Ashfall Fossil Beds State Park, Nebraska: A Post-Flood/Ice Age Paleoenvironment

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Abstract

Hundreds of skeletons of animals have been found in northeastern Nebraska, in an area known as Ashfall Fossil Beds State Park. The fossils are of various kinds of extinct and extant animals, including rhinoceroses, horses, camels, deer, birds, and turtles. The uniformitarian interpretation of the bone bed suggests that the animals were entombed by ash from a volcano that erupted in the region of Idaho approximately 1000 miles away during the Miocene Epoch.

However, we interpret the bone bed and associated stratigraphy as a post-Flood/Ice Age paleoenvironment that was destroyed by volcanic ash and later covered by fluvially-deposited sediments no more than a few thousand years ago. We believe that the skeletal evidences found at Ashfall Fossil Beds State Park reflect catastrophic conditions that occurred within the time frame of the young-Earth Flood model. (The names of various uniformitarian geological ages are used in this paper for reference, but we do not accept the presumed long ages and evolutionary assumptions.)

Site Location and Early Investigations

Ashfall Fossil Beds State Park (AFB) is located in Antelope County, in northeastern Nebraska. This isolated park is approximately six miles north of U.S. Highway 20 between the towns of Royal and Orchard (Figure 1) and contains a variety of unique animal and plant fossils.

During the summer of 1971, the skull with attached jaw of a juvenile rhinoceros was discovered in the wall of a ravine. Excavation of the skull revealed the entire skeleton of the animal and other complete rhinoceros skeletons were later found (Voorhies, 1992). This was the start of what has become one of the world's best exposures of terrestrial Miocene animals. Additional excavation at the site was conducted in 1977 by the University of Nebraska State Museum. Twelve rhinoceros and three horse skeletons

Figure 1. Location of Ashfall Fossil Beds State Historical Park in northeastern Nebraska.

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Figure 2. The Rhino Barn houses the megafossils that have been excavated and left in situ. Adjacent to the building is a ravine (shown in the lower part of the photograph) carved by headward erosion of a tributary of Verdigre Creek.

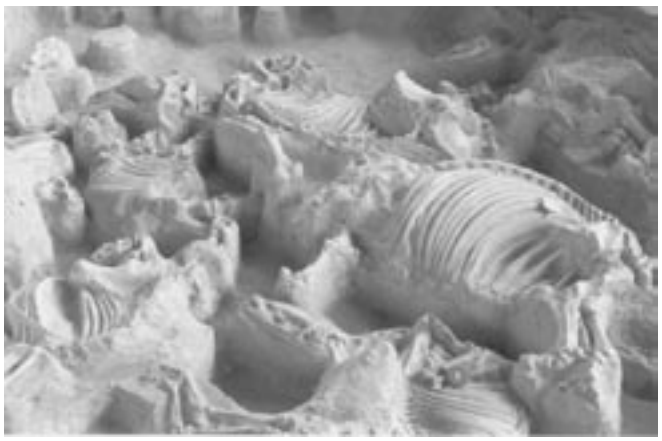

Figure 3. The large skeleton (right center) is a young adult male rhinoceros. Located in the upper center is an adult female rhinoceros.

were collected from an area of only a few square yards (Voorhies, 1978).

With funding from the National Geographic Society, extensive excavations were undertaken in 1978 and 1979. Heavy equipment was used in removing overburden from more than 700 square yards of the ash bed adjacent to the 1977 site. Several varieties of animal fossils, including additional horse and rhinoceros skeletons, as well as deer, camels, birds, and turtles were found (Voorhies, 1992).

In a cooperative effort between the University of Nebraska State Museum and the Nebraska Game and Parks Commission, this site was designated as a state park in 1991. A Visitor Center was constructed that includes a working

Figure 4. A horse skeleton (center left) is surrounded by rhinoceros skeletons.

fossil preparation laboratory and interpretive displays of fossils found at this and other nearby sites in Nebraska. A large building dubbed the "Rhino Barn" was constructed over a portion of the excavated site (Figure 2). Paleontologists working in the facility continually find more skeletons buried in the volcanic ash (Figures 3 and 4).

Geomorphology and Geology of the Area

The AFB site occurs in the Interior Plains Province, within the Great Plains subprovince, which is comprised of a broad plain with generally low relief and gently rolling hills. Ashfall Fossil Beds State Park lies midway between the Sand Hills region of central Nebraska and the glaciated region of eastern Nebraska. The area is dissected by dendritic drainage directed northward toward the South Branch of Verdigre Creek (Voorhies, 1978). Due to the nature of the sediments, some of the valley sidewalls are nearly vertical with considerable relief (e.g., up to 100 ft) that provide access to the stratigraphy of the area without having to rely on well logs and geophysical data.

