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PALEOCLIMATIC IMPLICATIONS OF PLEISTOCENE HERPETOFAUNAS OF EASTERN AND CENTRAL NORTH AMERICA

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A review of Pleistocene herpetofaunas of eastern and central North America does not support the classical concept of alternating cool-moist, warm-dry glacial and interglacial climates. On the contrary, herpetological evidence generally indicates Pleistocene climates south of the glacial boundaries were warmer or more equable than today until very Late Pleistocene time, when there is some evidence of cooling in the Ozark and Appalachian areas. On the other hand, there is evidence that climatic equability persisted in southern Texas, northeastern Mississippi, northwestern Georgia, and Florida, in very Late Pleistocene time. Since classical terms such as Nebraskan, Aftonian, Kansan, etc., reflect the concept of alternating glacial and interglacial climates, it is suggested that the use of Provincial Land Mammal Ages is more realistic in reflecting Pleistocene biostratigraphic units.

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INTRODUCTION

Current, crucial questions about the Pleistocene involve (1) the time of its onset, (2) the climates that occurred during its extent, (3) the best divisional terms to be used, and (4) the reasons for the extinction of such a large part of the megafauna in Late Pleistocene time. The present paper presents a review of Pleistocene herpetofaunas in which herpetological evidence reflects on questions 2, 3, and indirectly on 4.

In the course of collecting Late Tertiary and Pleistocene amphibian and reptile fossils in Nebraska (1971-1979), I have had several stimulating conversations with Mr. George Corner, Dr. C. Bertrand Schultz, and Dr. Michael Voorhies. Talks with these gentlemen as well as conversations with Dr. Walter Dalquest, the late Dr. C. W. Hibbard, and Dr. Bob H. Slaughter led to a presentation in 1977 at the 10th INQUA Congress in Birmingham, England. In Birmingham, I had further conversations with Dr. Schultz and also with Dr. Larry D. Martin. The present paper is an outgrowth of these events.

Hibbard (1960) first recognized the importance of large land tortoises and crocodilians in the interpretation of Pliocene and Pleistocene climates. But he also believed (personal communication) that details provided by the smaller amphibians and reptiles would give important information regarding Pleistocene climates. As he reasoned, these ectothermic animals would be much more at the mercy of the environment than their mammalian contemporaries, and would be more indicative of climatic change.

But other than the considerations given giant tortoises and crocodilians, considered to be especially indicative of very mild winters with few if any days of frost (Hibbard, 1960), little mention has been made of fossil herpetofaunas in reference to paleoclimatic interpretations.

Pleistocene mammalian assemblages from North America, especially some of those from the southern Great Plains region, often contain extralimital northern and southern forms that are climatically incompatible today. The most widely accepted hypothesis to explain this dilemma (Dalquest, 1965; Dalquest *et al.,* 1949; Hibbard, 1960, 1970; Hibbard and Taylor, 1960; Martin and Gilbert, 1978; Martin and Neuner, 1978; Slaughter, 1967, 1975; Slaughter and Hoover, 1963; and Taylor, 1965) has been a "climatic equability model" (terminology of Zakrzewski, 1975); in other words, mild winters account for the presence of the southern species, and cooler summers account for the presence of the northern species.

Holman (1969a), in a review of Pleistocene amphibians and reptiles of Texas, stated in his summary, "Several intrusive forms from the east and from the south, and at least one northern form, as well as the presence of large nonburrowing tortoises, indicate that until Recent times the winters in Texas were milder and the summers moister and perhaps cooler. This thesis is in line with the mammalian evidence."

Holman (1976) reviewed occurrences of "ecologically incompatible" herpetological species in the Late Pleistocene of the southeastern United States and stated in the abstract, "The occurrence of northern and southern herpetological species, ecologically incompatible today, from Late Pleistocene sites in northern Mississippi, northwestern Georgia, and north-central Florida is interpreted as reflecting a more equable climate than at present; the northern forms indicating cooler summers, the southern forms and large land tortoises of the genus *Geochelone* indicating milder winters."

The present paper reviews Pleistocene herpetofaunas of the eastern and central United States with reference to paleoclimatic implications.

