OHIO: Aultman deposit; same locality as W-52. Section 1, unit 4, colls. 4.1-4.10; marl, light to medium gray, peaty, grading into unit 5 above; 21 inches thick. (Sheatsley, 1960). Percentages based on 10,137 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	0.38
P. compressum	0.07
P. ferrugineum	5.36
P. nitidum	29.51
P. nitidum contortum	3.51
P. nitidum pauperculum	2.38
P. obtusale rotundatum	0.16
P. obtusale ventricosum	1.77
P. variabile	0.86

W-54: OHIO (cont.)	
P. walkeri	0.04
P. walkeri mainense	0.14
Sphaerium lacustre	0.89
S. rhomboideum	0.09
S. sulcatum	0.16
Freshwater gill-breathing Gastropods:	
Amnicola walkeri	1.24
Valvata lewisi	1.43
Valvata tricarinata	0.05
Freshwater lung-breathing Gastropods:	
Acella haldemani	0.09
Armiger crista	0.06
Ferrissia parallela	0.07
Fossaria obrussa decampi	21.87
Gyraulus deflectus	1.23
Helisoma anceps striatum	2.80
H. campanulatum	0.85
Land Gastropods:	
Gastrocopta tappaniana	0.03
Retinella sp.	0.01
Succinea avara	0.52
Vertigo morsei	0.04

W - 55. OHIO: Aultman deposit; same locality as W-52. Section 1, unit 5, coll. 55-1; peat, dark brown at top, light brown near base; grades into overlying soil above and into marl below; 8.5 inches thick. (Sheatsley, 1960). Percentages based on 780 specimens.

Sphaeriidae	PTI
Pisidium compressum	0.25
P. ferrugineum	1.41
P. nitidum	33.58
P. nitidum contortum	6.79
P. nitidum pauperculum	3.33
P. obtusale rotundatum	0.25
P. obtusale ventricosum	3.07
P. variabile	0.12
P. walkeri mainense	0.25
Sphaerium rhomboideum	0.12
S. sulcatum	0.12
Freshwater gill-breathing Gastropods:	
Amnicola walkeri	1.28
Valvata lewisi	1.79
V. tricarinata	0.12
Freshwater lung-breathing Gastropods:	
Fossaria obrussa decampi	13.20
W-55: OHIO (cont.)	PTI
Gyraulus deflectus	1.66
Helisoma anceps striatum	2.17
H. campanulatum	0.12
Land Gastropods:	
Succinea avara	0.64
Vertigo morsei	0.12

W - 56. OHIO: Castalia deposit; NW 1/4 Margaretta Twp., Erie County. Unit 1 of section, collections 1-6; marl, cream-colored, Chara stems and nodules; some clay in lower 6 inches, minor amounts of sand and peat lenses in upper 6 inches; masses of tufa irregularly located throughout unit; 12 inches thick. (Clark, 1961). Percentages based on 5,883 specimens.

Sphaeriidae	PTI
Pisidium casertanum	1.29
Freshwater gill-breathing Gastropods:	
Pomatiopsis lapidaria	0.03
Freshwater lung-breathing Gastropods:	
Ferrissia parallela	1.64
Fossaria humilis modicella	0.42
F. obrussa decampi	11.09
Gyraulus altissimus	30.23
Helisoma trivolvis	0.06
Physa gyrina	10.21
Planorbula armigera	3.63
Land Gastropods:	
Carychium exiguum	20.32
C. "exile canadense"	1.80
Euconulus fulvus	0.16
Gastrocopta contracta	1.64
G. tappaniana	8.02
Hawaiia minuscula	2.03
Helicodiscus parallelus	0.90
Nesovitrea binneyana	0.15
Oxyloma retusa	0.96
Punctum minutissimum	0.84
Retinella indentata	1.03
Strobilops labyrinthica	2.26
Succinea avara	0.08
Vertigo milium	0.64
V. morsei	0.25
Zonitoides arboreus	0.16

