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LATE CENOZOIC VERTEBRATE FAUNAS, SOUTHEASTERN ARIZONA

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INTRODUCTION

Fossil vertebrates are relatively common and widespread in late Cenozoic deposits of southeastern Arizona (fig. 1). Perhaps the best known vertebrate sites from this area are those of San Pedro Valley. Fossil mammals were first described from San Pedro Valley by J. W. Gidley (1922). Since that time, numerous fossil sites have been found in San Pedro Valley, primarily between Benson and the Mexican border. Another area in southeastern Arizona where vertebrate fossils are well known is San Simon Valley, near Safford. Knechtel (1936) described the Gila Conglomerate in San Simon Valley, including a list of fossils collected from Red Knolls and 111 Ranch. Faunal lists for vertebrate sites in Arizona are given in Lindsay and Tessman (1974).

Late Cenozoic terrestrial sediments in southeastern Arizona are good recorders of paleomagnetism. This fact, plus the occurrence of numerous fossils in these deposits, provide an excellent opportunity for correlation of vertebrate biochronology with the magnetic polarity time scale. Johnson and others (1975) demonstrated the first direct correlation of a vertebrate faunal sequence in North America with the polarity time scale. This work, on both late Pliocene and early Pleistocene deposits in San Pedro Valley, has continued on older deposits (early Pliocene) to the north, between Redington and Mammoth.

Four North American Land Mammal Ages are recognized in the late Cenozoic. A land mammal age is a biochronological unit, characterized by the association of several mammalian genera, and differing from earlier and later land mammal ages

