Are the Ashfall Site Sediments and Fossils Post-Flood?

Michael J. Oard*

Abstract

The fossils and sediments from Ashfall Fossil Beds State Historical Park are analyzed to determine whether the depositional environment was Flood or post-Flood. Several indications of a post-Flood environment are presented, but other criteria suggest the fossil beds were laid down by the Flood, and evidence for a post-Flood environment can be explained within a Flood model. Like dinosaur tracks, eggs, nests, and bonebeds, this site can be explained as a landscape briefly exposed during the Flood by local or regional fall in "sea level." The existence of mammal tracks places the time as early Flood.

Figure 1. A rhinoceros fossil graveyard within the Rhino Barn at Ashfall Fossil Beds State Historical Park in northeast Nebraska.

Introduction

Correctly distinguishing rocks and fossils deposited by the Flood from those laid down before or after the Flood is a crucial task for diluvialists. Every location needs to be evaluated on its own merits, since the specific chronostratigraphy of the geologic column cannot be trusted, even if its general sequence is accurate (Oard, 2006). This is especially true for the "Cenozoic" and the Miocene. Ashfall Fossil Beds State Historical Park in northeast Nebraska presents an interesting example.

"Miocene" is a date applied by uniformitarian scientists based on certain index fossils and radiometric dates. It is entirely possible that some "Miocene" rocks were deposited in the Flood (Oard,

* Michael J. Oard, 34 W Clara Ct, Bozeman, MT 59718, mikeoard@bridgeband.com

Accepted for publication June 3, 2009

2001). Even some Pleistocene deposits could be from the Flood (Holt, 1996). This is because the final or the retreating stage of the Flood (Walker, 1994) was primarily an *erosional* event in higher elevations like the western United States. If significant thicknesses of strata were eroded during this final stage, the remaining strata would likely be from the first half of the Flood—the inundatory stage (Walker, 1994).

If we cannot identify Flood strata based on their relative position in the geologic column, then how are we to determine which rocks were products of the Flood? To answer this question, I developed eleven criteria (Oard, 2007). As I continue to expand and refine that list, I have found that many of them are applicable to the Ashfall fossil site (Table I).

Table I. Environmental deductions from the eleven diagnostic criteria of Oard (2007).

Diagnostic Criterion	Environment
Thin, widespread sediments	Flood
Huge volume	Flood
Lithified sediments	Post-Flood
Permineralized fossils	Post-Flood
Thick, pure coal seams	N/A
Widespread and/or thick evaporites	N/A
Tall erosional remnants	N/A
Planation surfaces or pediments	Flood
Long-transported cobbles and boulders	Flood
Water and wind gaps	N/A
Part of continental margin	N/A

The Ashfall Site

The Ashfall Fossil Beds State Historical Park in northeast Nebraska represents a unique assemblage of fossils, mostly preserved in ash. Hundreds of fossil types are concentrated here; during excavations in 1978–1979, more than 200 fossil mammals were discovered. Some were left in place, and a barn, called the Rhino Barn (Figure 1), was built to preserve them for public viewing. Fossil species include rhinoceroses, five species of horse, camels, deer, three species of birds, a giant tortoise, and two small carnivores. In ongoing excavations, fossils are found almost every day, and the number of species continues to rise. For instance, in the first half of the summer of 2008, fossil hunters discovered elephant and rhinoceros tracks, a giant tortoise, bones from a four-tusked elephant, hatchling turtle bones, coprolites, scavenged bones, and an oreodont's jaw (Figure 2). The site is appreciated by paleontologists because all fossils are well preserved and many are fully articulated.