W - 57. OHIO: Castalia deposit; same locality as W-56. Unit 2 of section, collections

W-57: OHIO (cont.)
7-10; peat, black, a little sand and tufa interbedded, wood fragments; 8 inches thick. (Clark, 1961). Percentages based on 3,882 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	1.95
Freshwater lung-breathing Gastropods:	
Armiger crista	0.05
Ferrissia parallela	4.01
Fossaria humilis modicella	0.02
F. obrussa decampi	7.59
Gyraulus altissimus	25.09
Helisoma trivolvis	0.20
Physa gyrina	11.28
Planorbula armigera	9.71
Land Gastropods:	
Carychium exiguum	19.29
C. "exile canadense"	2.11
Euconulus fulvus	0.33
Gastrocopta contracta	1.03
G. tappaniana	5.43
Hawaiia minuscula	2.67
Helicodiscus parallelus	1.72
Nesovitrea binneyana	0.46
Oxyloma retusa	0.90
Punctum minutissimum	1.23
Retinella indentata	1.10
Strobilops labyrinthica	1.64
Vertigo milium	0.56
V. morsei	1.08
Zonitoides arboreus	0.43

W - 58. OHIO: Castalia deposit; same locality as W-56. Unit 3 of section, collections 11-28; marl, cream-colored and gray; very sandy in lower 2 inches; 36 inches thick. (Clark, 1961). Percentages based on 17,037 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	0.99
Freshwater gill-breathing Gastropods:	
Pomatiopsis lapidaria	0.38
Freshwater lung-breathing Gastropods:	
Armiger crista	0.19
Ferrissia parallela	0.45
Fossaria humilis modicella	0.08
F. obrussa decampi	24.14
Gyraulus altissimus	36.96
Helisoma trivolvis	0.04

W-58: OHIO (cont.)

	PTI
Physa gyrina	11.55
Planorbula armigera	0.16
Land Gastropods:	
Carychium exiguum	6.73
C. "exile canadense"	0.01
Euconulus fulvus	0.12
Gastrocopta contracta	0.52
G. tappaniana	7.95
Hawaiia minuscula	1.10
Helicodiscus parallelus	0.76
Nesovitrea binneyana	0.28
Oxyloma retusa	4.27
Punctum minutissimum	0.15
Retinella indentata	0.32
Strobilops labyrinthica	0.68
Succinea avara	0.21
Vertigo milium	0.01
V. morsei	1.73
Zonitoides arboreus	0.09

W - 59. OHIO: Castalia deposit; same locality as W-56. Unit 4 of section, collections 29-30; humus, black, fine-grained; 4 inches thick. (Clark, 1961). Percentages based on 1,880 specimens.

Sphaeriidae:	PTI
Pisidium casertanum	0.26
Freshwater gill-breathing Gastropods:	
Pomatiopsis lapidaria	2.34
Freshwater lung-breathing Gastropods:	
Armiger crista	0.37
Ferrissia parallela	0.26
Fossaria humilis modicella	0.10
F. obrussa decampi	13.08
Gyraulus altissimus	2.54
Physa gyrina	4.46
Planorbula armigera	0.37
Land Gastropods:	
Carychium exiguum	15.95
C. "exile canadense"	0.10
Gastrocopta contracta	3.56
G. tappaniana	13.93
Hawaiia minuscula	7.50
Helicodiscus parallelus	4.25
Nesovitrea binneyana	0.58
Oxyloma retusa	2.87
Retinella indentata	1.11

W-59: OHIO (cont.)

Strobilops labyrinthica	2.34
Succinea avara	0.15
Vertigo milium	0.15
V. morsei	1.11
Zonitoides arboreus	0.74

W - 60. OHIO: Cleveland loess. Loess exposed above gravels in large pit of the Cleveland Sand and Gravel Co., just south of Garfield Park, at the southeast margin of the city of Cleveland, Cuyahoga County. (Leonard, 1953: 372). His sample 2, species in lower (Farmdale?) loess. No abundance data.