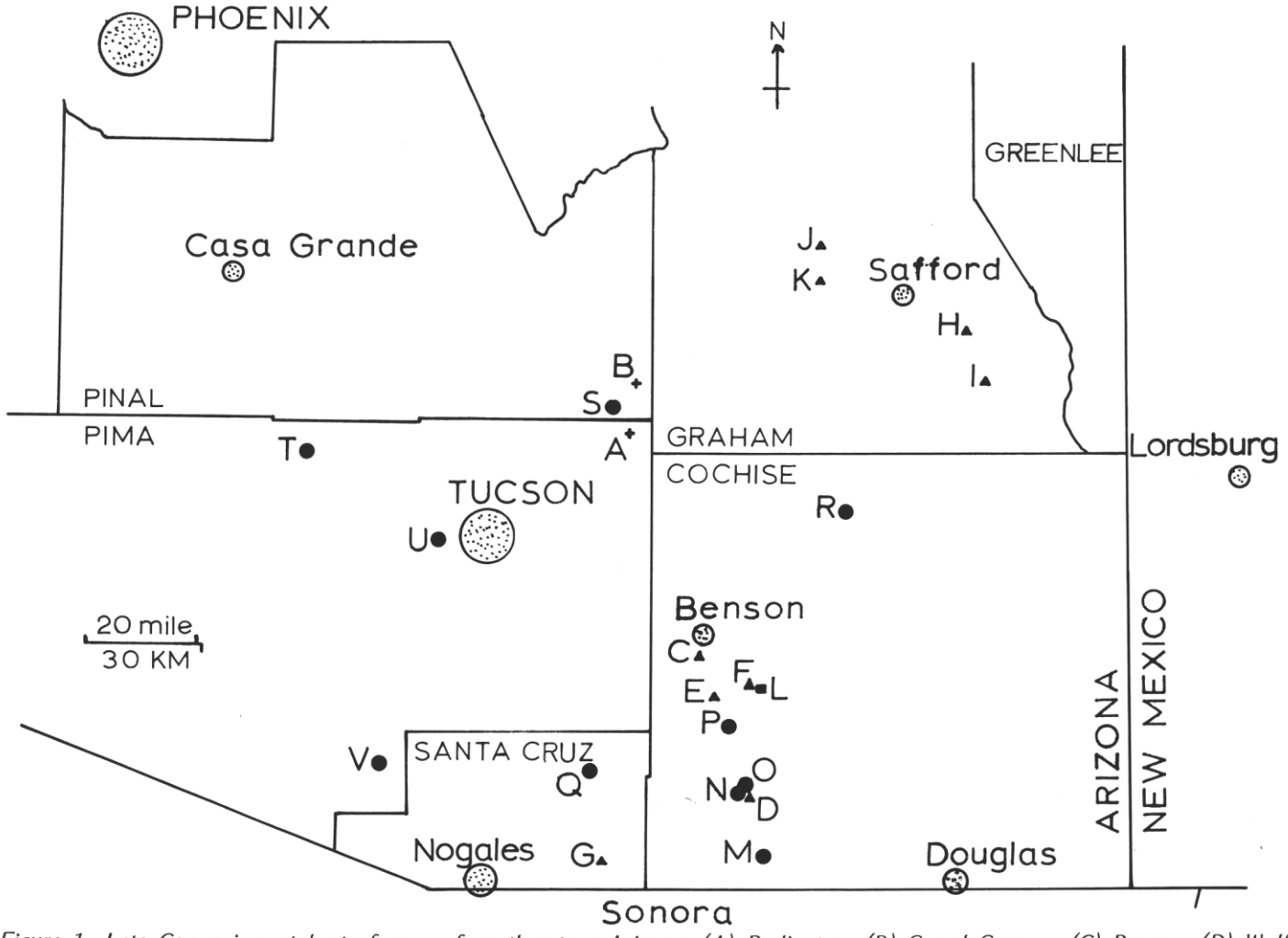

Figure 1. Late Cenozoic vertebrate faunas of southeastern Arizona. (A) Redington, (B) Camel Canyon, (C) Benson, (D) Wolf Ranch, (E) California Wash, (F) Cal Tech, (G) Comosi Wash, (H) 111 Ranch, (I) Whitlock Hills, (J) Red Knolls, (K) Bear Spring, (L) Curtis Ranch, (M) Lehner Ranch, (N) Murray Spring, (O) Murray Spring Arroyo, (P) San Pedro Valley, (Q) Papago Springs, (R) Willcox, (S) Cerros Negros, (T) Silver Bell Mtns., (U) Tucson Mtns., (V) Canez Wash. + = Hemphillian age, ▲ = Blancan age, ■ = Irvingtonian age, ● = Rancholabrean age.

in a different characterizing assemblage. The late Cenozoic land mammal ages of North America are: Hemphillian (early Pliocene), Blancan (late Pliocene), Irvingtonian (early Pleistocene) and Rancholabrean (late Pleistocene). Each of these ages is relatively well represented in southeastern Arizona.

PLIOCENE MAMMAL FAUNAS OF SOUTHEASTERN ARIZONA

Hemphillian

Two Hemphillian faunas, Redington and Camel Canyon, are recorded from southeastern Arizona. The only published description of mammals from these deposits is Jacobs (1977), who described and named three new genera and six new species of rodent from the Redington fauna. Table 1 lists mammal genera from these faunas; it is derived, in part, from fossils in the American Museum of Natural History, compiled by R. H. Tedford and B. E. Taylor of that institution.

Hemphillian faunas of southeastern Arizona are characterized by the presence of the horse *Pliohippus* (or *Dinohippus);* the bear *Agriotherium;* commonly a rhinoceros *Aphe/ops;* several mustelids, e.g. *Spermophilus* (ground squirrel), *Perog nath us* (pocket mouse), *Prodipodomys* (kangaroo rat), *Copemys* (meadow mouse) and(or) *Paronychomys* (mouse).

During Hemphillian, some South American ground sloths (e.g., *Megalonyx* and *Pliometanastes)* migrated to North America. Similarly, a number of Eurasian genera (e.g., *Agriotheriutn, Machairodus* and *Plesiogulo)* became well established in North America during the Hemphillian.

