Creation Research Society Quarterly 2022 59:4–13

Mammalian Megafauna Bone Beds of North America: Agate Fossil Beds National Monument and Cita Canyon, Texas

Don McClenagan*

Abstract

Important mammalian megafauna bone beds are located in Nebraska's Agate Fossil Beds National Monument (Agate Fossil Beds) and Cita Canyon, Texas. Similarities between these two sites are the predominance of broken and disarticulated skeletons, evidence of rapid burial, and similar sedimentary environments. The two bone beds discussed herein are interpreted as post-Flood because they appear to have been deposited in rocks that were carved into older receding phase layers. A hill about 1.5 miles (3 km) east of and at about the same stratigraphic level as the Agate Fossil Beds has yielded over 100 mummified carcasses of *Stenomylus* (gazelle-like camelids), apparently buried and suffocated by a sand/dust storm. Based on the site description, water did not create this deposit or alter it, indicating that the *Stenomylus* camelids perished after the Flood.

Key Words: mammal, megafauna, Stenomylus, Cita Canyon, Palo Duro Canyon, Agate Fossil Beds, loess

Introduction

The timing and depositional mechanisms of mammalian megafauna bone beds in North America is not well understood. This paper discusses Agate Fossil Beds National Monument in Nebraska (Agate Fossil Beds) and Cita Canyon in Texas.

Agate Fossil Beds National Monument was originally a ranch in northwest Nebraska owned by James Cook. Native Americans of that area, the Lakota Sioux, called the fossil localities A'bekiyia Wama'kaskan s'e, meaning "Animal Bones Brutally Scattered About" (Graham, 2009). Cook made the first recorded fossil find in 1885. Over the next several decades, the site was investigated by scientists including Edward Cope of Philadelphia, Othniel Marsh of Yale University, and Olaf Peterson from the Carnegie Museum of Pittsburgh (USDI, 1980).

The fossil beds mostly comprise two main sites, University and Carnegie

* Don McClenagan, PhD, Smithers, BC, don@mcclenagan.net
Accepted for publication January 21, 2022

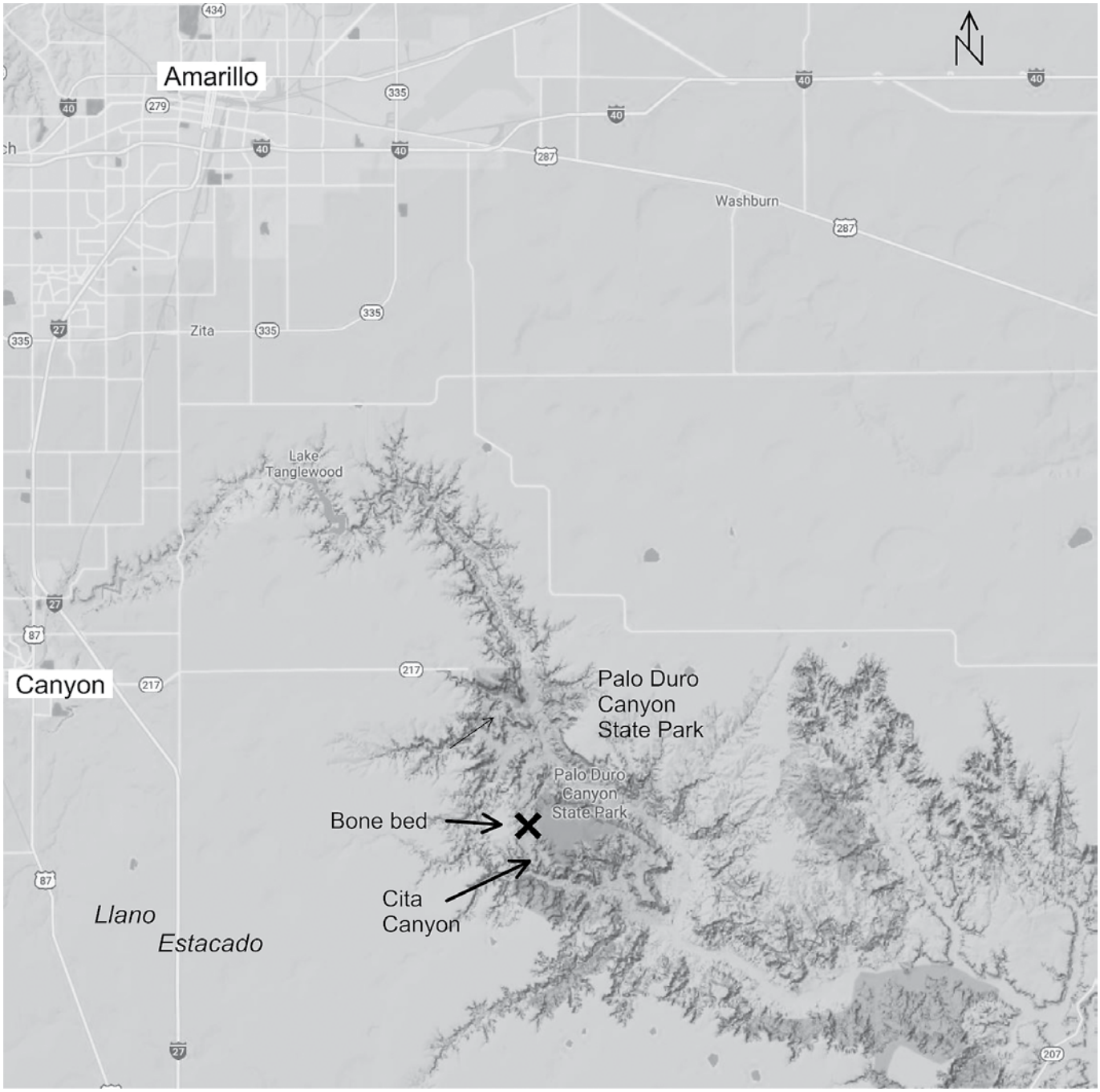

Figure 1. Map showing Palo Duro Canyon State Park in the Texas Panhandle. Palo Duro Canyon is a large erosional entrenchment in the Llano Estacado, an extremely flat area of the southern High Plains. Mammalian fossils are found at a number of locations in the Texas Panhandle where water has cut into the surface of the plains. Base map from Google Maps.