Freshwater lung-breathing Gastropods:
- Anisus pattersoni
- Fossaria dalli grandis
- Gyraulus parvus
- Helisoma anceps
- Menetus sp.

Land Gastropods:
- Carychium "exile canadense"
- Cionella lubrica
- Discus mc clintocki
- Euconulus fulvus
- Hawaiia minuscula
- Hendersonia occulta
- Pupilla muscorum
- Strobilops labyrinthica
- Succinea grosvenori
- Vertigo alpestris oughtoni
- V. pygmaea

W - 61. OHIO: Cleveland loess. Same locality as W-60. (Leonard, 1953: 372). His sample 3, species in lower part of pro-Tazewell loess; and sample 4, species in upper part of pro-Tazewell loess. These two units are listed together here as they contain exactly the same species. No abundance data.

Land Gastropods:
- Catinella gelida
- Cionella lubrica
- Columella alticola
- Discus patulus
- Euconulus fulvus
- Hendersonia occulta
- Pupilla muscorum

W-61: OHIO (cont.)
- Stenotrema leaii
- Succinea grosvenori
- Vertigo alpestris oughtoni
- V. pygmaea

W - 62. INDIANA: Martinsville section: NE 1/4 sec. 31, T. 12 N., R. 1 E., Morgan Co. (Martinsville Quadrangle), southwest wall of a small pit used for borrow in highway construction 1.5 miles northwest of Martinsville. Fossiliferous laminated silt and sand about 2 meters thick is overlain by nonfossiliferous sand; stratification resembles that of floodplain sedimentation. Base of the unit overlies siltstone bedrock and is about 8 meters above the present floodplain of White River. The entire unit is probably correlative with terrace sediments of Wisconsin age elsewhere along the Valley. (Wayne, 1959: 14, 16). His assemblage F. Percentages based on 197 specimens.

Land Gastropods:	PTI
Anguispira alternata	10.2
Catinella gelida	30.4
Cionella lubrica	0.1
Columella alticola	5.6
Deroceras laeve	0.1
Euconulus fulvus	11.2
Gastrocopta armifera	0.1
Hendersonia occulta	11.2
Punctum minutissimum	3.0
Pupilla muscorum	1.5
Succinea ovalis	20.3
Vertigo gouldi hubrichti	3.0
V. modesta	3.0

W - 63. INDIANA: Thompson Branch section: NE 1/4 NW 1/4 sec. 36, T. 12 N., R. 9 W., Vigo County (Seelyville Quadrangle), road cut at Terre Haute. (Thornbury and Wayne, 1953: 88). Fossiliferous loess of Wisconsin age which is poorly exposed along the east side of the Wabash Valley. (Wayne, 1959: 14, 16), his assemblage G. Percentages based on 150 specimens.

Land Gastropods:	PTI
Catinella gelida	23.4
Columella alticola	0.7
Gastrocopta armifera	16.0

W-63: INDIANA (cont.)

Hawaiia minuscula	3.3
Nesovitrea electrina	10.0
Punctum minutissimum	3.3
Succinea ovalis	2.0
Vallonia gracilicosta	36.0
Vertigo elatior	5.3

W - 64. INDIANA: Watson Farm section: SE 1/4 NW 1/4 SE 1/4 sec. 27, T. 11 N., R. 3 E., Johnson County (Fruitdale Quadrangle), 4 miles east of Morgantown along a small tributary of Lick Creek. Fossiliferous dark brown to gray calcareous sandy silt about a meter thick, resembling a floodplain sediment, overlies unweathered till and is overlain by calcareous laminated clay, silt, and sand. The exposure is a few hundred feet southeast of the Wisconsin glacial boundary. The fossiliferous part of the section probably is a sediment of Wisconsin age that was deposited in a small valley eroded in till and gravel of Illinoian age. (Wayne, 1959: 14, 16), his assemblage H. Percentages based on 772 specimens.