CHRONOLOGIC ACCOUNTS

Some believe that the Pleistocene began approximately between 3.2 and 3.4 m.y. before the present, between the Kimballian and the Blancan Provincial Land Mammal Ages (*see* Schultz *et al.*, 1978:60). An alternative view is that the Pleistocene began about 2.0 m.y. ago between the Blancan and the Irvingtonian Provincial Land Mammal Ages. I have chosen the latter date because of the essentially modern nature of the known post-Blancan herpetological species.

In this section on chronologic accounts, classical terms for glacial and interglacial ages such as Nebraskan, Aftonian, Kansan, etc. are used, for I later wish to discuss whether these classical terms or Provincial Land Mammal Ages are more realistic when applied to Pleistocene biostratigraphic units.

Other than extinct land tortoises of several kinds, most Pleistocene herpetological species are extant. But during the Pleistocene, several herpetological species occurred outside of their present ranges, and for these the term "extralimital" is used. Extralimital forms are summarized following the Discussion. These summaries are arranged on a regional basis with the faunas listed in temporal sequence.

Reports of single extralimital species are not included. By far, the most numerous of these are southern extralimital forms, especially the large tortoises (*Geochelone*) from Late Pleistocene sites in Florida (*see* Auffenberg, 1963a), and large, fossil box turtles of the genus *Terrapene* in some of the south-central states (*see* Milstead, 1967). Several records of *Emydoidea blandingii,* the false box turtle, exist south and east of its present range (Preston and McCoy, 1971). Moreover, there are recent individual reports of *Terrapene carolina putnami,* a form with southern affinities, in Missouri (Moodie and Van Devender, 1977), of *Graptemys,* the map turtle, slightly southeast of its present range in Florida (Jackson, 1975), and of the false map turtle, *Graptemys pseudogeographica* occurring in Michigan north of its present range (Wilson and Zug, 1966). The last three records and most of the records of the first three genera are from Late Pleistocene sites.

Nebraskan

No herpetofaunas have been reported from Nebraskan deposits.

Aftonian

The Nash Local Fauna of Meade County, Kansas, is the only one that has been referred to the Aftonian interglacial age. The herpetological fossils of this fauna consist mainly of species of lizards that occur in the area today. Only one form, *Eumeces septentrionalis,* is extralimital, occurring about 80 km to the east of the site at present.

Summary. Nothing in the fauna indicates that the climate of the area was different from the present except for the slight possibility of a little more annual moisture.

Kansan

The Kansan is represented by only two large herpetofaunas, one in South Dakota and one in Maryland, although three small, Late Kansan, northern Texas faunas have two or more extralimital forms.

The Java Local Fauna of north-central South Dakota is America's northernmost Pleistocene herpetofauna. It is thought to represent Early Kansan time. Most of the extralimital forms are from the south, southeast, and east; but one form, *Phrynosoma douglassi,* occurs west of the area today.

The Cumberland Cave Fauna, Allegany County, Maryland, mainly contains species that occur in the area today, but *Ambystoma tigrinum* is now absent from the Appalachian Plateau and *Elaphe vulpina* occurs west of the area. Nothing in this large, Pleistocene herpetofauna indicates that the climate was any cooler than at present.

Three small, Late Kansan herpetofaunas from northern Texas (Summary III) are noteworthy in that they all yield two or more southern forms, including giant tortoises, gopher tortoises, and alligators.

Summary. None of the Kansan herpetological material indicates a cool-moist climate for this age, which has classically been considered to be glacial. In fact, a warmer climate than at present is indicated for north-central South Dakota; a climate at least as warm as at present is indicated for Maryland; and a climate with much warmer winters than at present is indicated for northern Texas. It is quite important to note,

I believe, that not one extralimital northern herpetological species is known from any Kansan fauna.

Yarmouthian

The Yarmouthian is represented by only one large herpetofauna, the Kanopolis Herpetofauna of Ellsworth County, Kansas. Evidence from this fauna (Summary I) indicates that winters were much warmer than at present and that summers were possibly somewhat moister.

