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BY

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NASH LOCAL FAUNA (PLEISTOCENE: AFTONIAN) OF MEADE COUNTY, KANSAS

By

Ralph E. Eshelman[1] and Claude W. Hibbard[2]

Abstract.—Eleven species of mammals, all rodents, are reported from the Nash local fauna. Nine of the mammalian taxa are extinct. Stratigraphic evidence and stage of evolution of the mammals suggest an early to middle Irvingtonian age for the Nash local fauna. Volcanic ash dates bracket the age of the fauna between 1.2 and 1.96 m.y. Paleoclimatological and biogeographical implications of the fauna suggest a semi-arid prairie climate.

INTRODUCTION AND GEOLOGY

The Nash local fauna is significant for the following reasons: 1) it lies stratigraphically between two volcanic ashes dated at 1.2 and 1.9 m.y. before present; 2) it represents an additional fauna to the Meade County late Conozoic sequence now totaling twenty-three local faunas; 3) the Nash local fauna is located in the same stratigraphic section, 1.2 m. above the important and well studied Borchers local fauna; and 4) represents a poorly documented portion of early Pleistocene vertebrate history in North America.

During the summer of 1972, Hibbard and his field crew washed matrix containing the Nash local fauna from two locations in the Rosco Nash Pasture of the Borchers Badlands in NW¼, NE¼, Sec. 21, in T.33S., R.28W., Meade County. The vast majority of the fauna was taken from locality UM-K1-72 (faunule A), located approximately 107 meters northeast of a small mesa capped by the type B ash, the local reference landmark (Kovach, 1979:35). Fossils were recovered from a 51cm zone of sandy silt that is 50cm below Frye's bed 15 (1942:98) and approximately 2.4 to 3 meters above the type B ash (Hibbard, 1972, pers. comm. to Gutentag). The second locality, UM-K1-71 (faunule B) is located approximately 125 meters southeast from the mesa. Fossils were recovered from a 46cm zone that is 2 to 2.4 meters above the type B ash (Hibbard, 1972, pers. comm. to Gutentag). Kovach (1979) states that the sediments at this locality are channel fil deposits of the Crooked Creek Formation.

Hibbard began working on the Nash faunal list prior to his death as evidenced by a page of notes found in his handwriting and dated September 26, 1972. This list noted the following mammalian taxa:

Peroganthus, 2 species
Synaptomys (*Mictomys*)
Reithrodontomys
Onychomys
Citellus

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Prodipodomys written next to crossed out *Dipodomys*
Geomys

The mammalian remains form the basis for this report. The herpetofauna previously was reported by Holman (1979:747). The gastropod and pelecypod were identified by B. B. Miller of Kent State University and the fish remains by G. R. Smith of the University of Michigan (UM). A complete faunal list as presently known is given in Table 1. All vertebrates are deposited in the Museum of Paleontology, University of Michigan. The invertebrates are housed in the Department of Geology, Kent State University.

SYSTEMATIC PALEONTOLOGY

Class MOLLUSCA

PELECYPODA

cf. *Sphaerium* sp.

Material: Locality UM-K1-71; one shell fragment

GASTROPODA

Deroceras aenigma Leonard

Material: Locality UM-K1-71; 135 shells.

Remarks: The molluscs of the Nash local fauna are dominated by fossil slug shells, the larger of which include individuals with thick heavy shells that fall within the size range (3.5 x 2.0mm) of *Deroceras aenigma* (Miller, 1980, pers. comm. to Eshelman).

Class OSTEICHTHYES

Class SILURIFORMES

Family ICTALURIDAE

Ictalurus punctatus (Rafinesque)

Material: Locality UM-K1-72, UM74517; right pectoral spine.

Remarks: The only determinate fish specimen is a spine of a less than one year old individual (Smith, 1979, pers. comm. to Eshelman).

Class AVES

Material: Locality UM-K1-71, UM74518; 44 egg shell fragments.

