FOSSILS OF THE SAN SIMON VALLEY, GRAHAM COUNTY, ARIZONA

By **Lawrence C. Thrasher**[1]

[1]*U.S. Bureau of Land Management, 711 14th Avenue, Safford, Arizona 85546*

Contents

Abstract

A sequence of late Pliocene sediments known as the 111 Ranch beds is exposed as badlands terrain in the northern part of the San Simon valley, north of Interstate 10. These deposits contain a significant Blancan-aged assemblage of mammals, reptiles, and birds that date to the beginning of the Ice Age, about 2.5 million years ago. Over 50 species have been recorded in the literature, including animals such as deer and rabbits that still live in the area, animals such as camels and giant tortoises that no longer live in North America, and classic Ice Age mammals such as mastodonts, ground sloths, and glyptodonts that no longer live at all.

The Safford Field Office of the U.S. Bureau of Land Management has been conducting fossil inventories in the San Simon valley since 1998, assisted by the University of Arizona, the International Wildlife Museum, the Mesa Southwest Museum, and its affiliated volunteer group, the Southwest Paleontological Society. The BLM inventory has so far added beaver, tapir, deer, elk, raccoon, swan, turkey, hawk, goose, and mud turtle to the faunal list. Other material may represent new species.

The fossils represent the beginning of the Great American Faunal Interchange, when South American animals such as porcupines, opossums, and glyptodonts first arrived from South America, and animals such as horses, camels, and mastodonts dispersed to South America. This event was triggered by the exposure of the Isthmus of Panama, which was caused primarily by lowering of sea levels due to growing continental ice sheets.

Other fossils from the valley consist primarily of mammoth material rarely found in Pleistocene deposits; two mammoth skulls have been found over the past ten years or so.

INTRODUCTION

Location

The San Simon (San See-moan) Valley is one of the structural intermountain basins of Arizona's Basin and Range physiographic province. It is bordered by the Whitlock and

Peloncillo Mountains on its east side, and the Pinaleno (or Graham) Mountains on its west side, with the Gila Mountains to the north. It grades into the Safford (or Gila) Valley to the north, and into the San Bernardino Valley south of Interstate-10 (Figure 1).

Acknowledgements

Thanks go especially to William Civish, Wayne King, Debrah Rawhouser, and Gay Kinkade of the Bureau of Land Management at the Safford Field Office, and to Denise Meridith, Gary Bauer, and Gary Stumpf of the Bureau of Land Management at the Arizona State Office in Phoenix for their support of this project. Dr. Everett Lindsay, Professor emeritus of the University of Arizona, Dr. Robert McCord, Curator at the Mesa Southwest Museum, and Richard White, Director of the International Wildlife Museum, are thanked for their assistance, as are Buck Tegowski, Andria Skaff, Gavin McCullough, Erin Schirtzinger, and all the other members of the Southwest Paleontological Society who used their personal time and expense on this project.

GEOLOGIC SETTING

Sediments of the San Simon Valley consist mostly of alluvial valley-fill deposits thousands of feet thick. Deposition of these sediments began about 16 Ma at the beginning of the Basin-and-Range tectonic event. The currently exposed sediments are near the top of the sedimentary section and are mostly weakly consolidated to unconsolidated clays, silts, sands and gravels, with localized lenses of limestone, marl, and diatomite, and occasional beds of well-cemented sandstones and conglomerates. Beds of halite and gypsum up to about 80 feet thick occur at depth in parts of the basin. The Whitlock and Peloncillo Mountains consist mostly of lava flows and tuffs produced during the Miocene, and the Graham Mountains represent a metamorphic core complex developed in Precambrian rocks with Tertiary granitic intrusions on the southern end.