The small, Arkalon Fauna of Seward County, Kansas, includes both southern and northern extralimital forms (Summary II). But the northern form in the Arkalon Fauna is *Emydoidea blandingii,* and the possibility exists that its past distribution is more a reflection of habitat elimination than of climatic change (*see* Preston and McCoy, 1971).

Summary. Much warmer winters with few, if any, days of frost, as well as summers that were possibly cooler and moister, are indicated for Kansas in the Yarmouthian.

Illinoian

Two large herpetofaunas are known from the Illinoian, one from Kansas and one from Texas; and a small Oklahoma fauna has both northern and southern extralimital species.

The Sandahl Local Fauna of McPherson County, Kansas, has no extralimital forms, but the Slaton Local Fauna, Lubbock County, Texas, has southern and southeastern forms (Summary I) including *Alligator* remains. The small Berends Fauna of Beaver County, Oklahoma, has the southern *Gopherus* sp., as well as the northern *Emydoidea blandingii.*

Summary. Again, the herpetological evidence does not support the classical idea of a cooler, moister climate for the Illinoian age. There is nothing to indicate that the climate of Kansas was any cooler than today, and indications are that the winter temperatures in Texas and Oklahoma were much warmer than at present.

Sangamonian

The Sangamonian is relatively well represented by large herpetofaunas with one in Kansas, two in north Texas, and six in Florida (Summary I). Moreover, one locality in Texas and three in Florida have small herpetofaunas, with both northern and southern extralimital forms (Summary II).

Large herpetofaunas from Kansas and Texas include the Cragin Quarry Fauna, Meade County, Kansas, with southern, southwestern, and eastern extralimital forms; the Easley Ranch Local Fauna of Foard County, Texas, with southern and eastern extralimital forms; and the Clear Creek Local Fauna of Denton County, Texas, with a southern and a western extralimital form. The small Moore Pit Fauna of Dallas County, Texas, has both northern and southern extralimital forms.

Three of the six large Florida faunas of Sangamonian age have both northern and southern extralimital forms, and three small Florida herpetofaunas have both northern and southern forms.

Summary. The classical hot and dry climates of the older literature and textbooks are not indicated by the herpetological evidence. In fact, many of the faunas indicate a more equable climate, with milder winters and cooler summers.

Wisconsinan

Three large, Early Wisconsinan faunas are known; the Jinglebob Fauna in southwestern Kansas, the Groesbeck Fauna in northern Texas, and the Haile XIVA Fauna in northern Florida. The Kansas and Florida faunas have northern and southern extralimital forms indicating climatic equability in these areas; a somewhat moister climate may be indicated for Texas as eastern extralimital forms occur (Summary I).

The other large Wisconsinan herpetofaunas all represent Late Wisconsinan times. In Missouri three cave faunas (Summary I) have species that are found in the area today, with the exception that *Elaphe vulpina* occurs in two of them and *Emydoidea blandingii* in one. These northern extralimital forms may indicate somewhat cooler conditions, or on the other hand, their presence in the Pleistocene may reflect the presence of grassy or marshy areas that no longer exist in the area (*see* Preston and McCoy, 1971). The Conard Fissure site in Arkansas has *Elaphe vulpina,* but it also has *Phrynosoma cornutum,* a form that occurs southwest of the area today.

Three large cave faunas in south-central Texas have Late Wisconsinan herpetofaunas. Miller's Cave represents very Late Wisconsinan time and has no extralimital forms; but Cave Without a Name and Freisenhahn Cave have southern and eastern extralimital forms.

In the Appalachian region, a large cave fauna is known from Tennessee, one from Virginia, and two from Pennsylvania (Summary I), but none of these has extralimital forms. But the Ladds Fauna in northwestern Georgia is of great interest as it has giant tortoise remains (*Geochelone*) and southern toad remains (*Bufo terrestris*), as well as wood turtle remains (*Clemmys insculpta*). The wood turtle occurs far to the north of northwestern Georgia today, and the southern toad occurs today in the Coastal Plain. The giant tortoise remains were newly discovered in the fauna (Holman, unpublished).