The local geologic strata consist of a number of sedimentary units reflective of fluvial transport and sorting (Table I). All of the exposed strata are interpreted as Miocene or younger. The lowest unit is the Valentine Formation, largely comprised of clastic materials fluvially transported from the uplifted Rocky Mountains. The Valentine Formation contains two members: 1) Crookston Bridge Member and 2) Devils Gulch Member. Above the Valentine Formation is the Ash Hollow Formation that contains the Cap Rock Member. The volcanic ash layer that created AFB occurs within the Cap Rock Member (Figures 5 and 6). Above the Ash Hollow Formation is the Long Pine Formation. Sedimentary features throughout these stratigraphic units

Figure 5. A diagram of the general order of fossils found in the ash layer within the Cap Rock Member at Ashfall Fossil Beds State Historical Park.

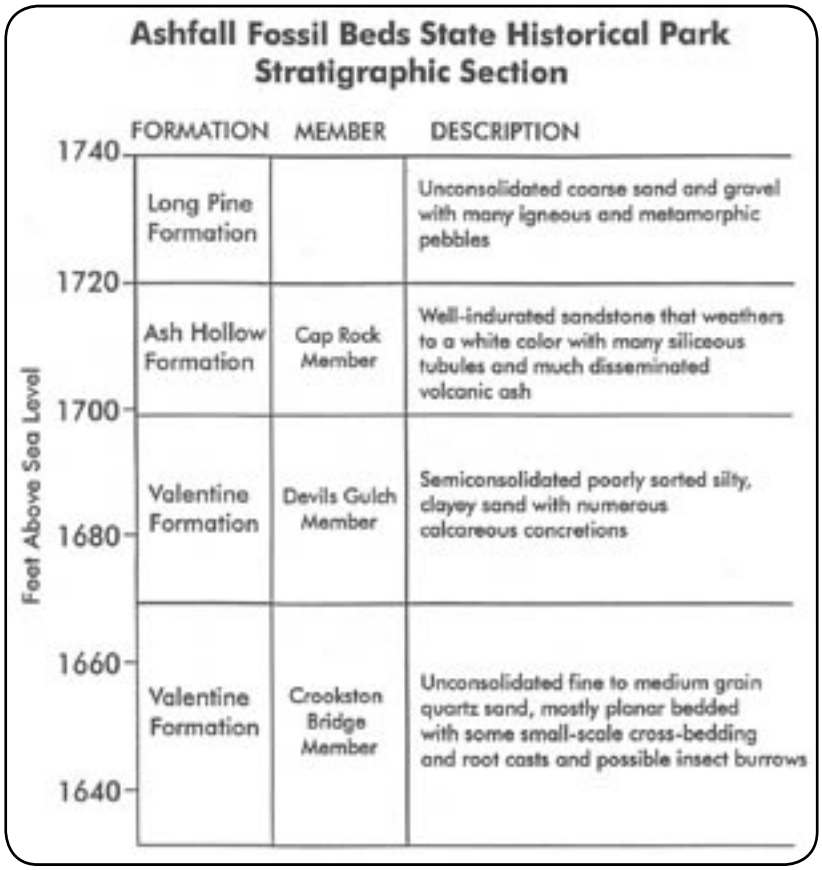

Table I. A stratigraphic section of the site of this study. Adapted from Voorhies, 1978.

suggest water transport from sources west of the site. The fossils identified in these successive layers could be interpreted as being deposited in a wet, low-lying coastal plain setting (lowest) to one of grasslands and prairies (moving up section).

Volcanic ash layers occur in all of the exposed stratigraphic units at the AFB site and are reflective of periodic volcanic eruptions. The four-foot-thick unit that comprises the fossil bone bed at the Ashfall Fossil Bed State Park is perhaps one of the thickest and lithologically consistent layers of volcanically-derived material found to date in the region. The bedding planes of the ash we observed beneath the skeletons on display in the Rhino Barn appeared laterally continuous and displayed minimal disturbance (Figure 7). In places, the layered volcanic ash exhibits ripple-marked bedding suggested by uniformitarian scientists to reflect deposition in relatively quiescent water (Voorhies, 1978). However, the morphology and topography of the site appear to indicate that water transport is a better means of understanding how the ripple marks were formed.

Paleontological Discoveries at Ashfall Fossil Beds

Several hundred animals died at this site, apparently due to the resultant ashfall from a volcanic event that occurred approximately 1000 miles away. Twelve of the seventeen species of vertebrates found in the volcanic ash layer are mammals, while the remaining animals are birds and reptiles (Ashfall Fossil Beds State Historical Park, 2003). Of special interest is the extinct barrel-bodied rhinoceros (*Teleoceras major*). A typical fossil skeleton of one of these creatures has large premaxillary bone, upper incisors, hypsodont teeth, and evidence of their having possessed nasal horns when alive (Voorhies, 1978). With short legs and a girth measuring about the same as their length of nearly 10 feet, these rhinos must have looked much like hippopotamuses.

Five of the eight known genera of late Miocene (Clarendonian) horses were discovered at this site. Three species of camelids have been excavated, including the limbs of a giant camel. The skeletons of several deer that were apparently trampled and disarticulated (*Longirostromeryx*) have also been recovered (Voorhies, 1978). All of these creatures are thought to be grassland

Figure 6. The Cap Rock Member of the Ash Hollow Formation in cross-section. The lowest marker is positioned near the upper level of the ash bed. The Rhino Barn is only a short distance to the right of this scene.