Blancan

Blancan faunas of southeastern Arizona include the Benson fauna, Wolf Ranch fauna, California Wash fauna and Cal Tech fauna, all from San Pedro Valley, plus the 111 Ranch fauna, Whitlock Hills fauna, Red Knolls faunta, Bear Springs fauna and Duncan fauna from San Simon Valley. Comosi Wash in San Rafael Valley, near the Mexican border, is also Blancan. Table 2 lists the vertebrate genera recorded from these Blancan faunas, modified slightly from Lindsay and Tessman (1974).

Blancan faunas of southeastern Arizona are best characterized by the occurrence of the horse *Equus,* the carnivores *Borophagus* and *Chasmoporthetes,* the gomphothere *Stegomastodon,* the camel *Hemiauchenia,* and several rodents (e.g., *Calomys (Bensonomys), Sigmodon* and *Pliophenacomys.* Blancan records the appearance of several mammalian immigrants to North America from both South America (e.g., *Glyptotherium, Coendou* and *Neochoerus)* and Eurasia (e.g., *Chasmoporthetes,* deer and some rodents like *Synaptomys).* Rabbits are relatively common and diverse in Blancan deposits of southeastern Arizona, probably reflecting a locally high rate of evolution. Downey (1962, 1966) described these rabbits, naming a new genus, *Aluralagus.* Many new specimens have been collected since then and are presently under study.

PLEISTOCENE MAMMAL FAUNAS OF SOUTHEASTERN ARIZONA

Irvingtonian

The Curtis Ranch fauna in San Pedro Valley gives the best record of Irvingtonian vertebrates of southeastern Arizona, and it is very early Irvingtonian, practically at the transition between Blancan and Irvingtonian according to the magnetic polarity sequence of the Curtis Ranch section (Johnson and others, 1975). Irvingtonian vertebrates from Curtis Ranch are listed in Table 3.

Table 1. Hemphillian vertebrate genera of southeastern Arizona.

	Redington	Camel Canyon
Pisces (fish)		X
Aves (bird)		X
Mammalia		
Chiroptera (bat)	X	
Lagomorpha		
Leporidae		
Hypolagus (rabbit)		
Rodentia		
Sciuridae		
?*Tamias* (chipmunk)	X	
Spermophilus (ground squirrel)	X	
Eomyidae		
Ronquillomys (rodent)	X	
Heteromyidae		
Perognathus (pocket mouse)	X	
Prodipodomys (kangeroo rat)	X	
Cricetidae		
?*Copemys* (rodent)	X	
Paronychomys (rodent)	X	
Galushamys (rodent)	X	
Carnivora		
Canidae		
Vulpes (fox)		
Canis (wolf)	X	
Osteoborus (dog)	X	?
Mustelidae		
Martes (marten)	X	
Pliotaxidea (badger)	X	
Plesiogulo (wolverine)	X	
Procyonidae		
Bassariscus (ring-tail cat)		X
Ursidae		
Agriotherium (bear)	X	X
Felidae		
Machairodus (stabbing cat)	X	X
Adelphailurus (stabbing cat)	X	
Felis (cat)	X	
Proboscidea		
Mammutidae		
Pliomastodon (mastodon)	?	X
Perissodactyla		
Equidae		
Pliohippus (or *Dinohippus*) (horse)	X	X
Artiodactyla		
Camelidae		
Hemiauchenia (llama)	X	X
Megatylopus (camel)	X	X
Protolabini (camel)	X	X
Antilocapridae		
Texoceros (pronghorn)	X	X

Irvingtonian is characterized by the occurrence of the elephant *Mammuthus* (an immigrant from Africa by way of Eurasia), the rabbit *Lepus* (probably evolved in North America from a Blancan species of *Sylvilagus),* the stabbing cat *Smilodon* (probably an immigrant), short-faced bear *Arctodus* (another immigrant), and a number of cricetid (e.g., *Sigmodon, Neotoma, Ordatra* and *Microtus)* and geomyid (e.g., *Geomys* and *Thomomys)* rodents, most of which evolved from Blancan species of the same genus. *Paramylodon* is a South American

Table 2. Blancan vertebrate genera of southeastern Arizona.