Almost as striking is the small Catalpa Creek Fauna of northeastern Mississippi which has giant tortoise remains associated with the northern *Emydoidea blandingii.*

A Coastal Plain site in Texas and most Florida Late Wisconsinan sites have *Geochelone* remains (Summaries I and II) and in the Florida Devil's Den Site and the Ichetucknee River sites these giant tortoise remains are associated with northern extralimital forms, indicating an equable climate could have persisted in the southeastern Coastal Plain until Late Wisconsinan.

Summary. Early Wisconsinan climates in Kansas and Florida appear to have been more equable than today. There is some evidence of cooling in the Ozark and Appalachian areas, but on the other hand there is evidence of an equable climate persisting in southern Texas, Mississippi, Georgia, and Florida well into Late Wisconsinan time.

DISCUSSION

A review of Pleistocene herpetofaunas of eastern and central North America shows that all faunas consist mainly of species living today. But in most fossil faunas, extralimital species occur outside of their present ranges. Except for a few Late Wisconsinan faunas in northern and central areas with one or two northern extralimital species, Pleistocene herpetofaunas in eastern and central North America mainly have: (A) extralimital southern species existing with species that occur in the area today, or (B) mixtures of northern and southern extralimital species existing with species that occur in the area today. These type A and type B occurrences are interpreted as reflecting either warmer or more equable Pleistocene climates. In fact, this review indicates these warmer or more equable climates existed throughout most of the Pleistocene (Table I). There is some evidence of cooling in the Ozark and Appalachian areas in Late Wisconsinan time; but there is also evidence of the persistence of climatic equability well into Late Wisconsinan time in southern Texas, northeastern Mississippi, northwestern Georgia, and Florida.

TABLE I. Generalized hypothetical Pleistocene climates south of the glacial boundaries in eastern and central North America.

	Classical Interpretation	Herpetological Evidence
Aftonian	Warm-dry	Small fossil sample, but little to indicate climate different than at present
Kansan	Cool-moist	Warmer, at least in winter, than at present
Yarmouthian	Warm-dry	Mild-equable, warmer winters, cooler summers
Illinoian	Cool-moist	Warmer, at least in winter, than at present
Sangamonian	Warm-dry	Mild-equable, warmer winters, cooler summers
Wisconsinan	Cool-moist	Possible cooling in central Appalachian and in Ozark regions in Late Wisconsinan, but apparent persistence of equability in southeast

It is obvious that there is no herpetological evidence for the classical cool-moist, warm-dry glacial and interglacial climatic model (Table I); yet, the classical terms Nebraskan, Aftonian, Kansan, etc. are ingrained in the biological literature, and they convey the concept of alternating glacial and interglacial climates south of the glacial boundaries. In fact, the neo-herpetological literature is replete with evolutionary hypotheses based on these concepts.

Schultz and Martin (1977:288) pointed out, "The terms Nebraskan, Kansan, Illinoian, Wisconsinan, Aftonian, Yarmouthian, and Sangamonian may not be meaningful when applied to faunas. In fact, they may not be very useful when applied to tills. In Nebraska they all appear to be complexes of glacial advances and retreats (Schultz, Tanner, and Martin, 1972, presented at 8th INQUA Congress, Paris, 1969), and no good criteria yet exist to distinguish stadials and interstadials from glacials and interglacials. Perhaps we should face the possibility that no distinction exists"; the same authors point out (page 289), "The benefits of hindsight now suggest that building a Pleistocene stratigraphy around glacial retreats and advances perhaps was a mistake. Tills are notoriously difficult to trace and correlate, and many of the assumptions upon which the till stratigraphy was based have proven to be false. The most serious change in our thinking has been the discovery that the glacial advances and retreats do not fit a simple pattern of four glacials and three interglacials. In fact, the importance of the interglacials seems to have been much inflated. Some new evidence seems to indicate that they might have been less than 10,000 years in duration."

Dr. Larry D. Martin (personal communication, August, 1977) pointed out that the rodent faunal evidence in North America does not support the classical ideas of glacial and interglacial ages of the Pleistocene.