Figure 7. Inside the Rhino Barn are fossil bones of large mammals remaining in situ on pedestals after being excavated from the volcanic ash that buried them. Uniform horizontal layering of the ash can be seen in the sides of the ash pedestals.

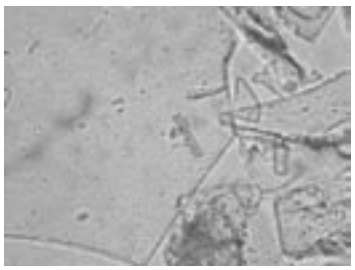

Figure 8. A photomicrograph of volcanic ash from Ashfall Fossil Beds that also includes a diatom, the rectangular, pencil-shaped feature in the center. The sharp edges of the ash particles would be damaging to fragile lung tissue when inhaled. Magnification = 600x. Photomicrograph by Mr. John Kilbourn.

grazers. Three species of birds have also been found: the crowned crane, secretary bird, and rail. Additionally, two species of turtles have also been recovered in the fossil menagerie: pond turtles and the giant tortoise (Ashfall Fossil Beds State Historical Park, 2003). Two carnivores (canids) have been documented at the site by skeletal remains: the raccoon-dog (*Cynarctus*) and the fox-sized dog (*Leptocyon*). Although actual fossils of larger carnivores have not been discovered, uniformitarian scientists speculate that these animals were present in this paleoenvironment because of large coprolites that were found and bite impressions that were visible on a few horse bones (Voorhies, 1978).

Characteristics of Fossils Found at the Site

The excellent condition and extraordinary preservation of many of the fossilized remains of animals at this site have generated widespread interest among geoscientists and paleontologists. Most of the large mammalian specimens are fully articulated and three-dimensional in their burial expression. This is in sharp contrast to fossil graveyards such as Agate Springs, Nebraska, and the La Brea Tarpits (Weston, 2002a; 2002b; 2003), where typically, the bones of the many different animals are usually broken, jumbled, and deposited together in considerable disarray.

The excellent preservation at the Ashfall Fossil Bed site is due to rapid and complete burial of the specimens. Shortly after their deaths, the creatures were buried in a fine-grained volcanic ash and were not subjected to the usual decay and disintegration processes. Although many of the specimens are preserved in exceptional detail, their bones reflect minimal permineralization. Bones still exhibit voids that were not yet permeated and filled (Voorhies, 1978).

Evidences Found at the Site Indicate Water was Present in the Paleoenvironment

The varieties of florae and faunae excavated at Ashfall Fossil Beds suggest a fluvial/lacustrine setting. The best evidence to support this interpretation comes from the skeletal remains of herons, turtle shells, and freshwater diatoms, as reported by Voorhies (1981) (Figure 8).

Scientists studying the site have proposed that the rhinoceros (*T. major*) probably spent much of its life in the water. Mead (2000) compares *T. major* to being ecologically similar to the extant *Hippopotamus amphibius* of Africa. In analyzing fossil *T. major* teeth excavated at AFB for oxygen isotope compositions, Clementz determined that the data indicate the rhinos were probably semi-aquatic (Stephens,

Figure 9. A fossil pelvis of an adult female rhinoceros containing bones of an unborn calf. The descriptive information indicates "…Marie's disease, the respiratory condition, that caused the death of the mother and all other mammals found in the ash bed."

2000). If these proposals are accurate, *T. major* may have gone into pools of water like many large extant grazers still do to escape the heat of the day, parasites, and bothersome insects, or simply to relieve their legs and feet from their massive body weight.

No fish fossils have been found in the volcanic ash. However, fish and other fossils do occur in a silty, clayey sand layer below the sandstone strata on which the ash bed is deposited (Voorhies, n.d.). Small silicified plant fossils were noticed during cleaning of the *T. major* skulls. Because these seed fossils were thought to be the possible remnants of the rhinos' food, huge volumes of ash were examined to determine whether the plant material was ingested by the

Figure 10. A fossil bone excavated from the ash bed for visitors to examine. According to the sign, the "rough, light-colored bone is symptomatic of lung disease that killed the animals."

living rhinos or had later become introduced to the ash. The researchers determined that the plant seed fossils were from inside the skeletons, leading them to conclude that this was probably associated with food eaten by the rhinos shortly before they died (Voorhies, 1978).

An authority on fossil grasses, Joseph R. Thomasson, identified the plant seed remains as three extinct species: *Berriochloa communis*, *B. nova*, and *B. primaeva*. The fossil seeds, or floral bracts, are exquisitely well preserved with cellular structures easily observed using scanning electron microscopy. This information was viewed as conclusive evidence that *T. major* was a grassland grazer (Voorhies, 1978). The presence of grass is an indicator of year-round availability of moisture because grasses do not proliferate in a dry or cyclic, wet-dry environment (Howe, G.A., 2003, personal communication). Grazing rhinoceros herds would have required widespread supplies of grass for their existence.