Hills (called the Fossil Hills), and two other important sites, Bear Dog Hill and an unnamed hill about 1.5 miles (2.4 km) east of the Fossil Hills that entombs mummified camelids (*Stenomylus*). The hills overlook the Niobrara River. The beds have produced thousands of fossil bones and teeth (Hunt, 1984).

North Cita Canyon is a tributary of Palo Duro Canyon, the head of which is 12 miles (19 km) east of Canyon, Texas, and 15 miles (24 km) southeast of Ama-

rillo (Figure 1). The canyon is 600–800 feet (180–240 m) deep along Palo Duro Creek. Palo Duro Canyon is a deep erosional cut into the eastern escarpment of the Llano Estacado (Staked Plains), a southern subregion of the High Plains. The head of the canyon is Palo Duro Canyon State Park, Texas. Tributary canyons include Timbercreek, Big and Little Sunday, North and South Cita, and Tule Canyons. The Cita Canyon bone bed is located at the head of North Cita Canyon where a narrow elevated upland plain landbridge separates the North Cita Canyon drainage from Palo Duro Canyon proper (Schultz, 2001).

Fossils of prehistoric animals in the Texas Panhandle were first recorded by E.D. Cope in 1892. Since his phytosaur find, many vertebrate fossils, predominantly mammals, have been found along the eastern High Plains escarpment and along the Canadian River north of the canyon. The Cita Canyon bone bed site was discovered by Floyd V. Studer of Amarillo in the 1930s (Schultz, 2001). Numerous other fossil deposits have been found in the Texas Panhandle (Johnston and Savage, 1955).

Stratigraphy and Sedimentary Context

Both fossil sites discussed here are located in the Great Plains of North America. The Great Plains is a vast area of low relief stretching from Texas northwards into Canada. One of the last continental-scale sedimentary units laid down by the Flood in North America is called the Ogallala Formation. As the Floodwaters ran off North America, the sheet flow that created the planar upper surface of the Ogallala Formation became concentrated into channels. Channelized erosion left erosional remnants. After this erosion, fluvial deposition occurred in channels and basins eroded into the Ogallala Formation. The fossil bone beds of both Agate Fossil Beds and Cita Canyon are part of deposits that infill erosional depressions cut into the Ogallala Formation. As such, both bone beds represent deposition sometime *after* the primary Flood runoff at the end of the Deluge.

The fossils at Agate Fossil Beds occur in the Miocene Harrison Formation and the overlying Upper Harrison (also called the Anderson Ranch Formation or the Marsland Formation) (USDI, 1980; Hunt, 1984; Graham, 2009). The name, Agate Fossil Beds, is due to abundant agates that occur at or near the surface immediately atop the Upper Harrison. The Harrison includes fine-grained, cross-bedded, horizontally-layered, and massive sandstones. The Upper Harrison Formation is about 295 ft. (90 m) thick, and includes calcareous volcanic tuff, fine- to very fine-grained sandstone, some calcareous, capped by dense limestone mud. Local pebble conglomerates occur. The Upper Harrison is interpreted as flood plain and channel deposits. The Fossil Hills bone beds occur in lenses along the bottoms of channels cut into the Upper Harrison (Graham, 2009). Since these channels were eroded into the Upper Harrison, the bone beds were deposited sometime later than the primary deposition of the Upper Harrison. Locally, a silica-cemented land surface is found at or near the top of the Upper Harrison. Sands and silts of the Harrison Formation are pyroclastic (Graham, 2009). Microscopic analyses of the sands in the Harrison beds show approximately equal parts of angular quartz crystals, feldspar, and volcanic glass (Hunt, 1984). In some cases, volcanic glass is fused to quartz crystals.

Palo Duro Canyon exposes Paleozoic, Mesozoic, and Cenozoic strata (Figure 2). Three unconformities are conventionally placed between the Quartermaster and Tecovas, the Tecovas and the Trujillo, and the Trujillo and Ogallala Formations. Beds above and below each unconformity are essentially parallel, so each is more accurately a disconformity (Hood and Underwood, 2001). Many uniformitarian geologists believe millions of years are represented by these unconformities. For example, the time represented by the contact between the Trujillo (upper Triassic dated about 210,000,000 years) and the Ogallala (about 5,000,000 years in the North Cita Canyon exposure) is 205,000,000 years.

The interpretation of these bed contacts as representing enormous expanses of missing time is not supported by the observed bed relationships; there is little or no evidence of erosion in the underlying surface at these contacts. It is difficult or impossible to imagine a plausible reason why the underlying surface at each of these contacts would be perfectly level after millions of years of weathering. Each unconformity more likely represents a short period of time since the exposed surface of each underlying bed is essentially horizontal and shows no significant erosion and surface roughening. Several papers comment on the missing time in the Texas Panhandle in particular (Reed, 2002) and the sedimentary record in general (Reed and Oard, 2017; Reed and Oard, 2018).