TABLE 1 — Taxa of the Nash Local Fauna

	Faunule A UM-K1-72	Faunule B UM-K1-71
PELECYPODA		
cf. *Sphaerium* sp.		X
GASTROPODA		
Deroceras aenigma Leonard		X
Class OSTEICHTHYES		
Order SILURIFORMES		
Family ICTALURIDAE		
Ictalurus punctatus (Rafinesque)	X	
Class AMPHIBIA		
Order URODELA		
Family AMBYSTOMATIDAE		
Ambystoma tigrinum (Green)	X	
Order ANURA		
Family PELOBATIDAE		
Scaphiopus (*Spea*) *bombifrons* Cope	X	
Class REPTILIA		
Order SQUAMATA		
Family IQUANIDAE		
Sceloporus undulatus (Latreille)	X	
Phrynosoma cornutum (Harlan)	X	
Family TEIDAE		
Cnemidophorus sexlineatus (Linnaeus)	X	
Family SCINCIDAE		
Eumeces obsoletus (Baird and Girade)	X	
Eumeces septentrionalis (Baird)	X	
Family COLUBRIDAE		
Heterodon platyrhinos (Latreille)	X	
Lampropeltis calligaster (Harlan)	X	
Class AVES		X
Class MAMALLIA		
Order RODENTIA		
Family SCIURIDAE		
Cynomys meadensis? Hibbard	X	
Spermophilus tridecemlineatus (Mitchell)	X	
Spermophilus cf. *S. franklini* (Sabine)	X	
Family GEOMYIDAE		
Geomys cf. *G. tobinensis* (Hibbard)	X	X
Family HETEROMYIDAE		
Penognathus cf. *P. gidleyi* Hibbard	X	
Penognathus cf. *P. pearlettensis* Hibbard	X	
Prodipodomys sp.*	?	
Family CRICETIDAE		
Onychomys cf. *O. hollisteri* Carleton and Eshelman	X	
Reithrodontomys sp.		X
Family ARVICOLIDAE		
Synaptomys (*Mictomys*) *kansasensis* Hibbard	X	X
Microtus (*Allophaiomys*)? sp.		X

*provisionly included (see Class MAMMALIA discussion)

Class MAMMALIA

Order RODENTIA

Family SCIURIDAE

Cynomys cf. *C. meadensis* Hibbard

Material: Locality UM-K1-72, UM74510, an unworn right mollariform tooth with no root development, UM74511, right molariform tooth and broken molar fragment of M_1 or M_2 of same individual, tooth badly worn.

Remarks: The tooth measurements are as follows: UM74510, 3.31 by 3.63mm; UM74511, 3.33 by 3.56mm. Assuming the tooth UM74510 is an M_2, the length measurements are slightly larger than the material questionably assigned to *Cynomys vetus* Hibbard (3.03 by 3.61 and 3.06 by 3.56mm) and *C. hibbardi* Eshelman (3.15 by 3.51mm) from the White Rock local fauna (Eshelman, 1975). Hibbard (1956:172) named a new prairie dog, *C. meadensis*, from the Deer Park local fauna of Kansas. The lower first and second molars of *C. meadensis* have a small conulid instead of a transverse mesolophid on the lingual side of the talonid basin. The youngest Recent *Cynomys* found in the USNM collections (USNM 273643, Oklahoma) has the M_2s unworn and M_3s unerrupted. In this specimen the mesolophid is already well developed in the M_2. Hibbard (1956:172) states the type of *C. meadensis* is that of a young animal with M_2 length 3.3mm. Without having had the opportunity to examine the type, and not having a statistically significant sample to determine the mesolophid character as used by Hibbard, I have tentatively assigned the Nash specimens to this species. The remaining molars (UM74511) are too worn to be of any value. A left and right P^3 (UM74512) measuring 2.57 by 2.69mm and 2.32 by 2.49mm may belong to this taxon but no assignment is possible. *Cynomys ludovicianus* (Ord) was reported by Wood (1933) from the Holloman local fauna (Kansan of Oklahoma).

Spermophlilus tridecemlineatus (Mitchell)

Material: Locality UM-K1-72, UM74508, eight right molars (M^1s and M^2s), two right P^4s, two left M^3s, three left molars (M^1s and M^2s), and two right M_3s, two left M_3s, right P_4, four left M_1s?, three right M_1s, and three left M_2s.

Remarks: The teeth compare well in size (Table 2) and morphology to recent specimens of *S. tridecemlineatus* from Kansas in the USNM collection. Paulson (1961:136) noted a slight groove extending anteriorly from between the hypoconid and entoconid of M_3 in specimens from the Cudahy local fauna. This groove was deeper and wider than in the Nash or Recent specimens. The Nash material shows no differences other than what might be expected by individual variation.

Spermophilus cf. *S. franklini* (Sabine)

Material: Locality UM-K1-72, UM74509, left tooth (either P^4, M^1 or M^2), right tooth (either P^4, M^1 or M^2).