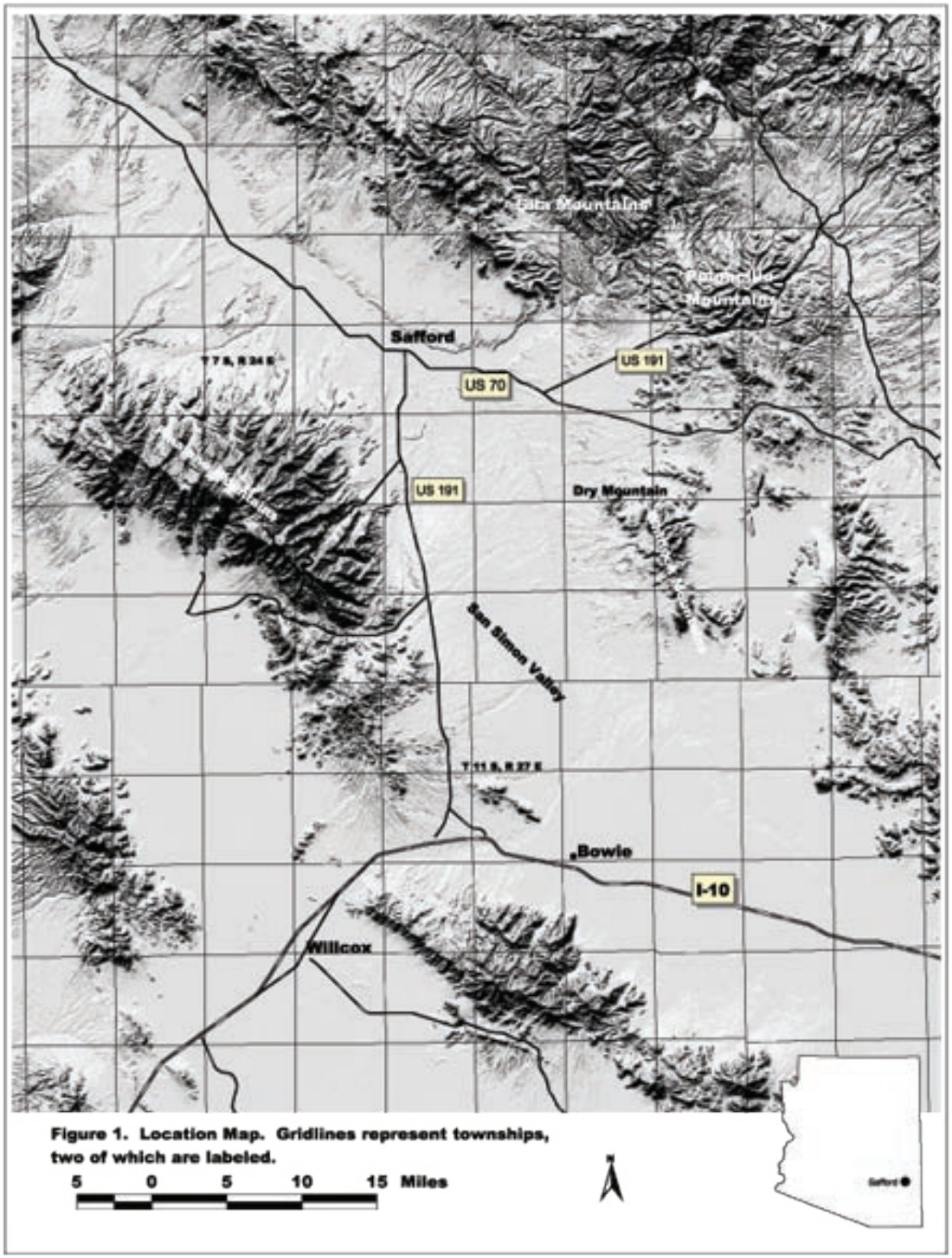

Figure 1. Location map. Gridlines represent townships, two of which are labeled.

STRATIGRAPHY

Most of the basin-fill deposits of the valley are part of the Gila Conglomerate. This unit was originally treated as a single rock formation but was later elevated to group status, based on studies of valley-fill deposits in Arizona and New Mexico (Morgan and others, 1997). The Gila Conglomerate in the San Simon Valley includes deposits from late Miocene (?) to early Pleistocene age (Tomida, 1985). In the San Simon Valley, the formation is exposed as erosional remnants located primarily around the margins of the basin, near the mountains, with most of the valley covered by alluvium and surficial deposits of Quaternary age.

A discrete unit over 300 feet thick in the higher strata of the Gila Conglomerate is known as the 111 (one-eleven) Ranch beds, named after the old 111 Ranch located near Dry Mountain just north of the Whitlock Mountains, where the best exposures of these beds occur. These sediments were informally named by Seff (1960) for the exposures at Dry Mountain, which is a northwest extension of the Whitlock Mountains (fig. 1).