For some years a system of Provincial Land Mammal Ages has been widely used to express biostratigraphic relationships in the Pleistocene. Sometimes these Provincial Land Mammal Ages have been correlated with the classical terms, as in Webb (1974:13). These terms (such as Blancan, Irvingtonian, and Rancholabrean) are based on both faunas and rocks and not on the superposition of tills alone as were the classical terms. Recently, Schultz *et al.* (1978) subdivided the Blancan and Irvingtonian Mammal Ages into smaller, more precise biostratigraphic units. On the basis of the herpetological evidence, I would suggest that the Provincial Land Mammal Ages are better terms to use with reference to Pleistocene faunas than are the classical ones: Nebraskan, Aftonian, Kansan, Yarmouthian, Illinoian, Sangamonian, and Wisconsinan.

SUMMARY OF EXTRALIMITAL FORMS

Pleistocene herpetofaunas of eastern and central North America are summarized with regard to extralimital forms. The faunas, listed by region or state, are arranged chronologically.

I. Regional Summary

All of the Pleistocene herpetofaunas from eastern and central North America with at least 10 identified forms are summarized. Almost all of these large herpetofaunas have extralimital forms.

Northern Plains Areas.

South Dakota. 1. Java Local Fauna, Walworth County, South Dakota, Early Kansan. Extralimital forms: southern, *Rana catesbeinana*; southeastern, *Nerodia sipedon, Elaphe vulpina*; eastern, *Eumeces septentrionalis*; western, *Phrynosoma douglasii.* Reference: Holman (1977a).

Central Plains Area.

Kansas. 2. Nash Local Fauna, Meade County, Kansas, Late Aftonian. Extralimital form: eastern, *Eumeces septentrionalis.* Reference: Holman (1979).

3. Kanopolis Local Fauna, Ellsworth County, Kansas, Yarmouthian. Extralimital forms: southern, *Geochelone* sp., large form; southeastern, *Hyla versicolor, Sternotherus odoratus, Pseudemys cf. P. concinna*; eastern, *Graptemys geographica, Eumeces* near *E. fasciata.* References: Holman (1972), Hibbard *et al.* (1978).

4. Sandahl Local Fauna, McPherson County, Kansas, Illinoian. Extralimital forms: none. Reference: Holman (1971).

5. Cragin Quarry Fauna, Meade County, Kansas, Sangamonian. Extralimital forms: southern, *Geochelone* sp., *Gopherus* sp., *Phrynosoma modestum*; southwestern, *Holbrookia texana*; eastern, *Pseudacris cf. P. triseriata, Storeria* sp. References: Etheridge (1958), Hibbard (1960), Tihen (1960), Brattstrom (1967).

6. Jinglebob Local Fauna, Meade County, Kansas, Early Wisconsinan. [*See* Zakrzewski (1975) for age.] Extralimital forms: southern, *Terrapene carolina putnami* x *triunguis*; eastern, *Pseudacris triseriata*; northern, *Emydoidea blandingii.* References: Brattstrom (1967), Chantell (1966), Milstead (1956), Preston and McCoy (1971).

Northern Texas. 7. Slaton Local Fauna, Lubbock County, Texas, Illinoian. Extralimital forms: southern, *Alligator mississipiensis*; southeastern, large form of *Terrapene carolina.* Reference: Holman (1969b).

8. Easley Ranch Local Fauna, Foard County, Texas, Sangamonian. Extralimital forms: southern, *Syrrhophus marnocki, Geochelone* sp., *Gopherus* sp.; eastern, *Hyla versicolor, Storeria cf. S. dekayi, Opheodrys aestivus.* References: Holman (1962a), Lynch (1966).

9. Clear Creek Fauna, Denton County, Texas, Sangamonian. Extralimital forms: southern, *Geochelone* sp.; western, *Arizona elegans.* Reference: Holman (1963).

10. Groesbeck Creek Fauna, Hardeman County, Texas, Wisconsinan. Extralimital forms: eastern, *Ambystoma texanum, Hyla versicolor.* Reference: Holman (1964).

Ozark Plateau.

Missouri. 11. Crankshaft Pit, Franklin County, Missouri, Late Wisconsinan. Extralimital forms: northern, *Elaphe vulpina.* References: Holman (1965a), Parmalee *et al.* (1969).

12. Zoo Cave, Taney County, Missouri, Late Wisconsinan. Extralimital forms: northern, *Elaphe vulpina.* References: Holman (1974), Hood and Hawksley (1975).

