Paleontological Resources of the Upper and Middle San Pedro Valley

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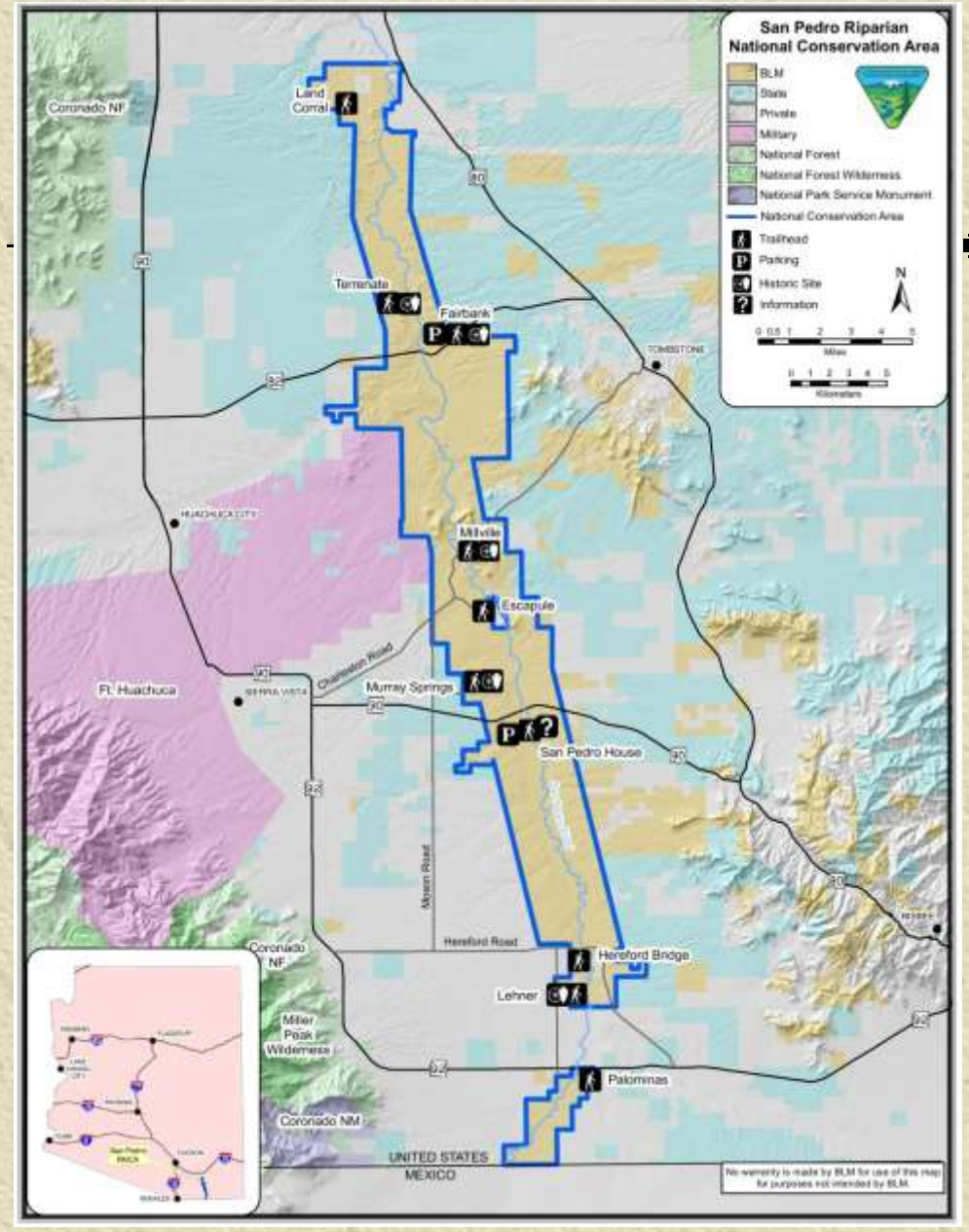
Arizona Museum of Natural History