Akridge and Froede (2005) interpreted the site as a post-Flood environ-

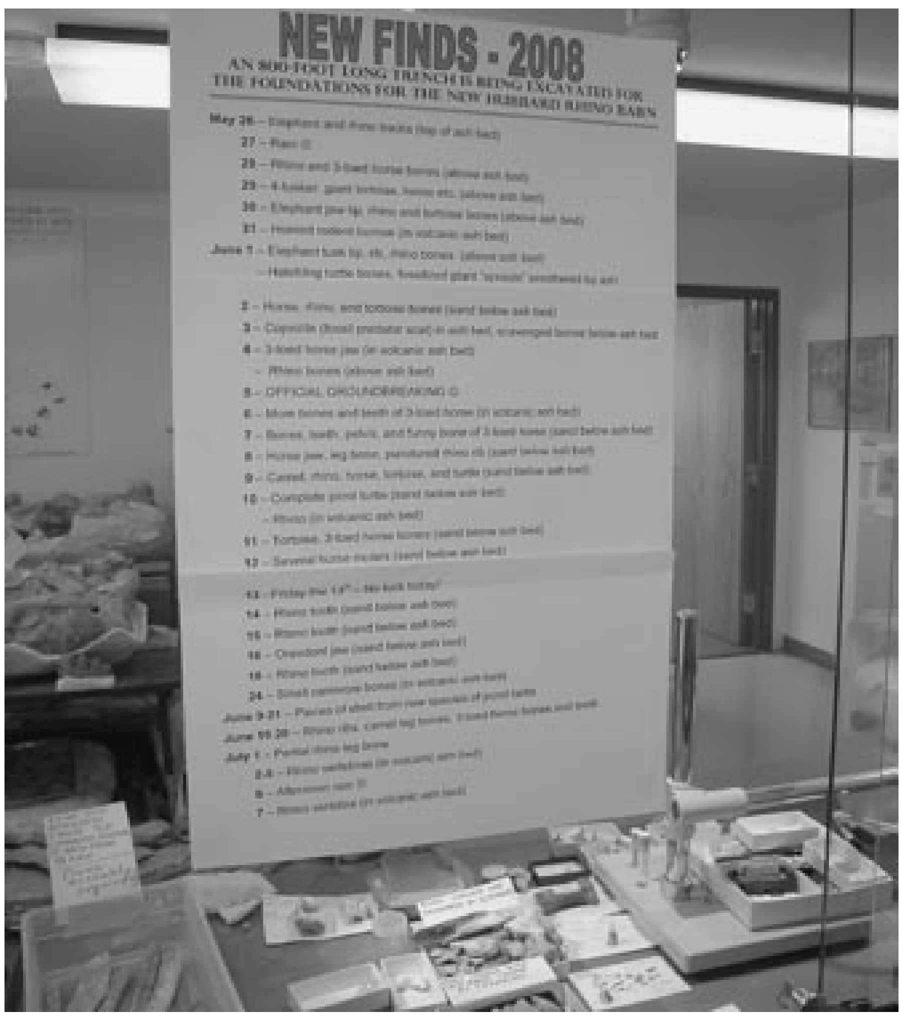


Figure 2. The fossil finds at Ashfall Fossil Beds State Historical Park during the first half of the 2008 summer season.