The Cita Canyon bone bed is found in the Ogallala Formation. The bone bed sediments infill a basin cut into the upper surface of the Ogallala (Johnston and Savage, 1955; Schultz, 2001). In other words, the Cita Canyon bed was not deposited at the same time as the Ogallala, but after it. The Ogallala is a vast complex of fluvial sands, silts, gravels, and caliche that extends from western Nebraska to the Edwards Plateau in Texas (Schultz, 2001), and serves as the principal aquifer of the High Plains. Ogallala sediments are thought by uniformitarian scientists to have been deposited by streams or rivers originating from the eastern Rocky Mountains as a vast alluvial blanket atop the undulating pre-Ogallala surface (Hood and Underwood, 2001). In contrast, some Flood geologists have suggested that the Ogallala was the result of late Flood

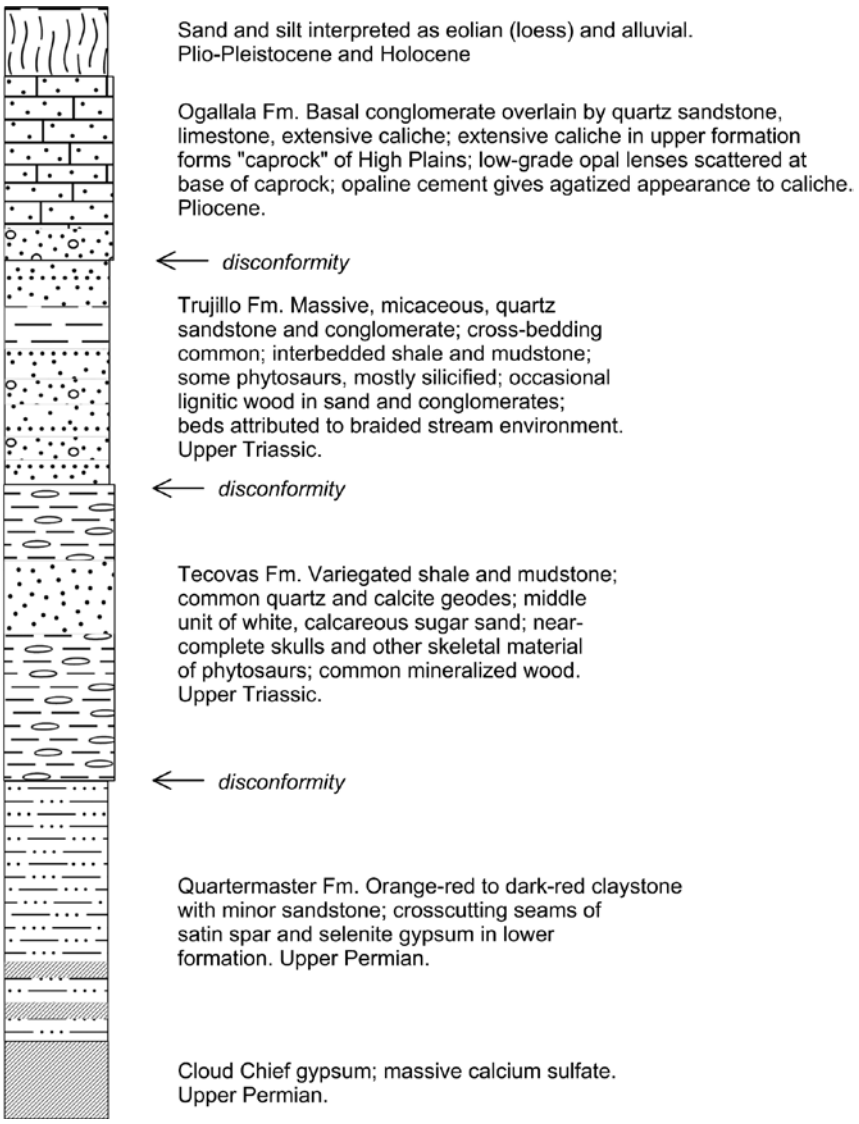

Figure 2. Stylized stratigraphic column showing the major units exposed at Palo Duro Canyon. Not to scale.

sheet flow as the waters were receding off the continents (Clarey, 2018). Channel sands and floodplain clays contain mammalian megafauna fossils at many sites in the Texas Panhandle. In Palo Duro Canyon, the Ogallala is only 20–40 ft. (6–12 m) thick, far thinner than the 400–500 ft. (122–152 m) at the Canadian River. It forms the canyon rim at some locations.

The general stratigraphy at the Cita Canyon fossil site contains both fossiliferous and non-fossil-bearing layers (Figure 3). Fossils are found in friable sandstone, unconsolidated sand, or calcareous sandstone. The total fossil-bearing thickness is about 30 ft. (9 m).

Field Visit to North Cita Canyon

Field exploration in Spring of 2019 located the fossil bone deposits (Figures 4 and 5). The beds were friable and appeared susceptible to erosion by rain events. A harder red shale/siltstone layer underlying the fossil-bearing units is probably the upper surface of the red Trujillo Formation (Triassic). Fossil bone fragments are scattered on this surface (Figures 6 and 7). I infer that these bones originated from the light-colored units in Figure 5, and were either moved by rain events or displaced by fossil collecting.

The North Cita Canyon fossils were deposited in a basin eroded into the Ogallala Formation (Johnston and Savage, 1955; Schultz, 2001). The basin was elongate, about 3–4 miles from east to west and 1.5–2 miles from north to south (Locality Map 1 in Johnston and Savage, 1955; Schultz 2001). It extended from the south edge of Big Sunday Canyon, across the head of Little Sunday Canyon, to the north side of North Cita Canyon (Figure 4). Subsequent headward erosion of North Cita Canyon cut into the basin and exposed the fossil bed. The interpretation of the deposit as fluvial basin fill is supported by the occurrence of ubiquitous rip-up clasts of caliche, probably from the High Plains caprock, and scattered quartzite in the fossil-bearing beds (Johnston and Savage, 1955). Fossil-bearing sediments are apparently alluvial deposits in a basin carved into the pre-existing Ogallala Formation. An interesting side point is that Johnston and Savage (1955) noted the fossil-bearing units have normal magnetic polarity; whereas, overlying units have reversed polarity.