13. Brynjulfson Cave, Boone County, Missouri, very Late Wisconsinan. Extralimital forms: northern, *Emydoidea blandingii.* Reference: Parmalee and Oesch (1972).

Arkansas. 14. Conard Fissure, Newton County, Arkansas, Late Wisconsinan. Extralimital forms: southern, *Phrynosoma cornutum*; northern, *Elaphe vulpina.* Reference: Dowling (1958).

Edwards Plateau.

Texas. 15. Miller's Cave, Llano County, Texas, Late

Wisconsinan. Extralimital forms: none. Reference: Holman (1966).

16. Cave Without a Name, Kendall County, Texas, Late Wisconsinan. Extralimital forms: southern, *Sceloporus variabilis, Eumeces t. tetragrammus*; eastern, *Terrapene carolina triunguis, Agkistrodon piscivorus.* References: Hill (1971), Holman (1968), Milstead (1967).

17. Friesnhahn Cave, Bexar County, Texas, Late Wisconsinan. Extralimital forms: southern, *Geochelone wilsoni*; eastern, *Terrapene carolina triunguis.* References: Mecham (1959), Milstead (1956 and 1967).

Appalachian Region.

Pennsylvania. 18. New Paris Sinkhole, Bedford County, Pennsylvania, Late Wisconsinan. Extralimital forms: none. Reference: Guilday *et al.* (1964).

19. Frankstown Cave, Blair County, Pennsylvania, Late Wisconsinan. Extralimital forms: none. Reference: Richmond (1964).

Maryland. 20. Cumberland Cave, Allegany County, Maryland, Kansan. Extralimital forms: western, *Elaphe vulpina*; note: *Ambystoma tigrinum* is present in the fauna and presently does not occur on the Appalachian Plateau. Reference: Holman (1977b).

Virginia. 21. Clark's Cave, Bath County, Virginia, Late Wisconsinan. Extralimital forms: none. Reference: Guilday *et al.* (1977).

Tennessee. 22. Baker Bluff Cave, Sullivan County, Tennessee, Late Wisconsinan. Extralimital forms: none. Reference: Van Dam (1978).

23. Robinson Cave, Overton County, Tennessee, Late Wisconsinan. Extralimital forms: southern, *Bufo terrestris, et al.* (1969).

24. Ladds Quarry Fauna, Bartow County, Georgia, Late Wisconsinan. Extralimital forms: southern, *Bufo terrestris, Geochelone cf. crassiscutata*; northern, *Clemmys insculpta.* References: Holman (1967 and 1976), Wilson (1975).

Gulf Coastal Plain.

Texas. 25. Sims Bayou Fauna, Harris County, Texas, Late Wisconsinan. Extralimital forms: *Geochelone* sp. Reference: Holman (1965c).

Florida. 26. Arredondo Fauna, Alachua County, Florida, Sangamonian. Extralimital forms: southern, *Geochelone crassiscutata, Geochelone incisa*; northern, *Necturus* sp., *Carphophis amoenus.* References: Auffenberg (1956, 1958, and 1963 a and b), Holman (1962b), Lynch (1966).

27. Haile VIIA, Alachua County, Florida, Sangamonian. Extralimital forms: none. References: Auffenberg (1963b), Goin and Auffenberg (1955).

28. Reddick B Fauna, Marion County, Florida, Sangamonian. Extralimital forms: southern, *Geochelone crassiscutata, Geochelone incisa*; northern, *Bufo woodhousei fowleri, Eumeces cf. E. fasciatus, Carphophis amoenus.* References: Auffenberg (1956, 1963a and b), Tihen (1962), Wilson (1975).

29. Orange Lake Site, Marion County, Florida, ?Sangamonian. Extralimital forms: southern, *Geochelone incisa.* Reference: Holman (1959b).

30. Sabertooth Cave, Citrus County, Florida, Sangamonian. Extralimital forms: northern, *Carphophis amoenus.* References: Holman (1958), Webb (1974).

31. Williston IIIA, Levy County, Florida, Sangamonian. Extralimital forms: southern, *Geochelone incisa* from unreported material in Michigan State University Museum (MSUVP 894). References: Holman (1959a), Webb (1974).