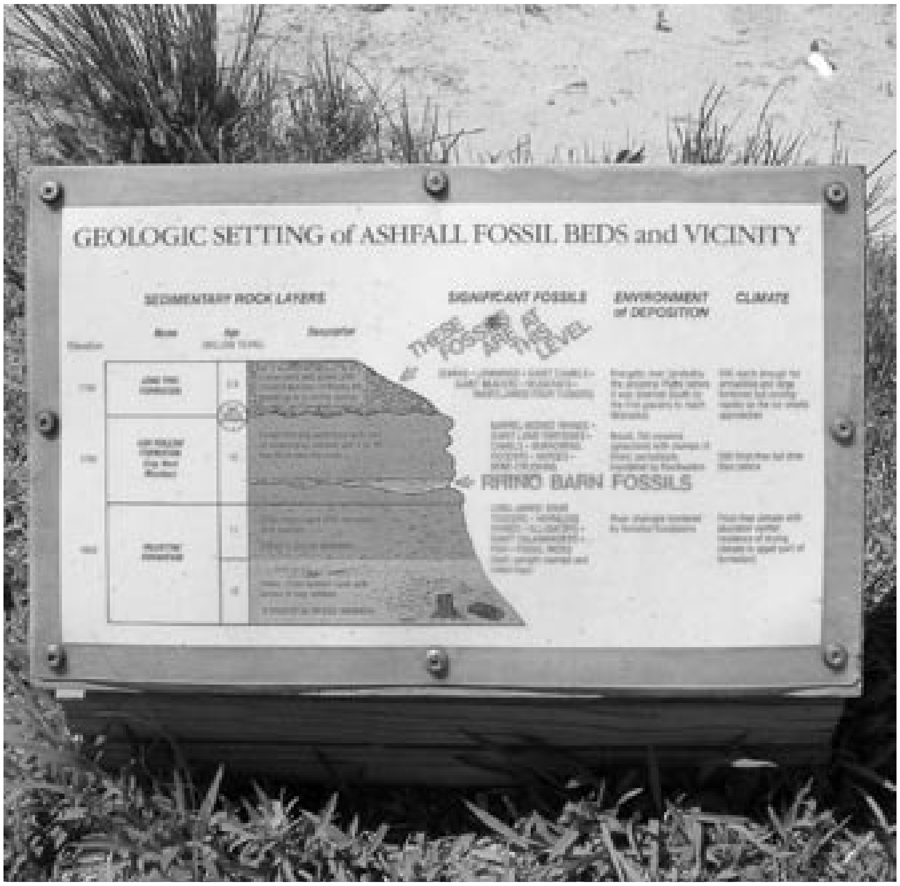


Figure 3. The stratigraphy of the Ashfall Fossil Beds Park.

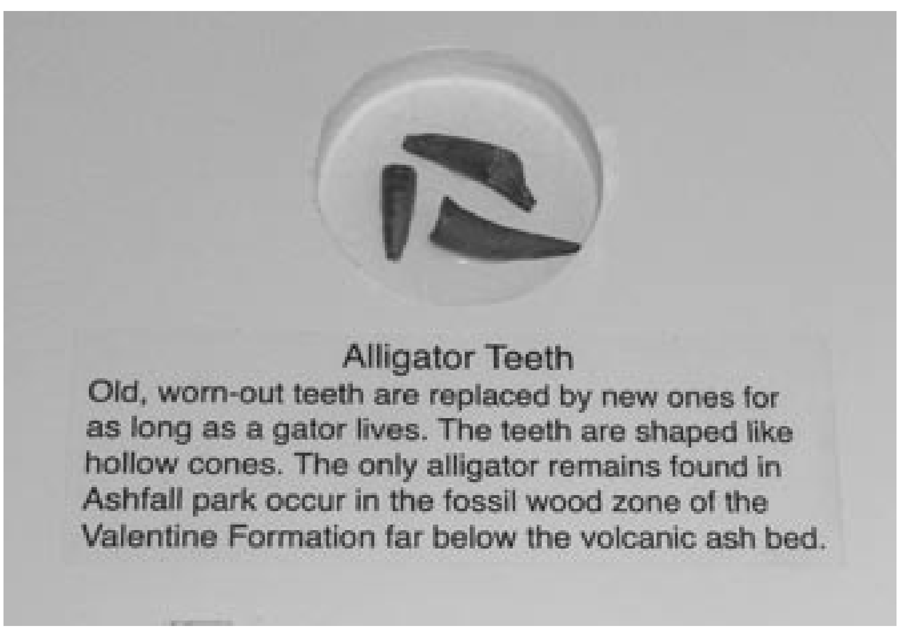


Figure 4. Alligator teeth found in the Valentine Formation below the ash bed.