To this day, the 111 Ranch beds, like other distinctive strata within the Gila Conglomerate, have not been formally named. Gillette and Ray (1981) considered the deposits along the northern, western and southern flanks of the Whitlocks as part of the 111 Ranch beds, and this terminology is used herein as well. Limited exposures of the 111 Ranch beds are also found on the west side of the San Simon Valley, about eight miles west of the Whitlocks. Houser and others (1985) and Houser (1990) extended the 111 Ranch beds across the San Simon basin into the Safford basin, where they mapped the beds as being over 1,500 feet thick, mostly covered by Quaternary sediments.

PALEONTOLOGY

It is the 111 Ranch beds that contain most of the fossils found in the San Simon valley. These fossils represent a late Blancan mammal assemblage comparable to that found in the middle member of the St. David Formation in the San Pedro Valley about 60 miles to the west (the California Wash and Wolf Ranch faunas) (Lindsay and others, 1987). Other main areas

around the continent with this fauna occurs include the Hagerman beds in southwest Idaho, the Anza-Borrego beds in southern California, and the type section for the fauna in the Mt. Blanco area of northwest Texas. Other significant areas include Pliocene deposits in Kansas and Florida (Lindsay, 1996).

The 111 Ranch fauna was originally divided into two parts, a lower Flat Tire fauna thought to be of late Pliocene age and an upper Tusker fauna of middle Pleistocene age (Lance, 1960; Wood, 1962). Later, biostratigraphic and paleomagnetic studies showed that the faunas are of the same late Pliocene age.

Wherever exposed, the 111 Ranch beds are heavily dissected, forming badlands topography. The beds themselves are typically undeformed and unfaulted, horizontal or with gentle slopes rarely greater than 3 degrees, sloping toward the axis of the valley. Individual beds, consisting mostly of sandy silts, are generally less than 20 feet thick.

Reports of fossils from these beds were first published by Knechtel (1936, 1938) of the U.S. Geological Survey, who was conducting a water survey in the area. In the area of Dry Mountain, he found remains of a three-toed horse, an equine horse, the peccary *Platygonus*, a camel, and a ground sloth. The American Museum of Natural History conducted fossil studies of the area from the late 1930's to the early 1950's, and the University of the Arizona conducted studies from the late 1950's to mid 1980's.

Recognizing the importance of the fossils, the Safford Field Office of the Bureau of Land Management (BLM) designated the Dry Mountain exposures as an Area of Critical Environmental Concern in 1991, creating special management prescriptions for protecting these fossils. With assistance from the University of Arizona, the International Wildlife Museum, the Mesa Southwest Museum in Mesa, and its affiliated volunteer group, the Southwest Paleontological Society, the Safford BLM has been conducting paleontological inventories of the area from 1998 to the present.

Over 50 species had been reported form these beds prior to the BLM inventory. As described by Galusha and others (1984) and Tomida (1986), these species include at least 4 types

of horse, including the small 3-toed horse *Nannippus phlegon*, and horses as large as modern ones such as *Equus* cf. *E. scotti* and the American zebra *Equus simplicidens*. Camelids are another common element, and include the giant camel *Megalotylopus*, standing over 8 feet high at the shoulder, and the llama *Hemiauchenia*. Carnivores include the canid *Borophagus* and the short-faced bear *Tremarctus*. Proboscidians from the beds seem to be mostly aligned with the gomphothere *Rhynchotherium*. As described by Gillette and Ray (1981), the beds contain some of the best glyptodonts found in North America (fig. 2). They represent the oldest species of glyptodont in North America, *Glyptotherium texanum*. The most complete glyptodont ever found in North America was collected from these beds by the American Museum of Natural History. That specimen also shows the only evidence seen of sabertooth cats in the area, as the skull has 2 large puncture holes that match bite marks of sabertooths (probably *Homotherium*).

Other mammals previously reported from these beds include the ground sloth *Megalonyx*, the antelope *Capromeryx*, and twenty-six species of small mammals, such as rodents, shrews, and rabbits. An eagle has been described from the beds (Emslie and Czaplewski, 1999), and the desert tortoise *Gopherus* and giant land tortoise *Hesperotestudo* have also been reported (McCord, 1994).