Fossils

Fossils at the Cita Canyon site in Texas occur in friable sandstones or sands, but also in sandy gravel at the base of the fossil-bearing units. Some sandstone is calcareous. The fossil matrix indicates fossil deposition in moving water. The most abundant megafauna fossils at the Cita Canyon site are horse bones, including hundreds of teeth, jaws, and leg bones, representing two types, a large zebra-like horse and a smaller, less-abundant 3-toed horse. Bones from several camel types, ranging from the

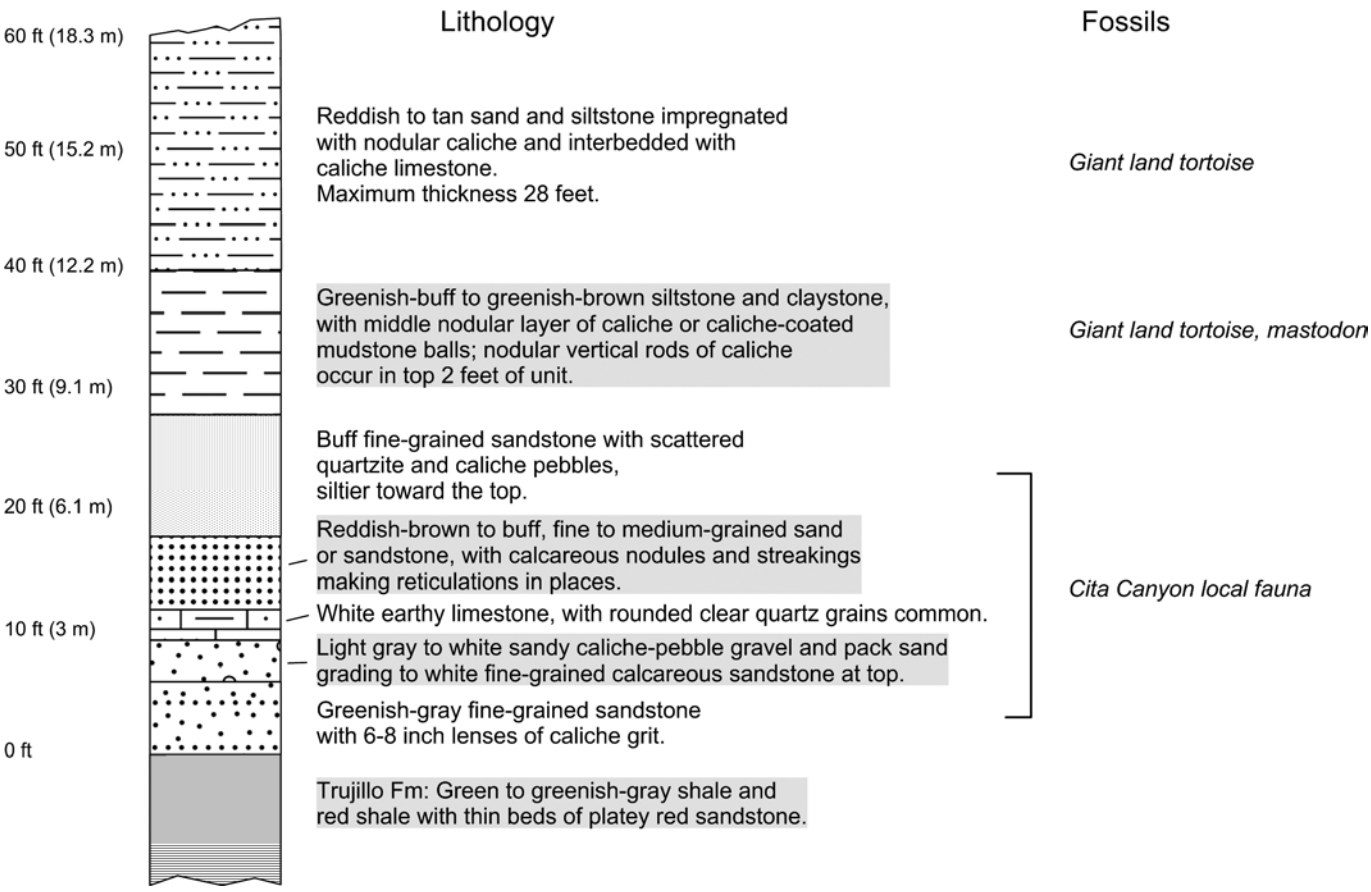

Figure 3. North Cita Canyon strata at bone bed location. Figure redrawn and modified from Figure 3 of Johnston and Savage (1955).

size of a modern dromedary to llama-sized, are also found. Other megafauna include deer, pronghorn, peccary, giant ground sloth, and giant armadillo. Carnivores comprise a small percentage of finds, including saber-toothed cat, puma (or cheetah), coyote, bone-crushing dog, and short-faced bear (Johnston and Savage, 1955; Schultz, 2001). An upper sedimentary unit at the site has yielded mastodon and bison.

Other fossils of interest include sand cat, racoon, rabbit/hare, badger, lynx, giant land tortoise, turkey, and ibis. Tortoises, about 5.0 ft. (1.5 m) long and 3.0 ft. (1.0 m) high, were identified by the recovery of several large shells, a skeleton, and an egg (Schultz, 2001). Mammal megafauna found at other sites in the Texas Panhandle and in similar stratigraphic context includes Columbian mammoth and dire wolf. The mammal types found at the Cita Canyon site are also found at other sites in the Texas Panhandle (Johnston and Savage, 1955).