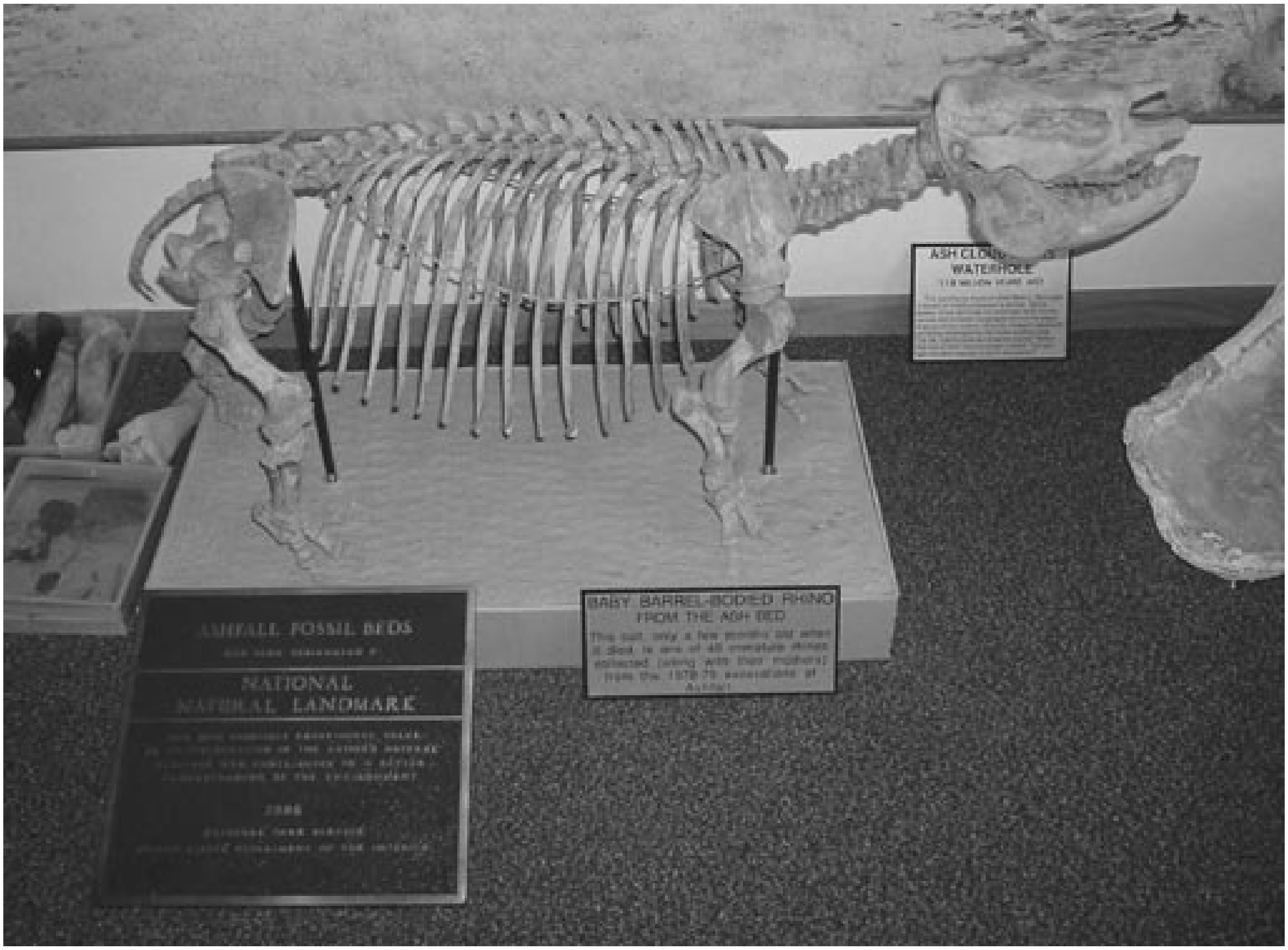
ment preserved by Ice Age volcanism in a catastrophic manner. Many aspects of the animals' deaths are inconsistent with the uniformitarian story presented at the visitor's center (Akridge and Akridge, 2008). But the evidence for the timing of the ashfall event is not clear. Despite some evidence that the fossils were formed after the Flood, there is other evidence that seems to indicate a Flood origin. Based on previously established criteria to differentiate between Flood and post-Flood strata, I will attempt to show that the site formed during the Flood.

The stratigraphy of the Ashfall area is shown in Figure 3. The fossils are mainly found within the ash layer of the Ash Hollow Formation, a well-indurated sandstone (Akridge and Froede, 2005). This ash averages about 1.0 ft (30.5 cm) in thickness but reaches 10 ft (3 m) in thickness locally. Many of the articulated fossils are found in the thickest zone of the ash, which geologists have interpreted as a watering hole. There is a systematic vertical change upwards in the ash layer, from small aquatic animals to the larger mammals found in the upper zones of the thicker ash.

The Ash Hollow Formation is bounded below by the Valentine Formation, which is about 70 ft (21.3 m) thick and contains fossils of four-tusked elephants, alligators, and fish, as well as petrified wood (Figure 4). Above the Ash Hollow is the Long Pine Formation, which contains gravel and cobbles up to 5 in (13 cm) in diameter from lithologies derived from the Rocky Mountains. According to the geologic timescale, there is a hiatus of 7.5 million years between the Ash Hollow and Long Pine Formations.