32. Devil's Den Sinkhole Trap, Levy County, Florida, Late Wisconsinan. Extralimital forms: southern, *Geochelone crassiscutata, Geochelone incisa*; northern, *Bufo woodhousei fowleri.* Reference: Holman (1978).

33. Haile XIVA, Alachua County, Florida, Wisconsinan. Extralimital forms: southern, *Geochelone crassiscutata, Geochelone incisa*; northern, *Terrapene carolina carolina.* Reference: Martin (1974).

34. Ichetucknee River Fauna, Columbia County, Florida, Late Wisconsinan. Extralimital forms: southern, *Geochelone crassiscutata, Geochelone incisa*; northern, *Bufo woodhousei fowleri.* References: Auffenberg (1963a and b), Tihen (1962), Webb (1974).

35. Vero Strata 2 and 3, Indian River County, Florida, Wisconsinan. Extralimital forms: southern, *Geochelone crassiscutata.* References: Weigel (1962), Webb (1974).

II. State Summary of Faunas with Northern and Southern Forms

Pleistocene herpetofaunas of eastern and central North America with fewer than 10 identified forms, but with both

northern and southern extralimital forms present are summarized.

Kansas. 1. Arkalon Local Fauna, Seward County, Kansas, Yarmouthian. Extralimital forms: southern, *Geochelone cf. G. johnstoni, Gopherus* sp.; northern, *Emydoidea blandingii.* Reference: Preston (1971).

Oklahoma. 2. Berends Local Fauna, Beaver County, Oklahoma, Early Illinoian. Extralimital forms: southern, *Gopherus* sp.; northern, *Emydoidea blandingii.* References: Galbreath (1948), Preston and McCoy (1971).

Texas. 3. Moore Pit Local Fauna, Dallas County, Texas, Sangamonian. Extralimital forms: southern, *Geochelone cf. G. crassiscutata, Terrapene carolina putnami* x *triunguis, Alligator mississipiensis*; northern, *Graptemys geographica.* References: Holman (1969a), Milstead (1967), Slaughter (1966).

Mississippi. 4. Catalpa Creek Site, Clay and Lowndes counties, Mississippi, Late Wisconsinan. Extralimital species: southern, *Geochelone cf. G. crassiscutata*; northern, *Emydoidea blandingii.* References: Jackson and Kaye (1974 and 1975).

Florida. 5. Haile IIB, Alachua County, Florida, Sangamonian. Extralimital forms: southern, *Geochelone incisa*; northern, *Carphophis amoenus.* References: Auffenberg (1963a and b), Webb (1974).

6. Kanapaha Site, Alachua County, Florida, Sangamonian. Extralimital forms: southern, *Geochelone crassiscutata*; northern, *Bufo woodhousei fowleri.* References: Auffenberg (1963a and b), Tihen (1962), Webb (1974).

7. Mefford Cave, Marion County, Florida, Sangamonian. Extralimital forms: southern, *Geochelone crassiscutata*; northern, *Carphophis amoenus.* References: Auffenberg (1963a and b), Webb (1974).

III. State Summary of Faunas with Northern or Southern Forms

Pleistocene herpetofaunas with fewer than 10 identified forms from eastern and central North America, but with two or more extralimital forms, either northern or southern, are summarized.

Texas. 1. Locality UM-T1-58, Seymour Formation, Knox County, Texas, Late Kansan. Extralimital forms: southern, *Syrrhophus marnocki, Alligator* sp., *Geochelone* large form. References: Chantell (1966), Hibbard (1960), Holman (1965b), Tihen (1960).

2. Gilliland Local Fauna, Knox County, Texas, Late Kansan. Extralimital forms: southern, *Geochelone cf. G. crassiscutata, Geochelone johnstoni, Gopherus hexagonata, Terrapene carolina* large form, *Alligator* sp. References: Hibbard and Dalquest (1966), Hibbard (1960), Preston (1966).

3. Rock Creek Local Fauna, Briscoe County, Texas, Late Kansan. Extralimital forms: southern, *Geochelone* large form, *Gopherus* sp. Reference: Hibbard and Dalquest (1966).

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