San Pedro Riparian
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TOMBSTONE
HUACHUCA CITY
Miville
Escapule
Murray Springs
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Ft. Huachuca
SIERRA VISTA
San Pedro House
Moson Road
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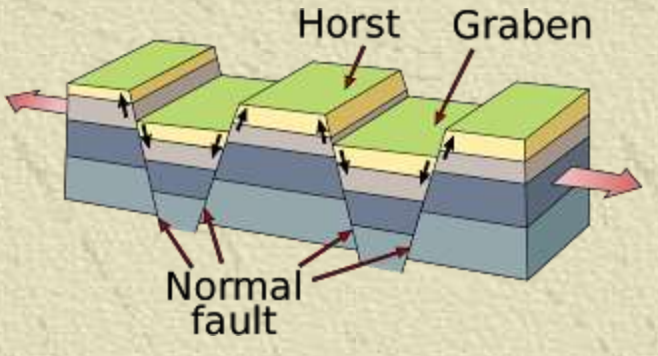
Geological setting

- Regional extension causing block faulting – creation of the Basin and Range ~15Ma



- Poorly developed drainage results in lakes in valley bottom ?-3.4 Ma
- Drainage develops with flow to north, marshes, ponds and lakes significant from time to time

FIELDNOTES
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Windows to the Past:
Fossils of the San Pedro Valley

Figure 1. During the late Miocene and Pliocene, open-country animals were widespread across North America. Pronghorns, rhinos, and camels were plentiful (far left and center). The horse *Dinohippus* and the bear *Agriotherium* were common inhabitants of the San Pedro Valley in the early Pliocene. The Pleistocene Epoch in North America was the time of the great ice ages. The giant beaver *Castoroides* (center) and the long-horned bison (right center) were widespread. During this time, woolly mammoths and musk oxen (center) were common in high latitudes; megatheres (giant ground sloths) and armadillolike glyptodonts (right), which dispersed to North America from South America, were common in low latitudes. From the Age of Mammals Mural by Rudolph F. Zallinger, courtesy of the Peabody Museum of Natural History, Yale University, New Haven, Connecticut.

by Everett H. Lindsay

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A drive along U.S. Highway 80 between Benson and Bisbee in southeastern Arizona offers the traveler varied and enchanting vistas, wildlife, and vegetation. The San Pedro Valley, through which this highway passes, lies at the western edge of the Chihuahuan Desert.

Plants and animals at various times have "moved into" the San Pedro Valley from other areas; some may have evolved there. Their present association in the valley represents a unique (and temporary) biotic assemblage: one scene of a dynamic, ever-changing drama. The natural history of the San Pedro Valley represents a kaleidoscope of changing plant and animal life, as new species evolve and old species migrate or become extinct in response to widespread geologic and climatic changes (Figure 1).

The San Pedro Valley is a prime area for studying life sequences because its fossil record preserves more than 6 million years (m.y.) of biotic changes. The valley has one of the best late Cenozoic terrestrial sequences in North America and has yielded the best record of early man and extinct mammals known on the continent.

This article summarizes the geologic and fossil record of the San Pedro Valley since its development about 6.5 m.y. ago, and compares the past biota, preserved as fossils, with the flora and fauna now living in that area. Only through such studies can the natural history of an area be understood.

LATE CENOZOIC GEOLOGIC HISTORY

The San Pedro Valley extends from northern Sonora to the confluence of the San Pedro and Gila Rivers near Winkelman. It is bounded on the east (from south to north) by the Mule, Dragoon, Little Dragoon, Winchester, and Galiuro Mountains. It is bounded on the west (from south to north) by the Huachuca, Mustang, Whetstone, Rincon, Santa Catalina, and Tortilla Mountains (Figure 2).