Most of the bones at the Nebraska site are from three mammals. The most abundant mammalian fossils come from a small rhinoceros called *Menoceras* meaning "crescent horned" (USDI, 1980; Hunt, 1984; Graham, 2009). It stood about 3.0 ft. (1.0 m) tall. Males had two, side-by-side horns on the tip of the snout. Females were hornless. Thousands of bones, representing hundreds of individuals, have been recovered. The next most common fossil is the chalicothere *Moropus*. The chalicothere is a large claw-footed browser thought to be related to horses, rhinos, and tapirs, standing about 8.0 ft. (2.4 m) high at the shoulder. Bones from 50–75 individuals have been found concentrated in one area of the quarry (Hunt, 1984; Graham, 2009). Graham (2009, p. 3) comments: "Remarkably, *Moropus* had toes that were tipped with claws instead of hooves, an anatomical feature difficult to explain in an ungulate." I presume that Graham thought this remarkable and difficult to explain because *Moropus* is considered to be an evolutionary ancestor of the horse.

The third most common mammal bones are from the huge entelodont called "terrible pig" or "hell pig" (Figure 8). These animals ranged from 330 lb. (150 kg) to 2,000 lbs. (900 kg) and were several times the size of modern pigs. The skulls typically measure 3.0 ft. (1.0 m) in length (Hunt, 1984). Two almost complete skeletons of these mammals have been recovered from Agate Fossil Beds.

Other minor mammal fossils at Agate Fossil Beds come from oreodont (sheep-sized, cud-chewing herbivore), saber-toothed cat, carnivorous bear dog, small horse, *Paleocastor* (a land beaver), small camels, 4-horned pronghorn antelope, and deer. Due to its unusual occurrence, an important deposit of the gazelle-like camelid, *Stenomylus*, was found about 1.5 miles (2.4 km) east of the Fossil Hills.

Descriptions of fossil occurrence

Based on the 2019 reconnaissance of the Cita Canyon site discussed above, the Cita Canyon fossil bones were not lithified. All the observed fossils were broken pieces of bone or antler (Figures 6 and 7). I examined a number of the bones. They were light and porous. Many of the fossils that were recovered from the site during fossil excavations in the early- to mid- 1900s were bone fragments and teeth (Johnston and Savage, 1955), although some more complete skeletal parts and skulls were recovered [see Figure 5 in Schultz (2001)]. I am not aware of any complete, articulated skeletons recovered from the Cita Canyon site.

The main bone beds at Agate Fossil Beds are in University and Carnegie Hills, in the upper Harrison formation. The bones are encased and packed in fine-grained sand, sometimes lithified, and calcareous silts and volcanic ash (USDI, 1980; Hunt, 1984; Graham, 2009). The silts are interpreted as loess.

Bone concentration in the principle fossil-bearing strata exceeds 100 bones

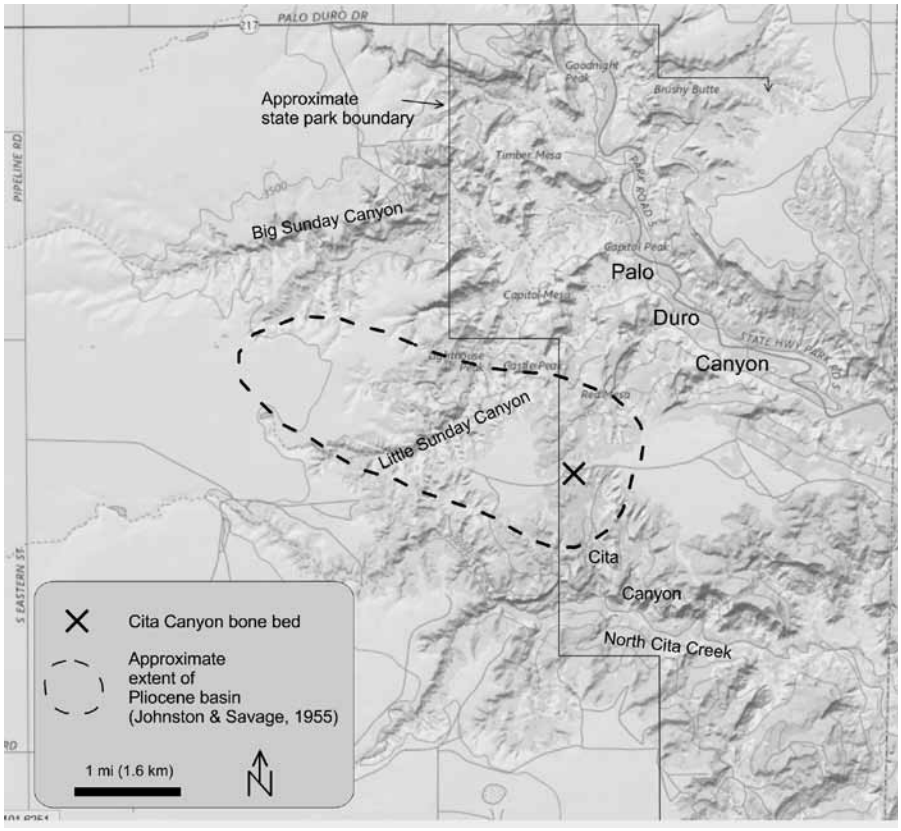

Figure 4. Location of Cita Canyon bone bed in Palo Duro Canyon State Park. Erosion into the outlined basin exposed the bone bed. Base map from: https://viewer.nationalmap.gov/basic/.

Figure 5. View northeast at the Cita Canyon bone bed. Red surface in foreground is Triassic Trujillo Formation. Lighter strata (background) are fossil-bearing Pliocene sediments. Bone shards in Figures 6 and 7 rest on Trujillo red beds but originated from the overlying sediments. Photograph by author.