	Benson	Wolf Rock	California Wash	Cal Tech	Comosi Wash	111 Rock	Whitlock Hills	Red Knolls	Bear Spring
Pisces (fish)		X	X						
Amphibia									
Ambystomidae									
Ambystoma (salamander)			X						
Pelobatidae									
Scaphiopus (toad)			X						
Bufonidae									
Bufo (toad)			X						
Hylidae									
Hyla (tree frog)			X						
Ranidae									
Rana (frog)			X						
Reptilia									
Emydidae (box turtle)	X								
Tstudinidae									
Geochelone (tortoise)	X		X			X			
Scincidae									
Eumeces (skink)			X						
Teidae									
Cnemidophorus (whiptail lizard)			X						
Iguanidae									
Crotaphytus (collared lizard)	X								
Phrynosoma (horned lizard)			X						
Sceloporus (fence lizard)			X						
Colubridae									
Coluber (racer)			X						
Pituophis (bull snake)			X						
Masticophis (whipsnake)			X						
Lampropeltis (king snake)			X						
Natrix (water snake)								X	
Thamnophis (garter snake)			X			X			
Crotalidae									
Crotalus (rattlesnake)			X						
Aves (bird)	X		X			X			
Mammalia									
Insectivora									
Soricidae									
Sorex (shrew)		X	X						
Chiroptera									
Vespertilionidae									
Simonycteris (bat)		X		X					
Edentata									
Meglonychidae (ground sloth)						X			
Glyptotheriidae									
Glyptotherium (glyptothere)			X			X			
Lagomorpha									
Leporidae									
Aluralagus (rabbit)	X								
Hypolagus (rabbit)						X			
Notolagus (rabbit)		?							
Nekrolagus (rabbit)		X							
Sylvilagus (bunny)			X			X			
Rodentia									
Sciuridae									
Spermophilus (ground squirrel)	X	X	X			X			
Paenemarmota (woodchuck)					X				
Geomyidae									
Geomys (gopher)	X	X	X			X			
Cratogeomys (gopher)	X								

Table 2. (continued)

	Benson	Wolf Rock	California Wash	Cal Tech	Comosi Wash	111 Rock	Whitlock Hills	Red Knolls	Bear Spring
Heteromyidae									
Perognathus (pocket mouse)	X	X	X			X			
Prodipodomys (kangaroo rat)	X	X	X			X			
Cricetidae									
Calomys (*Bensonomys*) (mouse)	X	X	X			X			
Peromyscus (deer mouse)		X							
Baiomys (pigmy mouse)	X	X				X			
Reithrodontomys (harvest mouse)						X			
Onychomys (grasshopper mouse)	X	X				X			
Sigmodon (cotton rat)	X	X	X			X			
Neotoma (pack rat)	X	X				X			
Pliophenacomys (tree mouse)	X					X			
Synaptomys (bog lemming)			X			X			
Ondatra (muskrat)			X						
Erethizontidae									
Coendou (porcupine)		X							
Hydrochoeridae									
Neochoerus (capybara)				X		X			
Carnivora									
Canidae									
Canis (wolf)	X				X				
Borophagus (dog)	X								
Mustelidae									
Mustela (weasel)						X			
Hyaenidae									
Chasmoporthetes (Hyaena)					X				
Felidae									
Felis (lynx)	X				X	X			X
Proboscidea									
Gomphotheriidae									
Cuvieronius (gomphothere)	X					X			
Rhynchotherium (rhynchothere)						X			
Stegomastodon (gomphothere)		X	X	X					
Perissodactyla									
Equidae									
Nannippus (three-toed horse)	X	X	X			X	X		
Equus (horse)	X	X		X	X	X	X	X	X
Artiodactyla									
Tayassuidae									
Platygonus (peccary)	X			X		X			
Camelidae									
Hemiauchenia (llama)	X				X	X			
Camelops (camel)	X	X	X		X	X	X	X	
Cervidae									
Odocoileus (deer)				X					
Antilocapridae									
Capromeryx (pronghorn)	X				X	X			

Table 3. Irvingtonian vertebrate genera from Curtis Ranch.