Freshwater lung-breathing Gastropods:	PTI
Fossaria parva	11.8
Land Gastropods:	
Carychium "exile canadense"	10.2
Catinella gelida	10.2
Cionella lubrica	3.7
Columella alticola	10.1
Deroceras laeve	1.8
Discus cronkhitei	7.8
Euconulus fulvus	4.7
Gastrocopta armifera	0.1
Hendersonia occulta	14.3
Nesovitrea electrina	1.9
Oxyloma decampi gouldi	6.7
Punctum minutissimum	3.7
Pupilla muscorum	3.6
Stenotrema leaii	2.2
Succinea grosvenori	1.0
Vallonia albula	1.9
Vertigo alpestris oughtoni	0.3
V. elatior	3.5
V. modesta	0.1

W - 65. INDIANA: Lick Creek section: SE 1/4 NE 1/4 NE 1/4 sec. 23, T. 11 N., R. 3 E., Johnson County (Trafalgar Quadrangle), 2.25 miles south of Trafalgar along the bank of Lick Creek (Thornbury and Wayne, 1957: 24-25). Two beds containing organic debris are present between a single till of Wisconsin age and an underlying paleosol on till of Illinoian age. The upper of these two zones contains leaves of Picea, Salix(?), and Arctostaphylos(?), as well as snails. (Wayne, 1959: 14, 16), his assemblage I. Percentages based on 555 specimens.

Land Gastropods:	PTI
Catinella gelida	16.9
Cionella lubrica	4.3
Deroceras laeve	1.8
Discus cronkhitei	3.1
Euconulus fulvus	3.4
Gastrocopta armifera	13.0
Hendersonia occulta	7.4
Nesovitrea electrina	1.8
Punctum minutissimum	22.4
Pupilla muscorum	0.4
Stenotrema leaii	0.5
Vallonia albula	4.1
Vertigo elatior	0.4
V. gouldi hubrichti	23.2
V. modesta	0.4

W - 66. INDIANA: Clayton section: NE 1/4 NW 1/4 sec. 26, T. 15 N., R. 1 W., Hendricks County (Plainfield Quadrangle), 2 miles northeast of Clayton, along southwest bank of the West Fork of White Lick Creek (Thornbury and Wayne, 1957: 4-5). A single bed of fossiliferous massive gray silt about 30 centimeters thick is part of a set of stratified sediments that separates two till beds of Wisconsin age. (Wayne, 1959: 14, 17), his assemblage J. Percentages based on 480 specimens.

Land Gastropods:	PTI
Catinella gelida	32.3
Columella alticola	9.6
Discus cronkhitei	3.1
Euconulus fulvus	0.6
Pupilla muscorum	1.7
Vallonia albula	4.2

W-66: INDIANA (cont.)

Vertigo alpestris oughtoni	10.8
V. elatior	0.2
V. modesta	37.5

W - 67. INDIANA: Buckhart Creek section: SE 1/4 NE 1/4 sec. 8, T. 11 N., R. 4 E., Johnson County (Franklin Quadrangle), stream cut about 500 feet north of Indiana Highway 252 and 1.5 miles east of Trafalgar (Thornbury and Wayne, 1957: 26-27). A fossiliferous silt separates two till beds of Wisconsin age in this section, as well as in several other similar sections nearby. Wood at the base of the exposure is embedded in weathered till of Illinoian age. (Wayne, 1959: 15, 17), his assemblage K. Percentages based on 467 specimens.