Remarks: Both teeth correspond in size and morphology with Recent specimens from Kansas in the USNM collections. Hibbard (1976) described a new squirrel *Spermophilus lorisrusselli* from the late Kansan age Wilson Valley local fauna as morphologically similar to, but decidedly smaller in size than, *S. franklini*. Zakrzewski and Kolb (in press) report the first upper molars of *S. lorisrusselli*, also taken from the Wilson Valley, but give no measurements. The Nash

TABLE 2 — Measurements (mm) of *Spermophilus tridecemlineatus* teeth from the Nash local fauna*.

	Length			Width		
Tooth	N	X	O.R.	N	X	O.R.
P_4	1	1.49		1	1.85	
M_1?	7	1.93	1.81–2.15	7	2.04	1.90–2.12
M_2?	3	1.80	1.74–1.84	3	1.80	1.75–1.88
M_3	4	2.21	2.14–2.39	4	2.06	2.04–2.07
P^4	2	1.46	1.40–1.51	2	1.67	1.48–1.85
M^1-M^2	11	1.65	1.56–1.80	11	2.05	1.87–2.22
M^3	2	2.02	1.97–2.07	2	1.85	1.84–1.85

*Upper M^1s and M^2s were not positively separated.

specimens are not smaller than *S. franklini* and are therefore, referred to *S.* cf. *S. franklini.* Hibbard (1976:284) suggests *S. lorisrusselli* gave rise to *S. franklini.* If *S. franklini* is present in the Nash local fauna, and if the Nash local fauna is of early to middle Irvingtonian age, *S. lorisrusselli* can not be a direct ancestor, but is a small off-shoot of the *S. franklini* line.

The left tooth measures 2.56 by 2.78mm and the right tooth, 2.42 by 2.89 mm.

Family GEOMYIDAE

Geomys cf. *G. tobinensis* (Hibbard)

Material: Locality UM-K1-72, UM74516, M^3, two P^4s. and two P^4 fragments (on one of which the enamel cap is still present), P_4 (enamel cap still present), nine upper and twelve lower first or second molars, sixteen upper incisor fragments and two lower incisor fragments. Locality UM-K1-71, UM74522, P_4, three upper incisor fragments, M^3 and six isolated molars.

Remarks: This assignment is based on the presence of enamel caps (Paulson 1961:138 and Hibbard 1956:183) on one each of the P^4_4s and on two of the molars from locality UM-K1-72. *Geomys tobinensis* is also reported from the late Kansan faunas, Cudahy, Holzinger, Tobin and Wilson Valley (Zahrzewski and Kolb in press), and Vera (Hibbard and Dalquest 1966).

Family HETEROMYIDAE

Prodipodomys sp.

Material: Right M^3, apparently lost.

Remarks: I was able to confirm the presence of all taxa mentioned by Hibbard except *Prodipodomys.* Inspection of the Museum of Paleontology, University of Michigan collections by Robert Habetler in 1974 and Gerald Paulson in 1979, both preparators at the Museum, also failed to locate a specimen. At least one right M^3 of *Prodipodomys* identified by Hibbard did exist because the following notation is present on the page of notes mentioned above.

> "RM^3 *Prodipodomys*, good anterior and posterior roots, a little larger than *Etadonomys* from Borchers; slight evidence of dentine track on posterior loop. Anterior part connected to labial edge of posterior loop as in *Dipodomys.*"

This taxon has therefore been included in the list of the Nash local faunal.

Perognathus cf. *P. gidleyi* Hibbard

Material: Locality UM-K1-72 UM74506, right maxillary fragment with P^4; V74507, right isolated M^1?

Remarks: The P^4 measures 1.32 by 1.39mm and the M^1, 1.05 by 1.34 mm. Measurements reported by Hibbard (1941B:350) for the type of *Perognathus gidleyi* are for the lower teeth only but the large size of UM74506 precludes its assignment to any other species.

Perognathus cf. *P. pearlettensis* Hibbard

Material: Locality UM-K1-72; UM74500, left mandible fragment with P_4 – M_2; UM74501 mandible fragment with associated M_1? fragment; UM74502, left mandible fragment with P_4, M_2 (M_2 isolated); UM74503, left maxillary fragment with P^4; UM74505, left maxillary fragment with P^4 and isolated M^1?; UM74505, right isolated P^4 and maxillary fragment; UM74514, mandible fragment with isolated incisor.

Remarks: The material is too incomplete for a positive identification. The tooth measurements (Table 3) fall slightly below the measurements reported by Hibbard (1941A:207) for *Perognathus pearlettensis*; P_4 width of type is 0.65mm and the Nash specimens 0.63 and 0.58mm; P_4 – M_2 length of type is 2.44mm and the Nash specimen 2.28mm. Hibbard (1941B:350) reports a P_4– M_2 length for the type of *P. gidleyi* as 2.8mm.