Figure 6. Bone shard on red Trujillo bed. Note sediment pedestal beneath fossil formed by erosion of red bed. Fossil specimen is about 6 in. (15 cm) long. Photograph by author.

Figure 7. Multiple fossil fragments on Trujillo at base of fossil-bearing sediments. Whitish objects are bone and antler pieces. Fossils came to rest here after either slumping/erosion of fossil-bearing sediments or from previous fossil collecting (circa 1930s). Photograph by author.

per square meter. One sandstone block, about 5.5 ft. by 8 ft. (1.7 m by 2.4 m), containing 22 skulls and an uncounted number of skeletons, is now at the American Museum of Natural History in New York (Graham, 2009). A similar block is on display at the Agate Fossil Beds National Monument Visitor Center (Figure 9).

The principle fossil-bearing strata is a "tangled mat" (USDI, 1980) about 1.5 ft. (0.5 m) thick (USDI, 1980; Hunt, 1984). In some parts of the quarry, the bones are so abundant a man could walk on bones without touching the underlying sediment (Hunt, 1984). Hunt refers to the deposit as a "logjam" of individual bones, and rhino bones are described as being piled "like a gigantic mass of jackstraws" (USDI, 1980). It is noteworthy that the bones are completely jumbled, but are not badly broken or abraded and show little evidence of water erosion (Figure 10). This is remarkable as the deposit is dated conventionally as being about 21,000,000 years old. Almost all of the bones are disarticulated, but rare partial or complete skeletons do occur (Hunt,

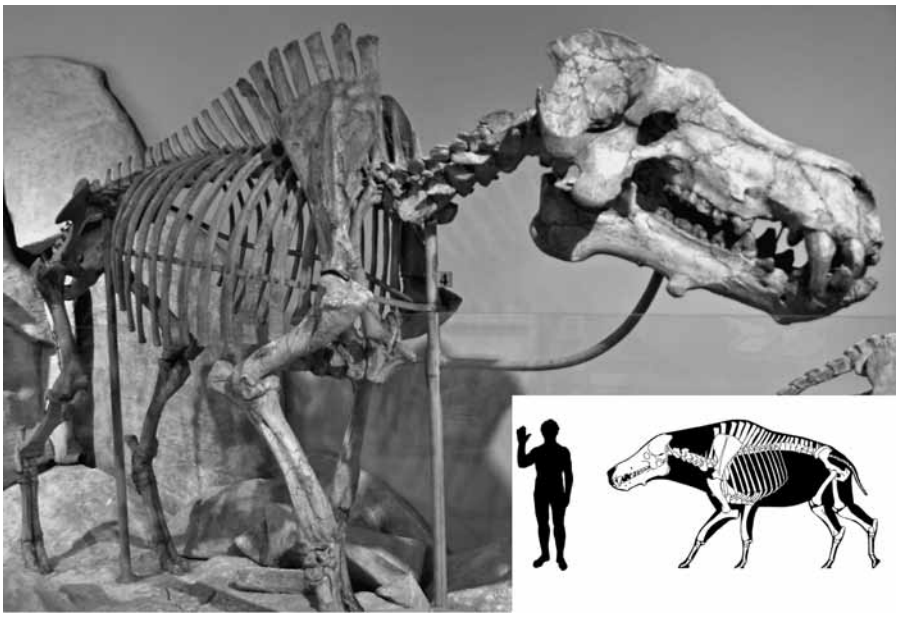

Figure 8. Complete skeleton of 'Terrible' or 'Hell' Pig recovered from Agate Fossil Beds in Nebraska. Skeleton photo by James St. John, https://commons.wikimedia.org/w/index.php?curid=57469214. Inset drawing by Deviant Art user bLAZZE92: https://blazze92.deviantart.com.