Freshwater lung-breathing Gastropods:	PTI
Fossaria parva	14.5
Land Gastropods:	
Catinella gelida	22.5
Columella alticola	4.3
Deroceras laeve	7.4
Euconulus fulvus	0.6
Gastrocopta pentodon	0.9
Nesovitrea electrina	0.4
Pupilla muscorum	0.2
Stenotrema leaii	0.6
Vallonia albula	4.7
Vertigo alpestris oughtoni	4.3
V. ovata	39.6

W- 68. INDIANA: Flat Rock River section: NE 1/4 NW 1/4 sec. 4, T. 12 N., R. 9 E., Rush County; stream cut 3 miles northwest of Milroy (Wayne, Thornbury, and Goldthwait, 1955: 25-26). A fossiliferous silt bed about 5 centimeters thick separates two till beds of Wisconsin age, the basal one of which overlies a paleosol on till of Illinoian age. (Wayne, 1959: 15, 17), his assemblage L.

Land Gastropods:	
Catinella gelida	abundant
Pupilla muscorum	rare
Vertigo alpestris oughtoni	rare

W - 69. INDIANA: Cave Stone Company Quarry. NE 1/4 NW 1/4 sec. 32, T. 11 N., R. 7 E., Shelby County (Hope Quadrangle), near the west edge of the village of Norristown (Murray and others, 1955: 35-36). In the thin overburden on the limestone of this quarry, a fossiliferous silt about 20 centimeters thick lies between two till beds of Wisconsin age. (Wayne, 1959: 15, 17), his assemblage M. Percentages based on 218 specimens.

W-69: INDIANA (cont.)

Freshwater lung-breathing Gastropods:	PTI
Fossaria parva	4.6
Land Gastropods:	
Catinella gelida	21.1
Columella alticola	3.2
Deroceras laeve	2.7
Discus cronkhitei	8.7
Euconulus fulvus	0.5
Pupilla muscorum	3.7
Vallonia albula	13.8
V. alpestris oughtoni	0.4
V. elatior	41.3
V. modesta	5.5

W - 70. INDIANA: NE 1/4 sec. 14, T. 13 N., R. 2 W., Wayne County; exposure along a creek bank 2.5 miles southeast of Centerville (Wayne, Thornbury, and Goldthwait, 1955: 33; Gamble, 1958: 29-31). The fossiliferous silt in this section separates two till beds, both of which are presumed to be of Wisconsin age, although Gamble (1958:31) suggests that they may be older. (Wayne, 1959: 15, 17), his assemblage N. Percentages based on 225 specimens.

Land Gastropods:	PTI
Catinella gelida	89.0
Gastrocopta armifera	2.2
G. tappaniana	0.9
Punctum minutissimum	6.2
Vertigo elatior	2.2
V. gouldi hannai	0.4

W -71. INDIANA: Avilla section: SW 1/4 NW 1/4 sec. 33, T. 34 N., R. 11 E., Noble County (Ege Quadrangle), Baltimore and Ohio Railroad cut about 7 miles west of Garrett. Till is overlain by fossiliferous calcareous sandy marl about 15 centimeters thick, which in turn is overlain by about 2.5 meters of laminated silty clay,

W-71: INDIANA (cont.)
presumably a deposit of an ice marginal lake (Wayne, Thornbury, and Goldthwait, 1955:9). (Wayne, 1959: 15, 17), his assemblage O. Percentages based on 600 specimens.

	PTI
Sphaeriidae:	
Pisidium sp.	0.1
Freshwater lung-breathing Gastropods:	
Fossaria parva	69.7
Land Gastropods:	
Catinella gelida	30.0
Deroceras laeve	0.2

W - 72. INDIANA: Fremont Ditch section: NE corner SE 1/4 sec. 2, T. 37 N., R. 14 E., Steuben County (Angola East Quadrangle), 3 miles southeast of Fremont, ditch bank exposure beside culvert. Peat and marl overlying till have been buried beneath gravelly sand, presumably glacial outwash, that slumped when a buried ice block melted. Radiocarbon dates from both the Washington and Michigan laboratories indicate that the marl and peat were deposited about 13,000 years ago. (W-57, W-65, M-350). (Wayne, 1959: 15, 17), his assemblage P.