Family CRICETIDAE

Onychomys cf. *O. hollisteri* Carleton and Eshelman

Material: Locality UM-K1-72; UM74513, left M^1, two right M_1s and left M_1.

Remarks: The first upper molar measures 1.87 by 1.17mm. The left first lower molars measure 1.80 by 0.98mm and 1.63 by 1.05mm. The left lower first molar is too badly worn to measure. The measurements of M_1 length fall within the range of variation for *O. torridus* populations in Texas and New Mexico, and *O. leucogaster* population in Wyoming and just outside the range of the fossil *O. hollisteri* (Carleton and Eshelman, 1979; Appendix 1). Width measurement of the Nash sample fall within the range of variation for *O. torridus* populations in Texas and New Mexico. In all other populations and species of *Onychomys* the measurements fall below the minimum observed size except the following. The ranges overlap partially in *O. torridus* populations in Nevada and Arizona and the fossil species *hollisteri* and *O. leucogaster* population from Nevada.

To date only thirteen molars have been assigned to the fossil species *hollisteri* (Carleton and Eshelman, 1979). As new material is recovered the range of variation for this species will no doubt broaden. Notes in Hibbard's handwriting dated September 29, 1972, state the Nash

TABLE 3 — Measurements (mm) of *Perognathus* cf. *P. pearlettensis* teeth from the Nash local fauna.

	Length			Width		
Tooth	N	X	O.R.	N	X	O.R.
P_4	2	.61	.58–.63	2	.61	.55–.67
M_1	3	.90	.88–.92	3	.88	.86–.91
M_2	2	.79	.78–.79	2	.93	.90–.95
P^4	3	.87	.82–.91	3	.91	.83–.99
M^1	1	.79		1	.92	

Onychomys molars, consisting of at least three individuals, are smaller than *O. gidleyi, O. fossilis* and *O. jinglebobensis* (the later two synomized by Carleton and Eshelman (1979) with *O. pedroensis*). Until statistically significant material can be obtained from the Nash local fauna a tentative assignment to *O. hollisteri* is made. Carleton and Eshelman (1979) state that *hollisteri* is ancestral to *O. torridus*. This indicates a diminution in molar length from Brochers to Recent time within the *O. torridus* line.

Reithrodontomys sp.

Material: Locality UM-K1-71; UM74521, four upper incisor fragments.

Remarks: The presence of the harvest mouse is based on the presence of a conspicuous groove on the upper incisor. No molars have been recovered. *Reithrodontomys* is the only mouse of this size with deeply grooved upper incisors.

Family ARVICOLIDAE

Synaptomys (*Mictomys*) *kansasensis* Hibbard

Material: Locality UM-K1-72; UM74515, three fragments of right M_1, four left M_1s, two fragments of left M_1, right M_2, three left M_2, two fragments of left M_2, right M_3, four right M^1s, five left M^1s, one fragment left M^1, three right M^2s, two left M^2s, right M^3 fragment, left M^3 and seven incisor fragments. Locality UM-K1-71, UM74519, two right M^1s, right M^1 fragment and two left M_3s.

Remarks: The molars are similar in size (Table 4) to those reported by Hibbard (1952:9) for the type and paratype material of this species from the Kansan age Kentuck local fauna. The mean of M_1–M_3 is 6.7mm from Kentuck, 6.64mm from Nash and 6.32mm for a population of *S.* (*M.*) *meltoni* reported by Eshelman (in preparation from the Kansan age Hall Ash local fauna). Unfortunately, no complete mandible material is available for comparison of the position of the basal capsular process as noted by Hibbard (1952:10) and Paulson (1961:144).

Microtus (*Allophaiomys*)? sp.

Material: Locality UM-K1-71, UM74520, right M_3, right M_1, anterior fragment and left M_1 posterior fragment.