This pattern of discontinuous, subparallel mountain ranges bounding a relatively linear (southeast to northwest) valley is characteristic of the Basin and Range geomorphic province of Arizona. The mountain ranges are uplifted blocks of the crust relative to the valley blocks. The discontinuous mountain ranges and sinuosity of the valleys suggest that this topography was developed over a long period of time by complex processes, rather than a single, simple geologic event.

Geologic data, supported by numerous radiometric age determinations on volcanic rocks, indicate that the existing basin-and-range topography was formed during the late Miocene, between 14 and 6 m.y. ago. This period of geologic change has been named the "Basin and Range disturbance" (Scarborough and Peirce, 1978). The Basin and Range disturbance, which is responsible for the formation of the San Pedro Valley and similar valleys in southern Arizona, has affected eight western States and represents an important episode in the history of the North American continent.

Sediments that accumulated after the San Pedro Valley formed are called "basin-

BUREAU OF GEOLOGY
AND MINERAL TECHNOLOGY

Early Pleistocene

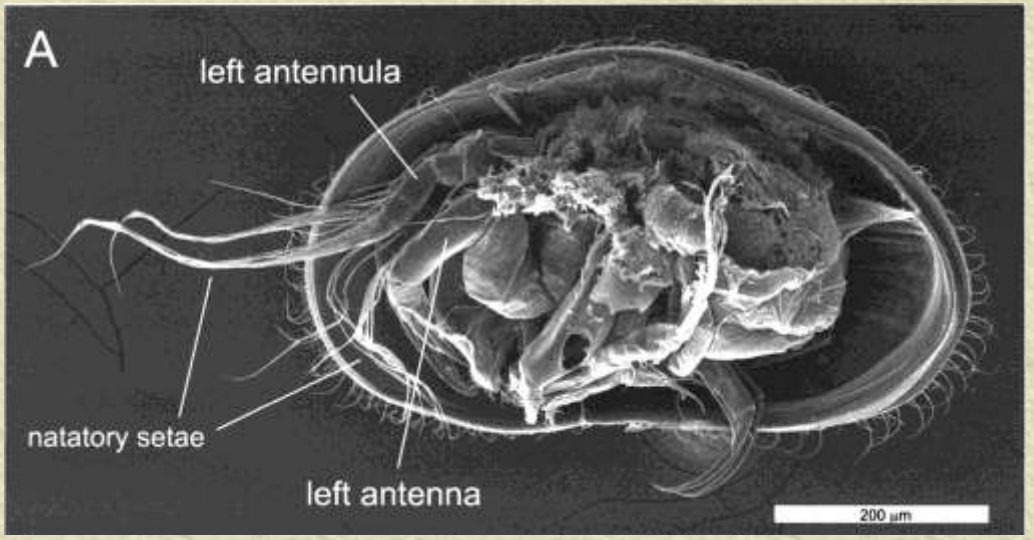
- Saint David Formation
- ? – 3.4 million lakes, few fossils
- Well developed paleomagnetic timeframe – a first for terrestrial sediments!
- Succession of faunas from ~3 to 1.5 Ma
- Blancan to ? Irvingtonian NALMA

Plants

- diatoms
- charophytes
- *Equisetum* (scouring rush)

Ostracoda (aquatic crustaceans)

- *Cypridopsis* cf. vidua
- *Limnocythere* cf. *staplini*
- *Limnocythere* sp.
- *Candona* cf. *renoensis*
- *Candona* sp. A
- *Candona* sp. B
- ?Candonlella sp.
- *?Heterocypris* sp.
- ?Cycloypris sp.
- *Potamocypris* sp.
- *Cyprideis* sp.
- *Darwinula* sp.