Evidence for a Post-Flood Environment

Evidence for a post-Flood entombment of the fossils takes several forms. Tracks of hoofed animals indicate the presence of live animals at the site. Since animal tracks would not be expected during



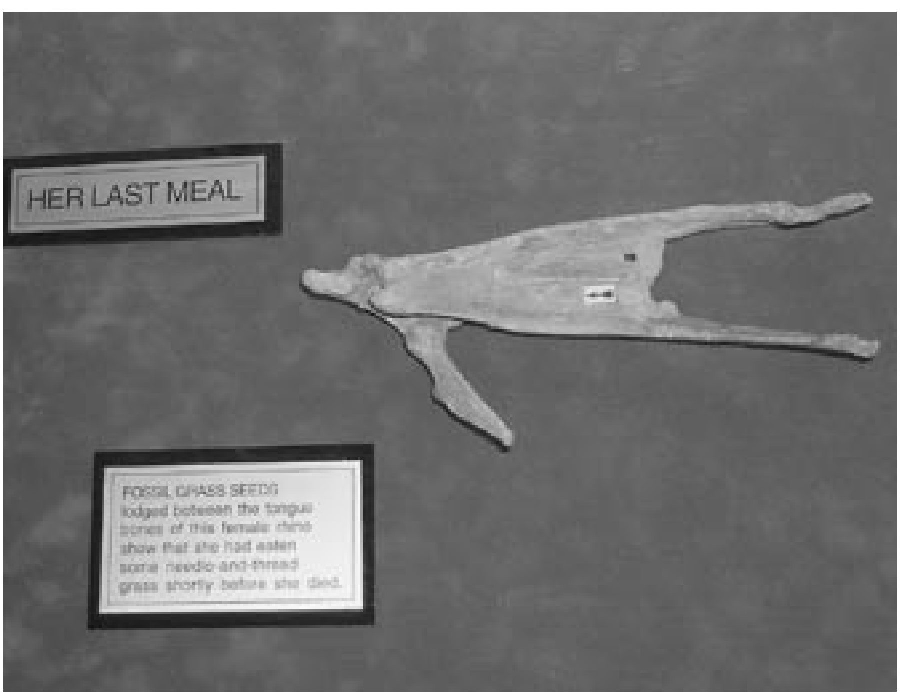


Figure 5 ***(above)*****. One of many baby rhinoceros skeletons found at the Ashfall site.**

Figure 6 ***(left)*****. Grass fossils found between the tongue bones of a rhino.**

the latter stages of the Flood, after all the animals outside the ark had been destroyed, these tracks would suggest either early Flood sediments or post-Flood deposits. The presence of thousands of feet of fossiliferous sediments under the Ash Hollow Formation would rule out a pre-Flood origin.

Fossils of baby animals and even fossil fetuses within adult fossils (Figure 5) suggest an environment where animals lived and bred, seemingly anomalous to the early chaos of the Flood. Contrary to dinosaur bonebeds, where the youngest dinosaurs are inevitably absent (Oard, 2009), the ashfall site contains everything from fetuses to mature creatures.

This site also suggests a terrestrial environment, not marine encroachment. Coprolites found in the area would not be expected to survive an aqueous environment. Land animal bones show signs of scavenging and trampling, also terrestrial activities. Freshwater diatoms imply freshwater streams or lakes in the vicinity. Also, grass has been found in the stomachs and mouths (Figure 6) of some of the animals, indicating they were feeding in a grassy environment before being engulfed by ash.

The fossils have minimal permineralization, which means that silicon dioxide or other chemicals have been little absorbed within the bones of the animals. This observation is an indicator of a post-Flood environment (Oard, 2007). Lithified sediments and permineralized fossils would result from the movement of mineral-rich water under high pressure through Flood sediments. Rapid deposition would cause rapid cementation and permineralization. Post-Flood and present-day environments would be low in cementing chemicals such as silica. Therefore, lithification and permineralization would be rare after the Flood. The ash at Ashfall Fossil Beds State Historical Park is poorly consolidated and the fossils are not significantly permineralized.

Evidence for a Flood Environment

But other evidence argues for a Flood origin for these fossils. The site meets many Flood criteria (Oard, 2007). First, the presence of "thin, widespread sediments" or sedimentary rocks suggests Flood deposition. The Ash Hollow and Valentine formations belong to the Ogallala Group. These formations continue west into the subsurface; ash bed markers can be correlated in wells to the west of the fossil site. This suggests that the ash layer in the Ash Hollow Formation is widespread. The entire Ogallala Group covers an area of around 300,000 mi^2 (777,000 km^2) east of the Rocky Mountains (black area in Figure 7) (Oard, 2008a), and the Ogallala once covered 590,000 mi^2 (1.53 million km^2) before erosion removed the shaded areas in Figure 7. The Ogallala Group ranges from 3 ft (0.9 m) to 800 ft (244 m) thick and is composed mostly of sandstone with interbedded coarse gravel and conglomerate derived from the Rocky Mountains (Figure 8). The Ash Hollow and Valentine Formations, and indeed