A Uniformitarian Interpretation of the Ashfall Event

The animals at AFB were overcome by a disastrous volcanic ash cloud. Researchers at the site concluded that a respiratory disease initiated by the ash was ultimately responsible for the deaths of the animals. On some of the museum specimens and accompanying descriptive notes are found these comments:

- On a specimen of an adult female rhino pelvis:
  Bones of the unborn [rhinos] do not show symptoms of Marie's Disease, the respiratory condition that caused the death of the mother and all other mammals found in the ash bed (Figure 9) [Brackets added].
- On an individual bone:
  Rough, light-colored bone is symptomatic of lung disease that killed the animals (Figure 10).
- On the skull of a rhino:
  It shows clear evidence of the excess bone growth caused by suffocation over a period of weeks (hypertrophic pulmonary osteodystrophy) (Figure 11).

Voorhies (1992), principle investigator of the site, stated that:

> Every fossil mammal so far discovered at the site has abnormal patches of highly porous superficial bone on various parts of its skeleton, especially on the lower jaw and the shafts of the major limb bones and ribs. Veterinarians have reported very similar growths on animals that have died of lung failure.

Other Speculations on Causes Leading to the Deaths of Animals at the Site

While we do not doubt that the bone disease was apparently present in many of the animals, we question whether this disease was a significant factor, much less a primary factor in their death. Hypertrophic osteodystrophy probably had little to no effect on the death of the animals and could have developed in their bodies for months before the ashfall. (Hypertrophic osteodystrophy is a more accepted term in veterinary science for this disease previously called by several names, including Marie's disease and hypertrophic pulmonary osteodystrophy. Marie's disease, or more properly called Marie-Bamberger syndrome, is the name given to the human form of this disease which varies in symptomatology from that of animals.) Other factors, such as hunger due to diminishing food supplies, fright, rapid change of the animals' ecological stability, as well as breathing ash into their lungs, would have produced further stress and likely contributed to the death of the animals. All of the animals would have been exposed at varying levels to the volcanic ash. Apparently, additional ash clouds followed from subsequent short-spaced eruptive volcanic events. Once the initial ash cloud settled on the land surface, the animals would have continued to breathe ash particles.

Figure 11. A skull of a young female rhinoceros removed from the ash bed. This specimen is said to show "…clear evidence of excess bone growth caused by suffocation over a period of weeks (hypertrophic pulmonary osteodystrophy)."

If the rhinos routinely went into water, they would have had much greater protection from the ash than all the other grazers. Perhaps that is why so many are found in the ash-filled basin at AFB. If the rhinos were migrating to find available exposed grasses on the ash-covered terrain, the pool of water at AFB would have provided a welcome respite to them. They could have used the water to help clear their eyes, throats, and noses of the ash.

How Long Did the Animals Possibly Survive after the Deadly Ashfall?

Voorhies (1978) proposed that the rhinos died "…over a very short period of time-surely less than a month..." Later, Voorhies (1992) also suggested that "the larger animals died more slowly, over a period of a few days to a few weeks." The reference, Ashfall Fossil Beds State Historical Park-The Ashfall Story (2003), states that the smaller animals died first (due to smaller lung capacities) and perhaps within three to five weeks the last of the rhinos perished. On our visits to the site, park guides related that the horses, camels, and deer probably died within 1–2 weeks while the rhinos expired within about a month. These various sources offer similar assessments of the time between the ashfall and the actual deaths of the animals, all of which is based on the order of burial in the basin. According to each interpretation, death came rather quickly to all kinds of animals now found as fossils at AFB. We agree that the animals at AFB would have died over a short time period resulting from exposure to vast volumes of volcanic ash in their environment. Perhaps even a shorter time frame for each of the animals' deaths will be determined through information gained from ongoing studies.

An Interpretation Within the Creation/Flood Framework

Our interpretation of the site begins with the uplift and erosion of the Rocky Mountains during the Flood. We believe that the mountains rose in elevation as the lithosphere was affected by powerful diastrophic and isostatic forces while the cataclysmic Flood impacted the planet.

Runoff of millions of cubic miles of energetic water at the end of the Flood would have caused major erosion and modification of newly emerging and uplifting land surfaces and mountains (Akridge, 1998; 2000; Whitcomb and Morris, 1961; Williams, 2002; 2003; Williams and Howe, 1996; Williams et al., 1997). As the mountains rose to the west of present-day Nebraska, erosional processes would have supplied vast volumes of sedimentary material that were transported eastward across the area at first by sheet erosion and then followed by fluvial processes. Water transport of sediments was greatly enhanced by gravitational assistance as the land surface decreased in elevation on its easterly course from the Rockies. From water sources beginning

as far away as the Rockies, a decrease of about two miles of elevation is experienced on the way to AFB. From as close as the western boundary of Nebraska, the elevation declines at a nearly linear rate to a loss of approximately 3000 feet at AFB.

Uniformitarian geoscientists acknowledge an acceleration of stream erosion in the later Tertiary with subsequent transport of silt, sand, larger gravels and cobbles eastward across Nebraska (Carlson, 1993). This is indicative of much greater volumes of energetic water involved in what we propose to be the lower Ice Age Timeframe (Froede, 1995; 1998). While we adopt much of the present geologic interpretation, we do not accept the assumptions of uniformitarian chronology.