Snails and a Clam

- *Pisidium casertanum* (clam)
- *Fossaria dalli* (aquatic snail)
- *Lymnaea caperata* (aquatic snail)
- *Lymnaea* cf. *elodes* (aquatic snail)
- *Bakerilymnaea bulimoides* (aquatic snail)
- *Gyraulus parvus* (aquatic snail)
- *Promenetus exacuous* (aquatic snail)
- *Promenetus umbilicatellus* (aquatic snail)
- *Physa virgata* (aquatic snail)
- *Gastrocopta cristata* (terrestrial snail)
- *Gastrocopta tappaniana* (terrestrial snail)
- *Pupoides albilabris* (terrestrial snail)
- *Vertigo milium* (terrestrial snail)
- *Vertigo ovata* (terrestrial snail)
- cf. *Succinea* (terrestrial snail)
- *Deroceras aenigma* (slug)
- *Hawaila minuscula* (terrestrial snail)

Fish and Amphibians

- indeterminate small fish

- *Ambystoma tigrinum* (tiger salamander)
- *Scaphiopus hammondi* (spadefoot toad)
- *Bufo alvarius* (toad)
- *Hyla eximia* (tree frog)
- *Rana* sp. (leopard frog)

Turtles and Lizards

- *Kinosternon arizonense* (mud turtle)
- *Terrapene* cf. *ornata* (box turtle)
- *Gopherus* sp. (tortoise)
- *Hesperotestudo* sp. (giant tortoise)
- *Eumeces* sp. (skink)
- *"Cnemidophorus"* sp. (whiptail lizard)
- *Crotaphytus* sp. (collared lizard)
- *Phrynosoma* sp. (horned lizard)
- *Sceloporus* sp. (fence lizard)

Snakes

- *Coluber* sp. (racer snake)
- *Pituophis melanoleucus* (bull snake)
- *Masticophis* sp. (whipsnake)
- *Lampropeltis intermedius* (kingsnake)
- *Natrix* sp. (water snake)
- *Thamnophis* sp. (garter snake)
- *Crotalus* cf. *molossus* (rattlesnake)

Birds

- "*Colymbus*" sp. (grebe)
- *Querquedula* sp. (teal duck)
- *Dendrocygna eversa* (tree duck)
- *Anabernicula miniscula* (goose)
- anatid indeterminate
- *Meleagris* cf. *progenes* (turkey)
- *Colinus* sp. (quail)
- *Gallinula* sp. (gallinule)
- *Micropalama hesternus* (sandpiper)
- *Columba micula* (pigeon)
- *Corvus* sp. (crow)
- *Junco* sp. (junco)
- fringilid indeterminate

Shrews and Bats

- *Sorex taylori* (shrew)
- *Sorex* sp. (shrew)
- *Simonycteris stocki* (bat)
- *Antrozous pallidus* (pallid bat)

Glyptothere

- *Glyptotherium texanum*
- Formerly referred to *Glyptotherium arizonae*

Lots of Bunnies!

- *Hypolagus edensis* (rabbit)
- *Aluralagus bensonensis* (rabbit)
- *Aluralagus virginiae* (rabbit)
- *Notolagus* cf. *N. lepusculus* (rabbit)
- *Notolagus* cf. *N.velox* (rabbit)
- *Nekrolagus progessus* (rabbit)
- *Sylvilagus cunicularius* (cottontail)
- *Sylvilagus hibbardi* (cottontail)
- *Sylvilagus* sp. (cottontail)

Rodents

- Sciuridae
  - *Spermophilus bensoni* (squirrel)
  - *Spermophilus cochisei* (squirrel)
  - *Spermophilus tuitus* (ground squirrel)
- Castoridae
  - *Castor* sp. (beaver)
- Geomyidae
  - *Geomys minor* (gopher)
  - *Geomys persimilis* (gopher)
  - *Cratogeomys bensoni* (pocket gopher)
- Heteromyidae
  - *Perognathus pearlettensis* (pocket mouse)
  - *Perognathus gidleyi* (pocket mouse)
  - *Perognathus* sp. (pocket mouse)
  - *Prodipodomys minor* (kangaroo rat)
  - *Prodipodomys idahoensis* (kangaroo rat)
  - *Dipodomys gidleyi* (kangaroo rat)

More Rodents!