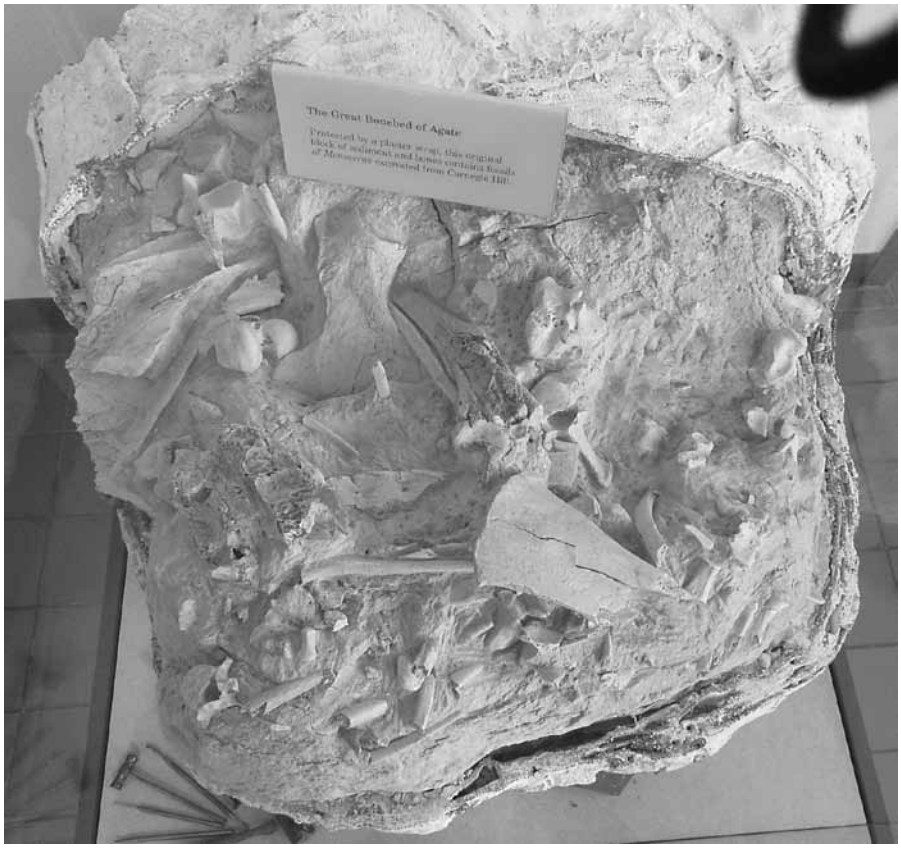

Figure 9. Block of bones, partially protected by a plaster wrap, from Carnegie Hill, Agate Fossil Beds National Monument. The bones are from the small rhinoceros, *Menoceras*. Display at the Agate Fossil Beds Visitor Center. The bones do not appear and are not reported as being lithified, and are easily recognizable as bones. They are dated conventionally as being about 21,000,000 years old.

1984). Whole bones of the three main animal types are common. In contrast, whole bones of other mammals are rare, these rare mammals being represented by isolated teeth, jaw fragments, and occasional bones. The Agate Fossil Bed bones are, apparently, not lithified. The excavation and survey methods of Hunt et al. (2018, p. 34) state that "Fragile bones were hardened with the preservative resin Glyptal." Lithified bones would not require stabilization.

A *Stenomylus* (small gazelle-camel) bone bed was discovered in a hill about 1.5 miles east of Fossil Hills. There is no public access to this site. Significantly, the fossils are dessicated, mummified carcasses of over 100 individuals. Stratigraphically, they are located in the lower Harrison Formation, although it is unclear whether they are in a channel or basin eroded into the Harrison. The gazelle-like camels are frequently found with the heads pulled sharply back in the familiar death pose of many dinosaurs. The carcasses are buried in windblown silt or sand, i.e. loess (USDI, 1980). Graham (2009, p. 3) remarks that "the demise of these animals remains a mystery." It is remarkable that, even though these animals are conventionally dated as at least 21,000,000 years old, they are preserved as mummies at a relatively shallow depth. It is more likely that these *Stenomylus* fossils are a few thousand years old.

There is disagreement in the literature about the "death pose" in which many dinosaurs and these Nebraskan gazelle-camels are found. A number of authors have propounded the idea that this fossil skeletal configuration, called "opisthotonic posture," is due to rigor mortis, desiccation, and/or contraction of tendons and ligaments. A study reported in *Paleobiology* maintains otherwise. Instead, Faux and Padian (2007) conclude that this common fossil posture is due to muscle spasms at death. These death throes are associated with asphyxiation and other causes (Faux and Padian, 2007).

Discussion

Key features of the Cita Canyon site in Texas are:

- Hundreds of mammalian megafauna fossils recovered from the site.
- Fossils found in a basin excavated into the Ogallala Formation.

The Cita Canyon fossil-bearing sediments were deposited in a basin carved into the Ogallala Formation. It is important to distinguish between fossils located in situ in Ogallala beds and fossils located in a basin carved into the Ogallala. If the fossils were deposited at the same time as the Ogallala Formation, and since the Ogallala was probably a late Flood deposit, then the fossils would be Deluge deposits. However, if deposited in a later basin (Schultz, 2001), then the fossils can be interpreted as post-Flood. I prefer the post-Flood interpretation.

Key features of the Agate Fossil Beds in Nebraska are:

- Disarticulated bones of hundreds of individuals, mainly small pig-sized rhinoceroses, occur as a thick, jumbled mass in fluvial channels cut into pyroclastic sandstone.
- Many individuals of the strange chalicothere are found.

Figure 10. Exhibit at Agate Fossil Beds National Monument Visitor Center. The bones in the exhibit are most likely replicas intended to show the original appearance of the bone bed deposits when excavated.

- Two of the best skeletons ever found of the large entelodont known as "terrible pig" were found at the site.
- A deposit of articulated, mummified, gazelle-sized camels was found nearby. These camelids were often found in the typical dinosaur death pose. The camelids were probably buried and suffocated by a catastrophic sand/dust storm.
- Nearby, the phenomenon interpreted as the corkscrew burrow of an extinct land beaver was found.
- The fossil-bearing strata are capped by limestone mud and, locally, by a silica-cemented surface containing agates.

The main bone beds were found in a channel incised in the Ogallala Formation. The Ogallala likely formed late in the Flood (Clarey, 2018). The channel could have formed from late-Flood runoff or sometime after the Flood. The Fossil Hills deposits are associated with volcanic pyroclastic debris, alluvial channel fill, and windblown loess.

Akridge and Froede (2005) interpreted the mammalian megafauna found at Ashfall Fossil Beds State Historical Park, Nebraska (Ashfall Fossil Beds), as post-Flood deposits. These fossil beds are about 300 miles (483 km) east of Agate Fossil Beds, and include articulated remains of rhinoceroses, camels, horses, and deer. The remains are buried in volcanic ash deduced to have originated in the Late Miocene from a volcanic center located in southern Idaho. Agate Fossil Beds could also have been affected by a plume of volcanic material from that same volcanic center since Agate Fossil Beds lies between Idaho and Ashfall Fossil Beds. The Ashfall Fossil Beds are in the Cap Rock member of the Ash Hollow Formation, which is part of the Ogallala Group. The fossil-bearing Harrison and Upper Harrison Formations of the Agate Fossil Beds are also in the upper part of the Ogallala Group.