The BLM inventory has so far added beaver, tapir, deer, elk, raccoon, swan, turkey, hawk, goose, and mud turtle to the faunal list. Some of the material collected may be the basis for new species. There is a jackal-like skull and a partial skeleton of a cat, including its skull, from the inventory currently under study. Many of the specimens are currently scattered around the country, being studied by specialists.

Petrified wood is rare in the beds, but is well-preserved. Pieces up to about a foot long are found; they are highly silicified and often opalized with a low-grade (non-fire) pale opal. This wood is the only evidence seen of hardwood trees.

Much of the fossil material represents a scrap bone fauna, with many identifications based on isolated diagnostic elements. Articulated skeletons, even partial ones, are rare, and

Figure 2. Glyptodont restoration.

occur mostly in the southern portions of the exposures, those closest to I-10. The northern area was relatively close to the head waters of the valley, with a resulting stronger fluvial influence. The waters were coming from the ancestral Bonita Creek in the Gila Box area, which is the area of the present Gila River, between the Gila and Peloncillo Mountains (Figure 1). Pebbles of red granite, copper minerals, and monzonites found in the lll Ranch beds have their sources in the Bonita Creek drainage system (Houser, l990). These fluvial conditions, along with scavenging and trampling of bones, would act to disarticulate and scatter skeletons. Fluvial conditions continue down the west flank of the Whitlock Mountains, and may have been influenced by seasonal floods, caused by melting ice in the highlands of the Bonita Creek watershed. Conditions become much sandier in the southern part of the Whitlocks, with the 111 Ranch beds being the source for the sand dunes around the BLM's Hot Well Dunes Recreation Area, suggesting the water flowed into a lake there. With less fluvial influence in the southern

exposures, skeletons were less susceptible to transportation, and thus had a better chance of remaining articulated.

Based on biostratigraphy, magnetostratigraphy, and fission-track dating of zircon from an ash bed in the Dry Mountain area, the 111 Ranch beds were thought by Galusha, et al. (1984) to be between 2.0 and 2.5 million years old. They estimated that deposition of these beds lasted about 130,000 years. Based on biostratigraphic factors, Tomida (1985) speculated that the beds may represent a greater length of time than this, occurring between 2.2 to 2.7 million years ago.

The 111 Ranch beds represent the beginning of the Great American Faunal Interchange, when South American animals such as ground sloths, glyptodonts, porcupines, opossums, and capybaras first arrived from South America, and animals such as horses, camels, and mastodonts dispersed to South America. This event was triggered by the exposure of the Isthmus of Panama, which occurred due to the lowering of sea level caused by growing continental ice sheets, as well as tectonism in Central America.

Galusha and others (1984, p. 717) stated that deposition of the 111 Ranch beds "terminated by a shift in sedimentary regime, which produced a conformable unit of coarse alluvial-fan material. Subsequent geological events are related to the establishment and entrenchment of the modern Gila drainage, including its important tributary San Simon Creek . . . " (Galusha and others, 1984, p. 717). The coarse alluvial fan material covering the 111 Ranch beds is typically up to about 20 feet thick.

The establishment of the external drainage of the Gila River and San Simon Creek is what led to the exposures and erosion of the 111 Ranch beds. This external drainage was thought to be established somewhere in the latest Pliocene to middle Pleistocene (Morrison, 1985; Houser and others, 1985). External drainage was also established in the nearby Duncan and San Pedro valleys about this time, resulting in Pliocene fossil exposures in those basins; the neighboring northern part of the Sulpher Springs valley has no external drainage, resulting in the Willcox Playa and a lack of Pliocene exposures (Lindsay and others, 1987).

Very rarely mammoth remains are found in the younger, Pleistocene deposits of the San

Simon Valley. We have been lucky enough to have two mammoth skulls, one with portions of its tusks, found over the past 10 years or so. The one with the tusks came from alluvium being cleared by miners in their development of the Bowie zeolite deposit southwest of the Whitlocks, and the other was found in the spring of 1999 in a sand and gravel pit about one mile south of Safford; a nearly complete mammoth tibia was found at a sand and gravel pit about a half mile from the latter skull in 1991. Fossils are so rare in these Pleistocene beds, however, that it is difficult to warrant the conducting of systematic inventories for them.

REFERENCES CITED

Emslie, S.D., and Czaplewski, N.J., 1999, Two new fossil eagles from the late Pliocene (late Blancan) of Florida and Arizona and their biogeographic implications: Smithsonian Contributions to Paleobiology, no. 89, p. 185-198.