- Muridae
  - *Calomys (Bensonomys) arizonae* (vesper mouse)
  - *Peromyscus* sp. (deer mouse)
  - *Baiomys minimus* (pigmy mouse)
  - *Baiomys brachygnathus* (pigmy mouse)
  - *Onychomys bensoni* (grasshopper mouse)
  - *Onychomys pedroensis* (grasshopper mouse)
  - *Sigmodon medius* (cotton rat)
  - *Sigmodon minor* (cotton rat)
  - *Sigmodon curtisi* (cotton rat)
  - *Neotoma fossilis* (pack rat)
  - *Neotoma* sp. (pack rat)
  - *Synaptomys (Metaxomys)* sp. (lemming)
  - *Pliophenacomys* sp. (pine vole)
  - *Ondatra idahoensis* (muskrat)

Yet more Rodents

- Erethizonitidae
  - *Erethizon bathygnathum* (porcupine)
- Hydrochoeridae
  - *Neochoerus* sp. (capybara)

Carnivores

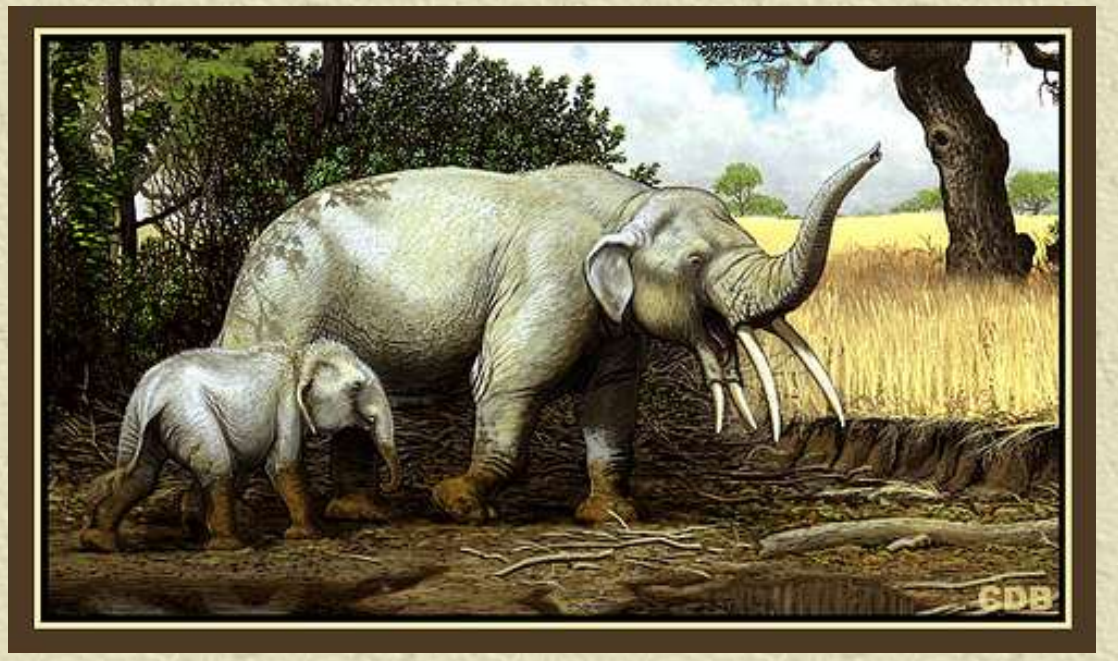
- *Canis edwardsi* (wolf)
- *Canis* sp. (dog)
- *Borophagus diversidens* (bone-crushing dog)
- *Spilogale pedroensis* (spotted skunk)
- *Panthera onca* (jaguar)
- *Felis* sp. (cat)
- *Chasmaporthetes ossifragus* (American hyaena)