Remarks: Unfortunately no sufficiently complete M_1s are available to determine if the *Allophaiomys* or *Pedomys* stage of evolution is present. I have followed van der Meulen (1978)

TABLE 4 — Measurements (mm) of *Synaptomys* (*Mictomys*) *kansasensis* molars from the Nash local fauna at locality UM-K1-72

	Length			Width		
Tooth	N	X	O.R.	N	X	O.R.
M_1	4	3.00	2.85–3.27	4	1.25	1.11–1.49
M_2	4	1.87	1.67–2.17	4	1.10	1.00–1.29
M_3	1	1.77		1	1.05	
M^1	8	2.62	2.40–2.97	8	1.28	1.13–1.38
M^2	5	2.01	1.84–2.17	5	1.10	0.96–1.22
M^3	1	1.95		1	0.95	

in the systematic classification of this poorly known taxon. The reader is also referred to Zakrzewski's discussion in Hibbard et al. (1978:30). The M_3, with occlusal measurements of 1.46 by 0.72mm and width girth measurement of 0.92, is that of a young individual as evidenced by the tapering of the molar. Martin (1975:Table 1) provides the following M_3 measurements for the following *Allophaiomys* specimens: Java local fauna (Martin, 1973), length 1.48 by 1.85mm for twenty specimens with a mean of 1.63mm, width 0.84 to 1.05mm for twenty specimens with a mean of 0.92mm; Kentuck local fauna (Hibbard, 1952), length 1.40 to 1.61mm for three specimens with a mean 1.52 and width 0.87 to 0.95 for three specimens with a mean of 0.90mm. The Nash molar falls well within the above reported ranges. The M_1 anterior fragment is also that of a young individual but complete enough to show a rounded anterior cap and conforms most closely to van der Meulen's (1978) morphotype 1. This character again argues for an *Allophaiomys* assignment.

PALEOECOLOGY

The specimens of molluscs do not permit any reasonable kind of environmental interpretation. The molluscan fauna from Deer Park local fauna (Miller, 1980, pers. comm. to Eshelman) is similar in the number, abundance, and species composition. In reality, the main similarity between the molluscan faunas is their paucity of species and individuals. The predominance of the thick shelled slug *Deroceras aenigma* to both faunas is more probably a factor of preservation.

Based on the herpetofauna, Holman (1979:748) believes the Nash local fauna represents a semiarid prairie environment. The nearest place where all these species could be found sympatric today is Comanche County, Kansas, about 80km east of the fossil locality (Holman, 1979:748). The mammalian predominance of ground squirrels, heteromyids and cricetids also reflect this environmental interpretation, although the arvicolids, *Synaptomys* (*Mictomys*) *kansasensis* and *Microtus* (*Allophaiomys*) may indicate some climatic deterioration (Zakrzewski, 1975:127).

Bayne (1976:18) summarizing Hibbards latest thoughts before his death states, "the fauna indicates moisture was more effective than it presently is in this area. Winters were no cooler than *Phrynosoma cornutum*, Texas horned toad, could tolerate, but summers were cool enough for *Synaptomys* (*Mictomys*) to live". The presence of fish remains and the fact the sediments containing the Nash local fauna are channel fill deposits (Kovach, 1979:37), suggest the presence of cool, moist microniches along a stream. These microniches may have provided these arvicolid rodents with appropriate, albeit limited, habitats. Climatic deterioration toward the close of the Aftonian may well have provided the unique environmental and zoogeographical circumstances necessary to support this seemingly allopatric fauna.

AGE AND COLLERATION

The Borchers local fauna, 1.2m below the Nash local fauna, is regarded as latest Pliocene (late Blancan) by Zakrzewski (1975: Fig. 4). The Borchers local fauna lies directly above the lower Borchers or Pearlette ash Type B dated at 1.96 m.y., (Boellstroff, 1976:Table 1). This fauna is regarded as a warm maritime climate with frost free winters (Hibbard, 1970). The Nash local fauna is also stratigraphically below the Upper Borchers Ash (also referred to as Kukla Ash) which dates at 1.2 m.y. (Boellstorff, 1976:54).

In summary, the Nash local fauna is younger than 1.96 and older than 1.2 m.y. The Nash is not typical of what one would regard as glacial, has a prairie assemblage similar to that living in the area at present, and therefore probably is not of Nebraskan but Aftonian Interglacial age. The channel fills containing the Nash local fauna indicate that an unconformity is present due to a hiatus in this section of the Crooked Creek Formation. Based on stage of mammal evolution, the Nash local fauna is post-Borchers (latest Pliocene) and pre-Cudahy (late Kansan) in age.

The Sappa local fauna (Schultz and Martin, 1970:347) from north-central Nebraska is similar but appears to be closer to typical late Kansan faunas due to the presence of *Synaptomys meltoni* and *Microtus* cf. *llanensis*.

The Java local fauna (Martin, 1973) of South Dakota is probably the closest correlative of the Nash local fauna known to date. However, the large number of arvicolids in Java may indicate an early Kansan or, more probably, late Nebraskan age or reflect its more northern distribution, or a combination of both. A resolution of the above discussion suggests an Aftonian age for the Nash local fauna.

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