Galusha, Theodore, Johnson, N.M., Lindsay, E.H., Opdyke, N.D., and Tedford, R.H., 1984, Biostratigraphy and magnetostratigraphy, late Pliocene rocks, 111 Ranch, Arizona: Geological Society of America Bulletin, v. 95, p. 714-722.

Gillette, D.D. and Ray, D.E., 1981, Glyptodonts of North America: Smithsonian Contributions to Paleobiology, v. 40, 255 p.

Houser, B.B., 1990, Late Cenozoic stratigraphy and tectonics of the Safford Basin, southeastern Arizona: *in* Gehrels, G.E., and Spencer, J.E., eds., Geologic excursions through the Sonoran Desert region, Arizona and Sonora: Arizona Geological Survey Special Paper 7, p. 20-24.

Houser, B.B.,. Richter, D.H., and Shafiqullah, M., 1985, Geologic map of the Safford quadrangle, Graham County, Arizona: U.S. Geological Survey Miscellaneous Investigation Series, Map I-1617.

Knechtel, M.M., 1936, Geologic relations of the Gila Conglomerate in southeastern Arizona: American Journal of Science, v. 31, p. 505-519.

Knechtel, M. M., 1936, Geological Relations of the Gila Conglomerate in Southeastern Arizona: American Journal of Science. v. 31, p. 81-92.

Knechtel, M.M., 1938, Geology and ground water resources of the valley of Gila River and San Simon Creek, Arizona: U.S. Geological Survey Water Supply Paper 796-F, p. 181-222.

Lance, J.F., 1960, Stratigraphic and structural position of Cenozoic fossil localities in Arizona: Arizona Geological Society Digest, v. 3, p. 155-159.

Lindsay, E.H., 1996, Chronologic resolution of Pliocene mammal biochronology, *in* Boaz, D., Dierking, P., Dornan, M., McGeorge, R., and Tegowski, B., eds., Proceedings of the Annual Fossils of Arizona Symposium: Mesa Southwest Museum/City of Mesa, pubs., vol. 4, p. 155-169.

Lindsay, E.H., Opdyke, N.D., and Johnson N.M., 1987, Late Cenozoic deposits, vertebrate faunas, and magnetostratigraphy of southeastern Arizona *in* Davis, G.H., and VandenDolder, E.M., eds., Geologic diversity of Arizona and its margins--Excursions to choice areas: Arizona Bureau of Geology and Mineral Technology, Geological Survey Branch Special Paper 5, p. 227-237.

McCord, R.D., II, 1994, Fossil tortoises of Arizona *in* Boaz, D., Dornan, M., and Bolander, S., eds., Proceedings of the Fossils of Arizona Symposium, vol. II: Mesa Southwest Museum/City of Mesa, pub., p. 83-89.

Morgan, G.S., Sealey, P.L., Lucas, S.G., and. Heckert A.B., 1997, Pliocene (Latest Hemphillian and Blancan) vertebrate fossils from the Mangas Basin, Southwestern New Mexico *in* New Mexico's Fossil Record 1: New Mexico Museum of Natural History and Science, Bulletin 11, p. 97-108.

Morrison, R.B., 1985, Pliocene/Quaternary geology, geomorphology, and tectonics of Arizona: Geological Society of America Special Paper 203, p. 123-146.

Richter, D.H., Shafiqullah, M., and Lawrence, V.A., 1981, Geologic map of the Whitlock Mountains and vicinity, Graham County, Arizona: U.S. Geological Survey Miscellaneous Investigation Series, Map I-1302.

Savage, R.J.G., and Long, M. R., 1986, Mammal evolution, an illustrated guide: Facts on File Publications, New York, NY, 258 p.

Seff, Philip, 1960, Preliminary report of the stratigraphy of the 111 Ranch beds, Graham County, Arizona: Arizona Geological Society Digest, v. 3, p. 137-140.

Tomida, Yukimitsu, 1985, Small mammal fossils and correlation of continental deposits, Safford and Duncan basins, Arizona: Ph.D. dissertation, University of Arizona, Tucson, 253 p.

Wood, P.A., 1962, Pleistocene fauna from 111 Ranch area, Graham County, Arizona: Tucson, University of Arizona, Ph.D. dissertation, 121 p.