The Valentine Formation contains fossils of alligators, salamanders, and fish among many other kinds of animal and plant fossils (Voorhies, n.d.; 1971). The presence of these kinds of animals suggests that water and warm weather were prevalent for the propagation of great numbers of complex aquatic and water-dependent life-forms. One can surmise that abundant rainfall supplied sufficient quantities of water for the maintenance of streams and bodies of water necessary to provide habitat for these animals. The upper portion of the Valentine Formation contains sediments that indicate a less wet climate (Voorhies, n.d.).

For many years following the Flood, water continued to shape the surface of the planet. Copious amounts of rain that fell during warmer times after the Flood would eventually turn into frozen precipitation as the Earth's climate cooled, forming continental ice sheets (Oard, 1990) that extended into the northeastern part of Nebraska and along its northern border (Trimble, 1990). Between the end of the Flood and the ensuing Ice Age, environmental conditions must have become sufficiently stable (albeit wetter than at present) in northeastern Nebraska to allow population of the land with abundant animals and plants. During this time, lush grasslands and perhaps even forested areas would have developed and supplied food for a variety of animals. Just above the Valentine Formation are the fossils of AFB contained in the Cap Rock Member of the Ash Hollow Formation. In contrast to the fossils in the Valentine Formation, the fossils at AFB indicate that the climate was drying and likely frost-free (Voorhies, n.d.).

A Drying Climate Brought Apparent Changes to the Paleoenvironment of the Site

From the fossil florae and faunae found laterally in the Ash Hollow Formation, the paleoenvironment appears to have been one of broad areas of grassland punctuated with occasional trees, lakes and undergrowth. The climate would have been moderate and supportive of herds of grazers that inhabited the grassed savannas. It was during this period that the climate remained moderate in temperature but precipitation generally decreased. In this post-Flood/Ice Age period, much of the Floodwater contained in the formerly saturated ground was flushed from the surficial aquifers.

Fluvial channels would have formed immediately following the Flood when overland flow of surficial water was initiated. This resulted in the formation of creeks and streams that likely contained pools or deep depressions along the course of their channels as demonstrated in modern streams. These pools and depressions likely served as water sources for the grazing animals. This is how we envision the AFB area, with a pool that was supplied by an ephemeral stream. Perhaps only rarely did the stream become completely dry. The ripple-marked bedding planes found in the ash indicate that there was water movement. Because the ash is relatively unmixed and laminated, we propose that this was likely a fluvial setting.

As many extant animals still do, herds during this time in the post-Flood environment would have lived and remained near food and water sources. In a drying climate, a dependable water source would have become a place for animals to congregate. Migrating herds would have stopped at pools of water to supply their needs. The fossilized pond turtles, frogs, cranes, rails and diatoms at the site, along with the presence of large numbers of *T. major* rhinos and numerous other mammals, indicate the availability of a viable water source.

The Beginning of the End

From a supervolcanic explosion, estimated to be at least a hundred times greater than that of Mt. St. Helens (Voorhies, 1981), a huge cloud of volcanic ash drifted eastward and covered much of northern Nebraska. Across this large area, the ash has been found to vary in thickness from a few inches to about 12 feet (Voorhies, 1978). Studies at the AFB site have chemically traced the ash to a now-extinct volcanic caldera located in southwestern Idaho. The caldera is called the Bruneau-Jarbridge Eruptive Center and is about 1000 miles west of AFB (Ashfall Fossil Beds State Historical Park, 2003; USGS, 2003).

What May Have Happened at Ashfall Fossil Beds: Evidence from the Ash Layer

The vertical succession of fossil skeletons within the volcanic ash layer suggests a progression of death and burial from

the smallest and most delicate life-forms to those considered more robust and able to survive for some time following the loss of food and water sources.

Turtles and birds are found at the bottom of the ash layer along with many footprints of hoofed animals and rhinos. The smashed and disarticulated remains of some of the smaller animals indicate that some of the larger animals lived longer and apparently trampled the animals that died first. At the middle of the fossil graveyard are found camels and horses followed by rhinos at the highest level of burial (Voorhies, 1992).

We envision that just before the ash arrived at AFB, a variety of animals were in the immediate area of the pool of water. Many of the animals would have experienced sudden disabling effects as the dense ash cloud rolled into the area. The thick, airborne ash cloud would have seriously impaired normal breathing and choked many of the animals. Birds would have been immediately grounded once the ash cloud arrived. Some close to the water source would have sought its safety until their respiratory systems were overcome by the ash particles. Birds would have died quickly, perhaps within hours, because of their unique pulmonary anatomy that is overly sensitive to airborne solid and gaseous pollutants.

In a surreal scene of darkening skies and ash rapidly covering their grassed savannas, the horses, camels, deer, and rhinos would have sought a water source. The falling ash would have covered much of the grazers' food supply, possibly leaving only the random tops of larger grasses visible. It would be certain that animals grazing on sparse vegetation in newly deposited, fine-grained ash would inhale much of it into their respiratory systems. The loss of an adequate food supply coupled with the inhalation of the ash particles as they grazed would soon weaken the animals.