Sphaeriidae:	
Pisidium sp.	abundant
Freshwater gill-breathing Gastropods:	
Valvata sincera	common
V. tricarinata	common
Freshwater lung-breathing Gastropods:	
Fossaria obrussa decampi	common
Gyraulus altissimus	common

W - 73. OHIO: Oxford Cut: along Bull Run, 0.5 mile west of U.S. Highway 27, NE 1/4 SW 1/4 sec. 26, T. 5 N., R. 1 E., Oxford Twp., Butler County. The Oxford Forest Bed underlies 70 feet of late? Wisconsin till. Mollusks and insects occur in the thin basal forest layer. Twenty-five spruce logs from the till show decreasing width of growth rings from birth, interpreted as indicating approach of the annihilating glacier. Radiocarbon dates from logs in the till gave ages of "at least 15,000" years (C-465) and 19,980 ± 500 years (W-92). The measured section is described by Wayne, Thornbury, and Goldthwait (1955: 36) and by Goldthwait (1958: 215). See also Forsyth (1961: 7). Long (1933: 9-10) collected 531 land snails from 915 cc. of soil. His revised list and abundance data follow.

W-73: OHIO (cont.)

Freshwater lung-breathing Gastropods:	
Fossaria? sp. (listed as "unidentified shell" by Long).	common
Land Gastropoda:	
Anguispira alternata	1 only
Carychium exile	fairly common
Columella alticola	very abundant
Discus cronkhitei	abundant
Euconulus fulvus	fairly common
Gastrocopta armifera	3 specimens
G. procera	6 specimens
Hendersonia occulta	very abundant
Nesovitrea electrina	1 only
Oxyloma retusa	fairly common
Pupilla "blandi"(?)	common
P. muscorum	abundant
Pupoides albilabris	3 specimens
Retinella indentata	1 only
Stenotrema leaii	5 specimens
Succinea avara	common
Vallonia costata	common
V. pulchella	common
Vertigo gouldi	common
V. modesta corpulenta	common
Zonitoides arboreus	fairly common

PLEISTOCENE ASSEMBLAGES OF UNCERTAIN AGE

U - 1. MISSOURI: Opposite mouth of Little Nemaha, Atchison County. Station 1 (Greger, 1933: 58). No abundance data.
Freshwater lung-breathing Gastropods:
Physa heterostropha
Land Gastropods:
Allogona profunda
Triodopsis multilineata

U - 2. MISSOURI: Along Missouri River, opposite mouth of Big Nemaha, Holt County. Station 2 of Greger (1933: 58).
Freshwater lung-breathing Gastropods:
Helisoma trivolvis
Stagnicola umbrosa
Land Gastropods:
Discus cronkhitei
Helicodiscus parallelus
Triodopsis albolabris
T. multilineata

U - 3. MISSOURI: Along Missouri River. Greger's Station 3 (Greger, 1933: 58).
Land Gastropods:
Anguispira alternata
Gastrocopta armifera
Stenotrema hirsutum
S. leaii
Succinea grosvenori
Triodopsis divesta

U - 4. MISSOURI: Along Missouri River. Station 4: Near mouth of Platte River, Platte County. (Greger, 1933: 59).
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Helisoma trivolvis
"Limnaea fragilis"
"Limnaea sp."
Physa gyrina
P. heterostropha
"Planorbis sp."
Planorbula armigera
Land Gastropods:
Discus cronkhitei
Gastrocopta armifera

U-4: MISSOURI (cont.)
Helicodiscus parallelus
Retinella indentata
Succinea "obliqua"
S. "ovalis?"
Triodopsis multilineata
Vallonia pulchella

U - 5. MISSOURI: Along Missouri River, Lexington, Lafayette County. (Greger, 1933: 59).
Freshwater lung-breathing Gastropods:
"Limnaea fragilis"
Land Gastropods:
Allogona profunda
Anguispira alternata

U - 6. MISSOURI: Along Missouri River, Glasgow, Howard County. (Greger, 1933: 59, his station 6).
Land Gastropods:
Anguispira alternata
Triodopsis multilineata
Succinea avara
S. ovalis