Chasmaporthetes

Borophagus

Probosideans

- *"Anancus" bensonensis* (gomphothere)
- *Stegomastodon mirificus* (gomphothere)



Prey Items

- *Nannippus phlegon* (three-toed horse)
- *Equus* sp. (single-toed horse)
- *Platygonus* sp. (peccary)
- *Hemiauchenia* sp. (llama)
- *Camelops* sp. (camel)
- *Odocoileus* sp. (deer)
- *Capromeryx arizonensis* (pronghorn)

Type Localities

- *Kinosternon arizonense*
- *Simonycteris stocki*
- *Glyptotherium arizonae*
- *Borophagus diversidens*
- *Spilogale pedroensis*
- *“Anancus” bensonensis*
- *Aluralagus bensonensis*
- *Spermophilus bensoni*
- *Spermophilus cochisei*

Type Localities

- *Geomys minor*
- *Geomys persimilus*
- *Cratogeomys bensoni*
- *Prodipodomys minor*
- *Dipodomys gidleyi*
- *Bensonomys arizonae*
- *Neotoma fossilis*
- *Baiomys brachygnathus*
- *Onychomys bensoni*
- *Onychomys pedroensis*
- *Sigmodon medius*
- *Sigmodon minor*
- *Sigmodon curtisi*

Significances

- Type localities to over a score of species
- Early South American immigrants
- Succession of faunas through well documented time

Late Pleistocene

- Granite Wash, Murray Springs, Millville, Lehner Ranch Formations (I may have missed some)
- .6 Ma- 10,000
- Rancholabrean NALMA indicated by the presence of *Bison*

Plants

Pollen only

- *Pinus* (pine)
- *Juglans* (walnut)
- *Juniperus* (juniper)
- *Celtis* (hackberry)
- *Ephedra* (Mormon tea)
- *Graminae* (grasses)
- *Sambucus* (elderberry)
- *Cyperaceae* (sedges)
- *Euphorbia* (spurge)
- *Quercus* (oak)
- *Eriogonum* (wild buckwheat)
- *Chenopodiaceae* (goosefoot)
- *Tidestromia* (espanta vaqueras)
- *Nyctaginaceae* (four-o'clock)
- *Kalistroemia* (summer poppy)
- *Onagraceae* (evening primrose)
- *Malvaceae* (mallow)
- *Hedyotis* (madder)
- *Umbelliferae* (parsley)
- *Aretemisia* (sagebrush)
- *Ligulifora* (composite)

Snails and Clams

- *Euconulus fulvus*
- *Nesovitrea hammonis electina*
- *Hawalia minuscula*
- *Zonitoides arboreus*
- *Deroceras leave*
- *Discus cronkhitei*
- *Helicodiscus singleyanus*
- *Punctum californicum*
- *Succinea* sp.
- *Oxyloma* sp.
- *Gastrocopta pentodon*
- *Gastrocopta prototypus*
- *Gastrocopta cristata*
- *Gastrocopta armifera*
- *Pupoides albilabris*
- *Pupoides hordaceus*
- *Pupilla blandii*
- *Pupilla muscorum*
- *Pupilla hebes*
- *Pubilla syngenes*
- *Vertigo milium*
- *Vertigo ovata*
- *Vertigo gouldii*
- *Vertigo berryl*
- *Vertigo elatior*
- *Vertigo ventricosa*
- *Vallonia perspectiva*
- *Vallonia cyclophorella*
- *Vallonia gracilicosta*
- *Cochlicopa lubirca*
- *Stagncola caperata*
- *Fossaria bulimoides techella*
- *Fossaria caperata*
- *Fossaria obrussar*
- *Fossaria parva*
- *Fossaria modicella*
- Physidae (aquatic snails)
- *Physa virgata*
- *Physa humerosa*
- Planorbidae (aquatic snails)
- *Gyraulus parvus*
- *Laevapex californica*
- *Pisidium casertanum*
- *Pisidium compressum*
- *Pisidium walkeri*