If the rhinos were semi-aquatic as Clementz's oxygen isotopic analysis suggests (Stephens, 2000) and Mead's (2000) assessment of their probable ecology indicates, they could have temporarily survived on vegetation that may have surrounded the pool. By their sheer size, formidable horns, sharp tusks, and probable aggressiveness, rhinos could have kept the much smaller horses, camels, and deer from getting to the vegetation around the edges of the pool. Because of their weakened condition, many of the lesser animals died and were buried by ash, forming the mid-layer of fossil bones found in the ash layer today.

It is also possible that the smaller and mid-sized animals reached the pool in staggered time frames before the rhinos arrived. Later entrants reaching the pool would have trampled already dead and dying animals, disarticulating the remains. After a short time, most had all succumbed before the rhinos arrived. The rhinos could have been last to reach the pool, its temporary safety offering only a slightly longer reprieve from death. The rhinos would have caused further disarticulation of the dead as they entered the ash-laden pool. Living a short time longer than the others would have placed them slightly higher in the ash covering.

Scientists have speculated that predators may have arrived at the scene in time to scavenge any exposed animal remains. The ash would not have been as great a respiratory problem to the carnivores as it was to the grazers. However, most of the excavated larger animals show minimal or no evidence that suggests scavenging occurred. The trampling of the bones by the hoofed animals and rhinos before they died would probably have caused most of the disarticulation noted in some of the smaller animals found in the middle layer of the ash deposit. Airfall and windblown ash continued to fill the depression containing the pool of water until it covered the dead and dying rhinos and other victims to a depth of up to about ten feet.

Proposed Evidence for a Post-Flood Setting at Ashfall Fossil Beds

Uniformitarian geoscientists date the AFB as Miocene based "…on precise measurements of radioactive isotopes in volcanic ash layers that occur in the fossil-bearing rocks…" (Voorhies, n.d.). (See Woodmorappe, 1999, for problems associated with radiometric dating.) However, we observed many evidences that point to a recent occurrence within the post-Flood history of the Earth. After the Floodwater subsided and animals populated this area of AFB, the Earth continued to undergo internal and external changes brought about by disequilibrium from the effects of the Flood. The Rocky Mountains had already risen in this post-Flood environment, channeling water and eroded sediments eastward toward AFB.

Because of moderate weather, available water, and a plentiful supply of food, the plains were fruitful with fecund herds of grazers and other kinds of animals. Volcanic activity and even an occasional supervolcanic event would have caused disruption to these environments.

Such a volcanic event buried this part of Nebraska under a heavy covering of volcanic ash, ultimately entombing many of the animals at AFB. The mostly-articulated and three-dimensional preservation of these macrofossils indicates rapid burial resulting from catastrophic conditions. After being covered, the animals were left relatively undisturbed in unconsolidated ash while further sedimentation covered the site to at least 40-50 feet in depth (Voorhies, 1978). The additional overburden of sediment covering this region offers what we view as further evidence of continued fluvial activity in this post-ashfall environment.

Post-Flood/Ice Age Deposits

The Cap Rock Member containing AFB is composed mostly of post-Flood, water-transported sediments. The Cap Rock is a rather heterogeneous body that varies laterally with abrupt changes in lithological expression. Although sandstone prevails in the Cap Rock, lenses of volcanic ash, siltstone, claystone, diatomite, and conglomerate are found that are all derived from local sources (Voorhies, 1978). This lithology is what would be predicted in a post-Flood/Ice Age setting with fluvially transported sedimentary materials, including eolian ash from volcanic sources. Many of the sediments remain unlithified. If the strata had been deposited in the Flood, we would expect deeper burial, less heterogeneity and more advanced lithification.

The minimal permineralization and fragility of the fossil bones indicate probable recency of deposition within a post-Flood setting. Minerals dissolved from volcanic ash into groundwater provide an excellent agent for permineralization and the petrifaction of organic material (Williams, 1993; Williams and Howe, 1993). However, the shallowness of burial of these fossil bones and the drying climate of this area since the Flood have impeded the permineralization of the bones. Ravines were carved into the area around AFB by headward erosion of tributaries from Verdigre Creek. One of these ravines is immediately adjacent to the fossil site (Figure 2). It is probable that rainwater was quickly diverted into the ravine from the surface of the ground above the bones before the site was excavated. This allowed minimal time for mineral dissolution and transport to accomplish permineralization of the bones. The fine volcanic ash layer may have also prevented much water from penetrating into the bone layers, further hampering the permineralization process.

Another consideration for the recent formation of AFB is the actual open voids remaining in the fossil bones that are yet unfilled by permineralizing agents (Voorhies, 1978). If up to 10 million years had elapsed since burial, more than adequate time should have been available for the complete infilling and replacement of the bones by diagenetic processes. However, the voids in the bones seem to indicate a much shorter period of elapsed time after burial.