- Pisces (fish)
- Reptilia
  - Kinosternidae
    - *Kinosternon* (mud turtle)
  - Testudinidae
    - *Geochelone* (tortoise)
  - Colubridae
    - *Coluber* (racer)
    - *Lampropeltis* (king snake)
    - *Natrix* (water snake)
    - *Thamnophis* (garter snake)
  - Crotalidae
    - *Crotalus* (rattlesnake)
- Mammalia
  - Edentata
    - Glyptotheriidae
      - *Glyptotherium* (glyptothere)
  - Lagomorpha
    - Leporidae
      - ?*Notolagus* (rabbit)
      - *Sylvilagus* (bunny)
      - *Lepus* (rabbit)
  - Rodentia
    - Sciuridae
      - *Spermophilus* (squirrel)
    - Castoridae
      - *Castor* (beaver)
    - Geomyidae
      - *Geomys* (gopher)
    - Heteromyidae
      - *Perognathus* (pocket mouse)
      - *Dipodomys* (kangaroo rat)
    - Cricetidae
      - *Calomys* (*Bensonomys*) (mouse)
      - *Peromyscus* (deer mouse)
      - *Baiomys* (pigmy mouse)
      - *Onychomys* (grasshopper mouse)
      - *Sigmodon* (cotton rat)
      - *Neotoma* (pack rat)
      - *Ondatra* (muskrat)
  - Carnivora
    - Canidae
      - *Canis* (wolf)
    - Mustelidae
      - *Spilogale* (skunk)
    - Felidae
      - *Felis* (cat)
      - *Panthera* (jaguar)
  - Proboscidea
    - Gomphotheriidae
      - *Stegomastodon* (gomphothere)
  - Perissodactyla
    - Equidae
      - *Equus* (horse)
  - Artiodactyla
    - Tayassuidae
      - *Platygonus* (peccary)
    - Camelidae
      - *Hemiauchenia* (llama)
      - *Camelops* (camel)
    - Antilocapridae
      - *Capromeryx* (pronghorn)

ground sloth that appears to have migrated to North America during Irvingtonian. Apparently, the elephant *Mammuthus* is rare or absent at the beginning of Irvingtonian, about 1.8 m.y. ago, but became widespread and abundant by early Rancholabrean, about 0.5 m.y. ago.

Rancholabrean

Rancholabrean fossil sites are very common in southeastern Arizona, especially in San Pedro Valley. Haynes (1968) listed 18 Rancholabrean fossil sites in San Pedro Valley, five of which (Lehner, Murray Springs, Escapule, Hargis and Naco) have artifacts of early man associated with extinct mammals.

During the last ten or so years, excavations and fossil collecting have continued both at Lehner Ranch and at Murray Springs. Renewed excavation at the Lehner Ranch early man site in 1975 produced a juvenile mastodon *(Mammut)* jaw and remains of the Pleistocene jaguar *(Fe/is atrox) (J.* I. Mead, pers. commun.). An early Rancholabrean fauna, the Murray Springs Arroyo fauna, dominated by small mammals (e.g., squirrels, gophers, kangaroo rat, harvest mouse, deer mouse, grasshopper mouse, cotton rat, pack rat and vole) is presently under study by C. B. Robbins of the U.S. National Museum. Numerous remains of the horse *Equus,* the camel *Camelops,* and the elephant *Mammuthus* were recovered from extinct spring deposits near Murray Springs in sediments that underlie the human occupation level. These fossils are presently under study by J. J. Saunders of the Illinois State Museum. Rancholabrean vertebrate genera of southeastern Arizona are listed in Table 4.