I interpret the Agate Fossil Beds as post-Flood. The mechanisms of catastrophe resulting in the bone bed deposit included volcanism, flooding, and windstorms. The nearby site of mummified camelids supports this idea. The camelids are buried in loess, not alluvial sediments, and are articulated mummies, unlikely to have formed during a flood. Also, the camelids show no evidence of being altered after burial by later flooding. The camelids are found in the Lower Harrison Formation, and the bones of Fossil Hills are found in the Upper Harrison. If the camelids were deposited after the Flood, then the Agate Fossil Beds were also post-Flood deposits.

Summary

There are similarities between Agate Fossil Beds and Cita Canyon fossil beds. The great majority of fossils found at both sites are dismembered skeletons and broken bones, explained most easily as resulting from transport and deposition by water. For example, at Agate Fossil Beds, the dense concentration of bones (Figures 9 and 10) would probably *not* result from *in place* death, disarticulation, bone mixing, *bone concentration*, and quick burial of hundreds of individuals. Rather, concentration by water of many already-dead carcasses is more likely.

The striking exception to the more common disarticulated state of the fossils at both sites is the *Stenomylus* bone bed near Agate Fossil Beds, in which over 100 mummified carcasses of the small gazelle-like camelid have been found (Graham, 2009). These animals obviously perished at the bone bed location, possibly by asphyxiation from a massive dust/sand storm that buried and smothered them.

Agate Fossil Beds bones are found in lenses at the base of channels cut into

the Upper Harrison, a member of the Ogallala Formation. The Cita Canyon site was a fluvial deposit into a basin eroded into this same region-spanning Ogallala Formation and later exposed by the erosion of Palo Duro Canyon and/or its tributaries. The deposit of mummified gazelle-like camels near the Fossil Hills in Agate Fossil Beds National Monument is an exception to the pattern of fluvial deposition.

Excellent bone preservation and high fossil concentrations at Agate Fossil Beds indicate rapid burial. If the fossil deposits accumulated over a long period of time, scattered bones in various states of weathering and decomposition would be expected. Rapid burial is indisputable at the nearby *Stenomylus* bone bed. The "death throes" posture of the camelids and the burial by windborne sediments indicates death was by suffocation in a sandstorm. Evidence for rapid burial at Cita Canyon was equivocal; however, rapid burial is almost always prerequisite for the preservation of an organic fossil. Without rapid burial, weathering, scavenging, and decomposition quickly break down the structure of the organic material. If a fossil exists in a well-preserved state, then rapid burial likely occurred.

The Laramide orogeny and subsequent deposition of the Ogallala Formation probably happened near the end of the Flood since the Ogallala was one of the last continent-scale sediment sheets in North America. Erosion into that surface would have occurred via flow channelization in the recessive stage of the Deluge, but could also occur at any time after the Flood by smaller-scale deposition and burial events. The bone beds of Agate Fossil Beds are found at the base of channels cut into the Ogallala Formation; hence, these fossils postdate the Ogallala Formation deposition. The Cita Canyon bone bed is in a small basin also eroded into the upper surface of the Ogallala Formation (Schultz, 2001). The fossil beds at North Cita Canyon and Agate Fossil Beds were both probably deposited by post-Flood catastrophes.

References

Akridge, A.J., and C.R. Froede, Jr. 2005. Ashfall Fossil Beds State Park, Nebraska: A post-Flood/Ice Age paleoenvironment. *CRSQ* 42(3): 183–192.

Clarey, T. 2018. Palo Duro Canyon rocks showcase Genesis Flood. *Acts & Facts* 47(7), June 29, https://www.icr.org/article/10713.

Faux, C.M., and K. Padian. 2007. The opisthotonic posture of vertebrate skeletons: Postmortem contraction or death throes? *Paleobiology* 33(2): 201–226.

Graham, J. 2009. *Agate Fossil Beds National Monument Geologic Resources Inventory Report*. Natural Resource Report NPS/NRPC/GRD/NRR—2009/080. National Park Service, U.S. Department of the Interior, Denver, CO.

Hood, C.H., and J.R. Underwood, Jr. 2001. Geology of Palo Duro Canyon, In Guy, T.F. (editor), *The Story of Palo Duro Canyon*, Texas Tech University Press, Lubbock, TX.

Hunt, R. 1984. Extinct carnivores entombed in 20 million year old dens, Agate Fossil Beds National Monument, Nebraska. *The George Wright Forum 4, no. 1*, http://www.jstor.org/stable/43597031.

Hunt, R.M., Jr., R. Skolnick, and J. Kaufman. 2018. The carnivores of Agate Fossil Beds National Monument: Miocene dens and waterhole in the valley of a dryland paleoriver. *Zea E-Books*, 74, https://digitalcommons.unl.edu/zeabook/74.

Johnston, C.S., and D.E. Savage. 1955. A survey of various late Cenozoic vertebrate faunas of the Panhandle of Texas, Part 1: Introduction, description of localities, preliminary faunal lists. *University of California Publication Geological Science*, 31:2.

Reed, J.K. 2002. Time warp 1: The Permian-Triassic boundary in the Texas Panhandle. *CRSQ* 39(2): 116–119.

Reed, J.K., and M.J. Oard. 2017. Not enough rocks: The sedimentary record and Earth's past. *Journal of Creation* 31(2): 84–93.

Reed, J.K., and M.J. Oard. 2018. The meaning of unconformities. *Journal of Creation* 32(1): 92–99.

Schultz, G.E. 2001. The paleontology of Palo Duro Canyon. In Guy, D.F. (editor), *The Story of Palo Duro Canyon*, Texas Tech University Press, Lubbock, TX.

USDI (U.S. Department of Interior, National Park Service). 1980. *Agate Fossil Beds*. U.S. National Park Service Publications and Papers, DigitalCommons@University of Nebraska—Lincoln.