U - 7. MISSOURI: Along Missouri River, Boonville, Cooper County. (Greger, 1933: 59, his Station 7).
Land Gastropods:
Discus cronkhitei
Hendersonia occulta
Nesovitrea electrina
Vallonia pulchella

U - 8. MISSOURI: Along Missouri River, Lupus, Moniteau County. (Greger, 1933: 59, his Station 8).
Land Gastropods:
Allogona profunda
Anguispira kochi
Haplotrema concavum
Mesodon appressus
M. elevatus
M. thyroidus
Triodopsis albolabris
T. albolabris alleni

U - 9. MISSOURI: Along Missouri River, Providence, Boone County. (Greger, 1933: 59, his Station 9).
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Discus patulus
Haplotrema concavum
Mesodon appressus
M. clausus
M. elevatus
M. inflectus
M. pennsylvanicus
M. thyroidus
Stenotrema hirsutum
S. leaii
Triodopsis albolabris
T. albolabris alleni
Ventridens ligera

U - 10. MISSOURI: Along Missouri River, near mouth of Middle River, Callaway County, (Greger, 1933: 59-60, his Station 10).
Freshwater gill-breathing Gastropods:
Campeloma subsolidum
Land Gastropoda:
Anguispira alternata
A. kochi
Carychium exile
Gastrocopta armifera
G. contracta
G. procera (?)
Hawaiia minuscula
Helicodiscus parallelus
Hendersonia occulta
Mesodon appressus
M. elevatus
M. multilineatus
M. thyroidus
M. zaletus
Stenotrema fraternum
S. hirsutum
S. leaii
Triodopsis albolabris
Vallonia pulchella
Vallonia sp.
Ventridens ligera
Zonitoides arboreus

U - 12. MISSOURI: Along Missouri River; south end of Quarry, Musick's Ferry, Bluff, St. Louis County; Greger, 1932, station 12 (Greger, 1933: 60).
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Bulimulus dealbatus var.
Gastrocopta armifera
Haplotrema concavum
Helicodiscus parallelus
Hendersonia occulta
Mesodon appressus
M. elevatus
M. multilineatus
Oxyloma retusa
Retinella indentata
Strobilops labyrinthica
Succinea ovalis
Triodopsis tridentata

U - 13. MISSOURI: Along Missouri River, station 13: Charbonnaiere /sic/ Bluff, St. Louis County, Greger, 1932. (Greger, 1933: 60).
Land Gastropods:
Allogona profunda
Anguispira alternata
A. kochi
Bulimulus dealbatus
Gastrocopta armifera
G. contracta
Haplotrema concavum
Helicodiscus parallelus
Hendersonia occulta
Mesodon appressus
M. elevatus
M. inflectus
M. multilineatus
Oxyloma retusa
Pupoides albilabris
Stenotrema fraternum
S. hirsutum

U-13: MISSOURI (cont.)
Strobilops labyrinthica
Succinea ovalis
Triodopsis albolabris

U - 14. MISSOURI: Along Missouri River, St. Louis City. (Greger, 1933: 61, his Station 14).
Freshwater gill-breathing Gastropods:
Pomatiopsis lapidaria
Land Gastropods:
Discus cronkhitei

U-14: MISSOURI (cont.)
Gastrocopta armifera
Haplotrema concavum
Hendersonia occulta
Nesovitrea electrina
Stenotrema hirsutum
S. leaii
Strobilops labyrinthica
Zonitoides arboreus

LIVING ASSEMBLAGES

The living associations listed here are only a few of those available in the literature and in my unpublished records. They have been chosen particularly to show the relationships of Pleistocene associations in eastern North America with those now living in the same area and in areas immediately adjacent, e. g. Manitoba, Minnesota, and Wisconsin. Most of these lists are readily available in the literature but the individual species are cited under a variety of names which is nothing short of bewildering. My aim here has been to gather all these records in one place and in one nomenclatorial system for convenience in reference.