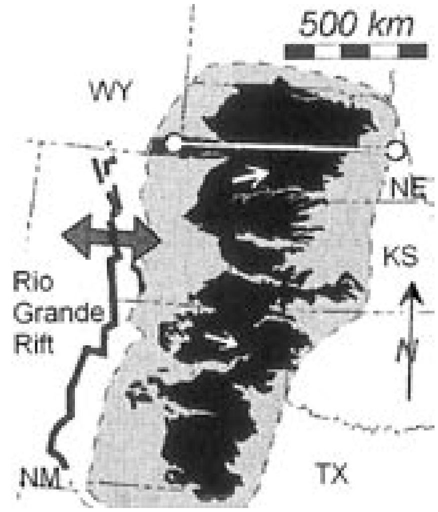


Figure 7. Distribution of the Ogallala Group on the central and southern High Plains of the United States, modified from Thornbury (1965) and Heller et al. (2003). Map shows observed (black) and inferred (shaded) original distribution. White arrows show generalized paleocurrent directions.

Figure 8. Ogallala Group gravel along Smokey Hill River, Highway 23, Kansas.

Figure 9. Sherman planation surface, the Gangplank, with monadnocks in the distance (viewed southwest from near milepost 346, Interstate 80, Wyoming). This surface extends from near the pass east of Laramie, Wyoming, east into western Nebraska.

the entire Ogallala Group, would appear to qualify as Flood-deposited sediments based on the diagnostic criteria of "thin, widespread sediments" (Oard, 2007).

Second, the immense volume of sediment in the Ogallala Group suggests the Flood. Since the Ash Hollow Group is a part of the Ogallala, it too would have to be a Flood deposit.

A number of the criteria are not applicable to the ashfall site (Table I). That of planation surfaces or pediments on or above the sedimentary rock may be applicable indirectly. Although there is no such planation surface or pediment around the site, all of northeast Nebraska could be considered a rough planation surface or an erosional surface. A well-known planation surface extends from the Continental Divide just east of Laramie, Wyoming, into central Nebraska along Interstate 80. Called "The Gangplank" (Figure 9), it truncates a wide variety of igneous and sedimentary rock, including the Ogallala Formation (Thornbury, 1965). If the Ash Hollow and Valentine formations are correlative across the entire Ogallala Group, then the "Gangplank" would suggest that they were deposited during the Flood.

Resistant boulders and pebbles from the Rocky Mountains are common in the Ogallala Group. At the ashfall site, the Long Pine Formation includes these Rocky Mountain clasts. I suspect that they are a facies of the Ogallala Group, though dated 7.5 million years younger. The age discrepancy might be due to questionable biostratigraphic dating.

Table I provides a summary of the evidence for and against Flood deposition of the Ash Hollow Formation. Two criteria favor a post-Flood environment and four a Flood environment. But other indicators also suggest a Flood environment.

Other Flood Criteria

As a follow-up to the Oard (2007) criteria, I am developing additional indicators that can distinguish between Flood and non-Flood strata. Several of these new criteria can be applied to the Ash Hollow Formation. Some of these have been mentioned before (e.g., Oard, 1996).

One is the amount of erosion at any given site. For example, the timing of the Green River Formation is a point of debate among creationists. I previously calculated that up to 17,000 ft (5.2 km) eroded from the north limb of the San Rafael Swell (Figure 10) of which the top formation is the Green River Formation (Oard and Klevberg, 2008). This strongly suggests that the formation was deposited during the Flood. Post-Flood processes would be incapable of this much erosion and transport of the debris off the continent. Similar amounts on the Colorado Plateau (Schmidt, 1989) suggest that exposed strata are also Flood deposits.

Post-Flood processes would be hard pressed to explain the erosion of the Ogallala Group, which is estimated to extend over 290,000 mi^2 (751,100 km^2). Holt (1996) also thinks that Ice Age erosion was insignificant. The correct sequence of events late in the Flood over this region appears to be: 1) widespread sheet deposition on the High Plains, 2) widespread sheet erosion, and 3) channelized erosion forming today's river valleys. That sequence fits well with Walker's (1994) late inundatory stage for the sheet deposition, the early retreating stage for the sheet erosion, and the late retreating stage for the channelized erosion (Walker, 1994; Oard, 2008b).