Conclusion

Ashfall Fossil Beds State Park is a unique place to examine a wide variety of some of the best-preserved, three-dimensional and fully-articulated post-Flood/Ice Age fossilized animal skeletons. The initial burial of the animals in a fine-grained, unconsolidated volcanic ash provides an excellent working medium for excavation and restoration of the fossils for study and scientific evaluation.

While uniformitarian scientists have assigned the site an age of about 10 million years and associated it with the Miocene Epoch, physical evidences found at Ashfall Fossil Beds favor an origin in the recent, post-Flood/Ice Age time frame. Some of these evidences are: the 1) shallow burial of the fossils, 2) incomplete permineralization of the bones, 3) lithology of the site, 4) cross-sectional profile of the underlying strata of Nebraska, and 5) evidence of major volcanic activity associated with post-Flood disequilibrium of the Earth's lithosphere. We hope that with increased understanding of sites such as this one, that the post-Flood/Ice Age world will also be better understood.

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References

CRSQ: Creation Research Society Quarterly

Akridge, A.J. 1998. A Flood-based origin of Little River Canyon near Ft. Payne, Alabama. In Walsh, R.E. (editor), *Proceedings of the Fourth International Conference on Creationism* (technical symposium sessions), pp. 9–20. Creation Science Fellowship, Pittsburgh, PA.

———. 2000. DeSoto Falls in DeSoto State Park, Alabama: Evidence for recent formation? *CRSQ* 36:170–176.

Ashfall Fossil Beds State Historical Park—Ashfall Animals; The Ashfall Story, 2003. http://ashfall.unl.edu/paleofinds.html.

Carlson, M.P. 1993. *Geology, Geologic Time and Nebraska*. Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska—Lincoln.

Froede, C.R. Jr. 1995. A proposal for a creationist geological timescale. *CRSQ* 32:90–94.

———. 1998. Defining geological time using the stratigraphic record. In Froede, C.R. (editor), *Field Studies in Catastrophic Geology*, pp. 1–5, Creation Research Society Books. St. Joseph, MO.

Mead, A.J. 2000. Sexual dimorphism and paleoecology in *Teleoceras*, a North American Miocene rhinoceros. *Paleobiology* 26:689–706.

Oard, M.J. 1990. *An Ice Age Caused by the Genesis Flood*. Institute for Creation Research. El Cajon, CA.

Stephens, T. 2000. Fossil teeth of North American rhinos reveal an aquatic lifestyle similar to modern hippos. *UCSC Press Release: Fossil Teeth of Extinct Rhinos*. University of California, Santa Cruz. http://www.ucsc.edu/news_events/press_releases/archive/00-01/11-00/teleoceros.html.

Trimble, D.E. 1990. *The Geologic Story of the Great Plains*. Theodore Roosevelt Nature and History Association. Medora, ND.

USGS. 2003. America's Volcanic Past—Nebraska. http://vulcan.wr.usgs.gov/LivingWith/VolcanicPast/Places/volcanic_past_nebraska.html.

Voorhies, M.R. 1971. Paleoclimatic significance of crocodilian remains from the Ogallala Group (Upper Tertiary) in northeastern Nebraska. *Journal of Paleontology* 45:119–121.

———. 1978. A Miocene rhinoceros herd buried in volcanic ash. *National Geographic Society Research Reports—1978 Projects*, pp. 671–688.

———. 1981. Ancient ashfall creates a Pompeii of prehistoric animals. *National Geographic*. 159:66–75.

———. 1992. Ashfall: life and death at a Nebraska waterhole ten million years ago. In Ratcliffe, B.C. (editor), *Museum Notes* Number 81. University of Nebraska State Museum, Lincoln, NE.

———. n.d. Nebraska wildlife ten million years ago. Reprinted from *NEBRASKAland Magazine*. Lincoln, NE. No other data available. Unpaginated.

Weston, W. 2002a. La Brea Tar Pits: An introductory history (1769–1969). *CRSQ* 38:174–180.

———. 2002b. La Brea Tar Pits: A critique of animal entrapment theories. *CRSQ* 39:160–167.

———. 2003. La Brea Tar Pits: Evidence of a catastrophic flood. *CRSQ* 40:25–33.

Whitcomb, J.C. and H.M. Morris. 1961. *The Genesis Flood*. Baker Book House. Grand Rapids, MI.

Williams, E.L. 1993. Fossil wood from Big Bend National Park, Brewster County, Texas: Part II - mechanism of silicification of wood and other pertinent factors. *CRSQ* 30:106–111.

———. 2002. Natural Bridge, Virginia: Origin speculations. *CRSQ* 39:101–105.

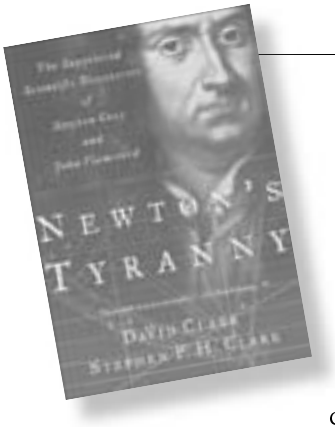
———. 2003. Natural Tunnel, Virginia: Origin speculations. *CRSQ* 39:220–224.