Ideally, only those lists representing a restricted area in a single ecological niche should have been included in this part of the report. In practice, it was found that much valuable information could be gained by including much more inclusive lists, for example Sterki's Tuscarawas County list (OHIO-43).

MANITOBA - 1. Temporary ponds (Nos. 1-4) recorded by Mozley (1938: 93-138). No. 1, a small pond between Lake Brereton and Mud Turtle Lake, eastern Manitoba. (Mozley, 1938: 130).
Freshwater lung-breathing Gastropods:
Aplexa hypnorum (only).

MANITOBA - 1a. Temporary ponds: a small pond near the shore of Mud Turtle Lake. (Mozley, 1938: 130).
Freshwater lung-breathing Gastropods:
Promenetus umbilicatellus (only).

MANITOBA - 2. Temporary ponds: a small pond near Stony Mountain. (Mozley, 1938: 130).
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Stagnicola palustris

MANITOBA - 3. Temporary ponds: a pond 4 miles southwest of Winnipeg. (Mozley, 1938:130).
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Planorbula campestris
Stagnicola caperata

MANITOBA - 4. Temporary ponds: a pond near St. Vital. (Mozley, 1938: 130).
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Planorbula campestris
P. crassilabris
Promenetus umbilicatellus
Stagnicola caperata
S. palustris.

MANITOBA - 5. Small freshwater lakes and ponds, containing water permanently: A pond at Mile 95, G.W.W.D. Ry. (Mozley, 1938:131)
Freshwater lung-breathing Gastropods:
Stagnicola lanceata

MANITOBA - 6. Small freshwater lakes and ponds, containing water permanently: Low-lying ground near Round Lake, Ninette. (Mozley, 1938: 131).
Freshwater lung-breathing Gastropods:
Fossaria humilis modicella
F. obrussa exigua

MANITOBA - 7. Small freshwater lakes and ponds, containing water permanently: A pond near the shore of Hudson Bay, east of Fort Churchill. (Mozley, 1938: 131).
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Gyraulus "arcticus"
Physa gyrina
Stagnicola palustris

MANITOBA - 8. Small freshwater lakes and ponds, containing water permanently: Douglas Lake, near Onah. (Mozley, 1938: 131).
Freshwater lung-breathing Gastropods:
Helisoma campanulatum davisi
H. trivolvis
Lymnaea stagnalis jugularis
Physa gyrina
Promenetus exacuous
Stagnicola palustris

MANITOBA - 9. Small freshwater lakes and ponds, containing water permanently: Pelican Lake, Ninette. (Mozley, 1938: 131). (1) On Potamogeton, near the center of the lake.
Freshwater lung-breathing Gastropods:

Physa gyrina	abundant
Stagnicola palustris	less common

MANITOBA - 10. Same as Manitoba - 9, but: (2) In Typha and Scirpus marsh around the shore of the lake.
Freshwater lung-breathing Gastropods:
Gyraulus "arcticus"
Lymnaea stagnalis jugularis
Physa gyrina
Planorbula armigera
Promenetus exacuous
Stagnicola palustris

MANITOBA - 11. Same as Manitoba - 9, but: (3) In a moist meadow on slightly higher ground near the marsh:
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Fossaria parva var.
Stagnicola caperata

MANITOBA - 12. Large lakes having outlet streams. Their outstanding characteristic is that they are of moderate depth (commonly up to 30 m.), and that their shores are subject to severe wave action. (1) Atikameg Lake, Mile 17, Hudson Bay Railway. (Mozley, 1938: 132).
Freshwater gill-breathing Gastropods:
Valvata tricarinata
Freshwater lung-breathing Gastropods:
Fossaria obrussa decampi
Gyraulus deflectus
G. hirsutus
Promenetus exacuous
Stagnicola emarginata var.

(TO BE CONTINUED IN A FUTURE NUMBER OF STERKIANA)