Rancholabrean faunas are characterized by the occurrence of *Bison* (an immigrant from Eurasia) as well as the ground sloths *Nothrotheriops* and *Paramy/odon,* the dire wolf *(Canis dirus),* jaguar *(Fe/is atrox),* elephant *(Mammuthus),* camel *(Camelops)* and musk ox *(Symbos).* Late Rancholabrean faunas also frequently include the immigrant *Homo sapiens.*

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(Table 4 starts on next page)

Table 4. Rancholabrean vertebrate genera of southeastern Arizona.

	Lehner Ranch	Murray Spgs	M.S. Arroyo	San Pedro	Papago Sp.	Wilcox	Cerros Negros	Silver Bell Mt.	Tucson Mt.	Canez Wash
Reptilia										
Emydidae										
Terrapene (box turtle)						X				
Testudinidae										
Geochelone (tortoise)										X
Gekkonidae										
Coleonyx (gecko)									X	
Iguanidae										
Crotaphytus (collared lizard)								X	X	
Sauromalus (chuckwalla)								X		
Sceloporus (spiny lizard)								X		
Teidae										
Cnemidophorus (whiptail lizard)								X		
Colubridae										
Masticophis (whipsnake)								X	X	
Lampropeltis (king snake)								X		
Rhinocheilus (long-nosed snake)								X		
Hypsiglena (night snake)										X
Aves (bird)										
Mammalia										
Insectivora										
Soricidae										
Notiosorex (shrew)								X		
Chiroptera										
Vespertilionidae										
Myotis (brown bat)					X					
Plecotus (big-eared bat)					X					
Antrozous (pallid bat)					X					
Molossidae										
Tadarida (free-tailed bat)					X					
Lagomorpha										
Leporidae										
Lepus (rabbit)		X								
Sylvilagus (bunny)			X					X	X	
Rodentia										
Sciuridae										
Marmota (marmot)					X					
Spermophilus (squirrel)			X		X				X	
Eutamias (chipmunk)					X				X	
Geomyidae										
Thomomys (gopher)			X					X	X	
Heteromyidae										
Perognathus (pocket mouse)		X						X		
Dipodomys (kangaroo rat)			X					X		
Cricetidae										
Reithrodontomys (harvest mouse)			X							
Peromyscus (deer mouse)			X		X			X	X	
Onychomys (grasshopper mouse)			X		X			X		
Sigmodon (cotton rat)			X							
Neotoma (pack rat)		X	X		X			X		
Microtus (vole)		X	X	X	X					
Erethizontidae										
Erethizon (porcupine)								X		
Carnivora										
Canidae										
Canis (wolf)		X	X		X					
Urocyon (fox)					X					
Ursidae										
Ursus (bear)					X					
Procyonidae										
Bassariscus (ringtail cat)					X					

	Lehner Ranch	Murray Spgs	M.S. Arroyo	San Pedro	Papago Sp.	Wilcox	Cerros Negros	Silver Bell Mt.	Tucson Mt.	Canez Wash
Mustelidae										
Taxidea (badger)					X					
Mephitis (skunk)					X					
Spilogale (spotted skunk)					X					
Felidae										
Felis (cat)		X								
Proboscidea										
Mammutidae										
Mammut (mastodon)	X									
Elephantidae										
Mammuthus (elephant)	X	X		X	X	X	X			X
Perissodactyla										
Equidae										
Equus (horse)	X	X	X	X		X	X			X
Tapiridae										
Tapirus (tapir)	X	X								
Artiodactyla										
Tayassuidae										
Platygonus (peccary)					X					
Camelidae					X					
Hemiauchenia (llama)		X								
Camelops (camel)		X		X		X				
Cervidae										
Cervus (elk)					X					
Antilocapridae										
Stockoceros (pronghorn)					X					
Bovidae										
Bison (bison)	X	X	X	X	X				X