Amphibians, Reptiles and Fish

- Strangely lacking in reptiles and amphibians and only indeterminate fish

Bird

- *Geococcyx californicus conklingi* (Giant Roadrunner)

Shrews, rabbits and bats

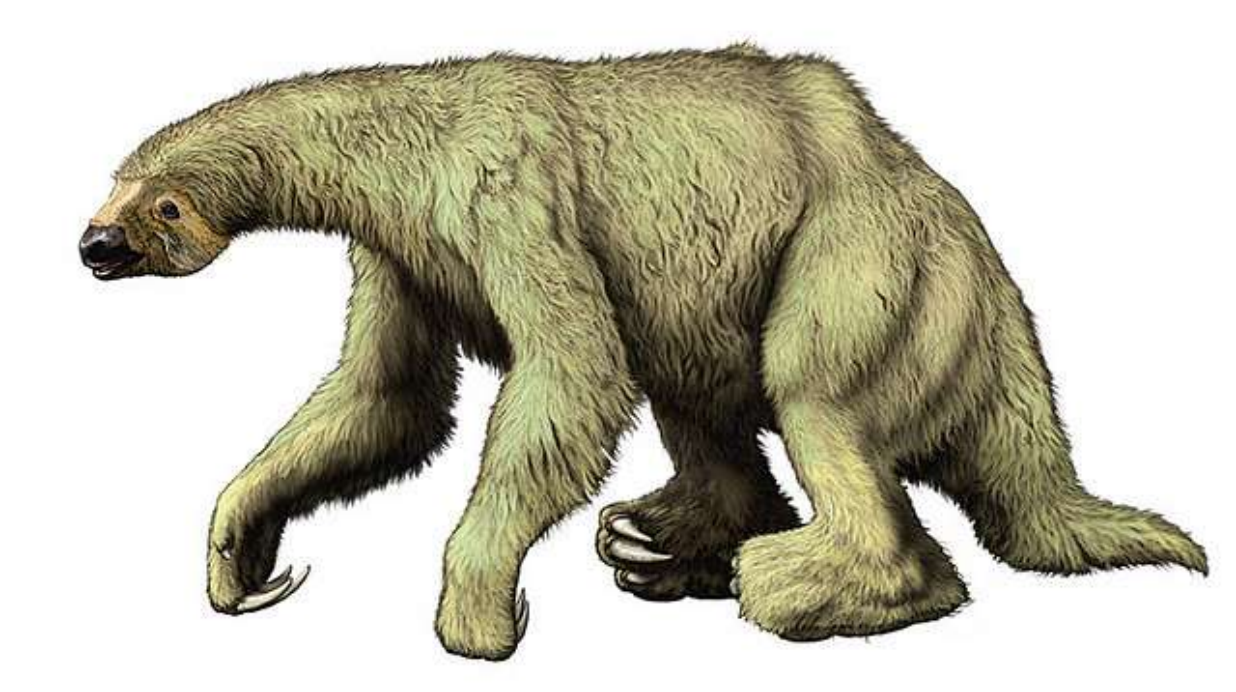
- *Notiosorex crawfordi* (desert shrew)

- *Lepus* sp. (jackrabbit)
- *Sylvilagus* sp. (cottontail)
- *Aztlanolagus* (rabbit)

- *Myotis velifer* (bat)

Sloth

- *Nothrotheriops shastensis* (Shasta ground sloth)