Williams, E.L. and G.F. Howe. 1993. Fossil wood of Big Bend National Park, Brewster County, Texas: Part I - geologic setting. *CRSQ* 30:47–54.

———. 1996. The formation of Santa Elena Canyon, Big Bend National Park: Origin speculations. *CRSQ* 33:89–101.

Williams, E.L., R.L. Goette, and J.R. Meyer. 1997. Kanab Canyon, Utah and Arizona: Origin speculations. *CRSQ* 34:162–172.

Woodmorappe, J. 1999. *The Mythology of Modern Dating Methods*. Institute for Creation Research. El Cajon, CA.



Book Review

Newton's Tyranny by David Clark and Stephen Clark

W.H. Freeman and Company, New York, 2001. 188 pages, $14.00.

Many creationists hold a high view of Isaac Newton. This scientific genius readily accepted the authority of scriptures and readily acknowledged his Creator. Newton clearly demonstrates that science and biblical truth are entirely compatible. Now comes a book which by its very title is an attack on Isaac Newton's character. Scarcely a single mention is made of Newton's science contributions without an accompanying negative dig. Isaac Newton is described as cantankerous and scheming (p. 27) with uncontrolled ambition and flagrant paranoia (p. 26). He is also an astrologer, occultist, alchemist, and tyrannical dictator (p. 142).

It is well known that Isaac Newton had major conflicts with Robert Hooke and Gottfried Leibniz concerning credit for science and mathematical insights. Newton also had Arian and non-trinitarian theological tendencies. Still, does

he deserve the nonstop criticism expressed in this book? Why is there no mention of Newton's generosity whereby he financially helped relatives and friends in need? Why is Newton's faith glossed over as religious extremism (p. 62)?

A further example of the author's low view of Newton involves the famous statement concerning discovery, "If I had been able to see farther, it was only because I stood on the shoulders of giants." The traditional (and correct) view is that Newton was honoring science pioneers including Descartes, Kepler, and also Galileo who died the year Newton was born. The book, however, suggests that Newton was making a sarcastic remark about science competitors who were below him in their intellectual and physical stature. This malicious *revision* of history is without basis.

The author's rally around John Flamsteed and Stephen Gray, two men who tangled with Newton. Flamsteed gathered astronomy data which he refused to share with Newton. Newton later "stole" the data to work out his gravity theory (p. 13). As "Astronomer Royal" employed by England, Flamsteed's measurements were not his private property, the viewpoint of Newton. However, there was great potential value in this data which might help solve the ongoing problem of finding one's longitude at sea. The data was valuable and one can see Flamsteed's rationale in keeping it confidential. Gray is a fascinating, unknown, amateur scientist in the spirit of Michael Faraday. Gray apparently worked out the rules for electrostatics and electrical conduction fifty years before they became widely known.

This book rightly documents the achievements of John Flamsteed and Stephen Gray while presenting a very biased, negative portrait of Isaac Newton. The authors claim that there has been a 250 year conspiracy to eulogize a basically evil man (p. 141). Certainly every scientist, past and present, has flaws but Isaac Newton deserves much better treatment than given by father and son authors Clark. They have collected a few facts and a lot of negative speculation.

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Book Review

Issues in Creation Number 1: A Creationist Review and Preliminary Analysis of the History, Geology, Climate, and Biology of the Galápagos Islands by Todd Charles Wood

Wipf and Stock Publishers, Eugene, Oregon, 2005, 241 pages. $32.00.

This book is the first of an anticipated series of monographs inspired and supported by the Center for Origins Research (CORE) at Bryan College in Dayton, Tennessee. In this volume Wood opens a new vista upon a landscape of creationist understanding of Galápagos data, material which evolutionists often offer as incontrovertible evidence for evolution. Now we have available a creationist perspective which constitutes a comprehensive coverage, even though somewhat preliminary, for a variety of significantly important Galápagos organisms and environs.

The contents cover the history of the 121 volcanic islands straddling the equator 600 miles west of Ecuador. In 1535 Europeans accidentally discovered this archipelago. Topics following the history include Darwin and the Galapagos, geology and climate, biology including biogeography, and an appendix on multidimensional scaling in baraminology. The word *baraminology* is explained in the biology chapter. There is an impressive 32 pages of references, and 5-page index. The book contains 45 figures and 6 tables.

The major portion of the monograph is concerned with the baraminological status of the giant tortoises, iguanids weevils, finches, pelecaniforms, penguins, hawks, and composites. Wood found little evidence of selection, but some forms showed evidence of pre-adaption. He believes that the Galapágos is an ideal location for testing creationist concepts rather than evolution. He states that "the biology and geology of the islands are consistent with a young-earth creationist model of earth and life history." (Abstract)

CORE Issues, which is peer reviewed, was created for publishing monographs in a variety of fields including philosophy, theology, physics, geology, biology, archaeology, and linguistics. Scholars interested in writing future monographs are encouraged to contact the *CORE Issues* Editor, Kurt Wise, at Bryan College.

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