Rodents

- Sciuridae
  - *Spermophilus mexicana* (Mexican ground squirrel)
  - *Spermophilus spilosoma* (spotted ground squirrel)
  - *Spermophilus variegatus* (rock squirrel)
  - *Spermophilus* sp. (ground squirrel)
  - *Ammospermophilus harrisii* (antelope ground squirrel)
- Geomyidae
  - *Thomomys bottae* (valley pocket gopher)
  - *Thomomys* sp. (pocket gopher)
- Heteromyidae
  - *Perognathus flavus* (silky pocket mouse)
  - *Perognathus* sp. (pocket mouse)
  - *Dipodomys spectabilis* (banner-tailed kangaroo rat)
  - *Dipodomys merriami* (Merriam's kangaroo rat)
  - *Dipodomys ordii* (Ord's kangaroo rat)

The Rats and Mice proper

Muridae

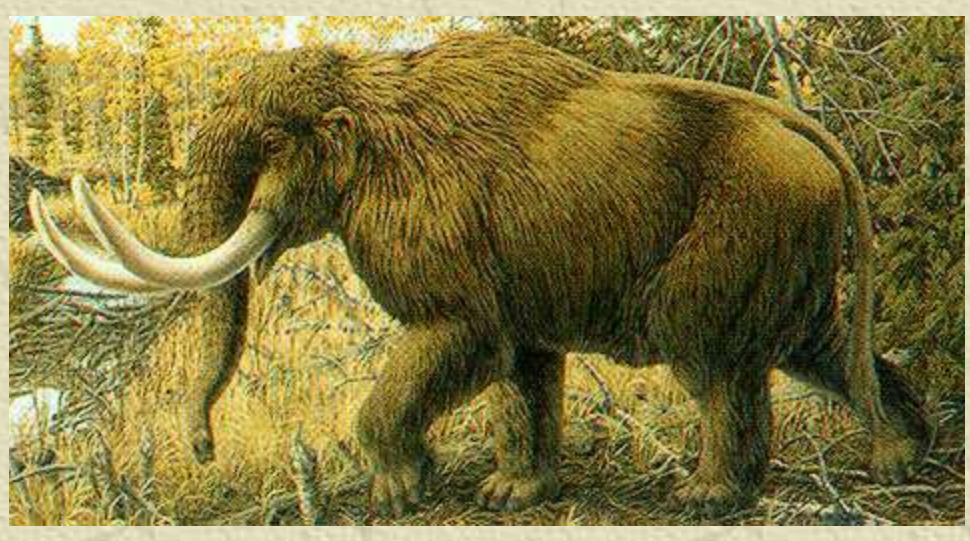
- *Onychomys leucogaster* (northern grasshopper mouse)
- *Reithrodontomys montanus* (Plains harvest mouse)
- *Reithrodontomys megalotis* (western harvest mouse)
- *Peromyscus* sp. (deer mouse)
- *Sigmodon curtisi* (cotton rat)
- *Sigmodon* sp. (cotton rat)
- *Neotoma albigula* (white-throated wood rat)
- *Neotoma* sp. (wood rat)
- *Microtus* sp. (vole)
- *Ondatra zibethicus* (muskrat)

Carnivores

- *Canis latrans* (coyote)
- *Canis lupis* (wolf)
- *Canis* sp. (wolf)
- *Ursus americanus* (bear)
- *Bassariscus astutus* (ringtail)
- *Panthera atrox* (American lion)
- *Felis* sp. (cat)

Proboscideans

- Mammutidae
  - *Mammut americanum* (mastodon)
- Elephantidae
  - *Mammuthus columbi* (elephant)



Odd Toed Prey

- Equidae
  - *Equus* sp. (horse)
- Tapiridae
  - *Tapirus* sp. (tapir)

Even Toed Prey

- *Hemiauchenia macrocephala* (llama)
- *Camelops huerfanensis* (camel)
- *Odocoileus* sp. (deer)
- *Bison* sp. (bison)
- *Platygonus* Sp. (javalena)
- *Stockoceros conklingi* (antelope)

Oh Yeah, Almost Forgot….

- *Homo sapiens* (ape)

Significances

- Humans
- Human Megafauna Interactions
- Arizona Mastodon
- Abundant Mammoth