Another item of interest is the presence of warm-climate animals in the Ash Hollow Formation. Alligator teeth have been found in the Valentine Formation and giant land tortoises in the Ash Hollow and Long Pine Formations (Figure 11). These animals indicate *winter temperatures above freezing* (Hutchison, 1982; Markwick, 1998). A climate this warm in the interior of North America during the Ice Age is unlikely, even if the Ice Age was delayed, because winter

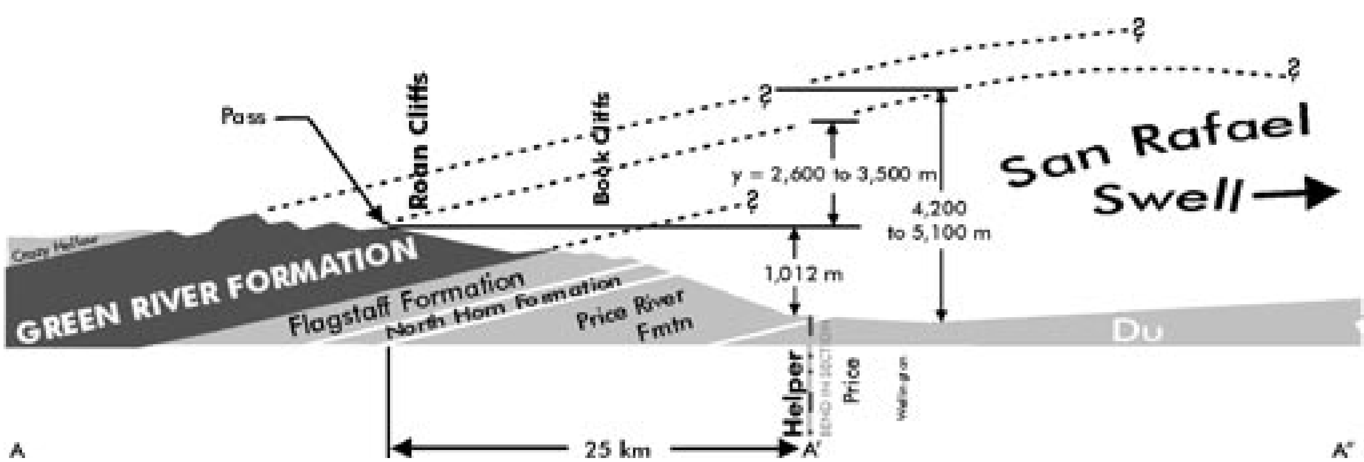


Figure 10. Cross section of the sedimentary rocks of the north limb of the San Rafael Swell. Dashed lines with question marks show the strata projected up over the San Rafael Swell, assuming no change in thickness. Du means diluvial undifferentiated. Note that the total erosion is 14,000-17,000 ft (4.3 to 5.2 km). Drawn by Peter Klevberg.

Figure 11. Giant land tortoise fossil from the Ash Hollow Formation. Some weighed up to 500 lb (227 kg).

Figure 12. The Nebraska Sand Hills.

temperatures depend mainly upon the *angle* of the sun (Oard and Klevberg, 2008). The angle of the sun would be the same in winter right after the Flood as it is now. Additional cooling would be expected due to the abundant ash in the atmosphere, which would be expected due to the numerous ash beds in the Ogallala Group and other Cenozoic sedimentary rocks on the High Plains (Carlson, 1993).

The types of animals at the ashfall site should be typical of the Ice Age if they are post-Flood. These would include woolly and Columbian mammoths, cave bears, woolly rhinos, dire wolves, ground sloths, one-toed horses, etc. (Oard, 1996). Instead, the ashfall site shows the four-tusked elephants, oreodonts, three-toed horses, and extinct rhinos.

The Nebraska Sand Hills are widespread over north-central Nebraska (Figure 12) and overlie the Ogallala Group. These deposits are likely from the Flood. They include a large volume of sand deposited from the northwest (Figure 13), being the largest area of stabilized sand dunes in the western hemisphere (Trimble, 1990). The sand hills are far from the Rocky Mountains, and there is no post-Flood source of sand to the northwest. Complicating this scenario even further is the fact that

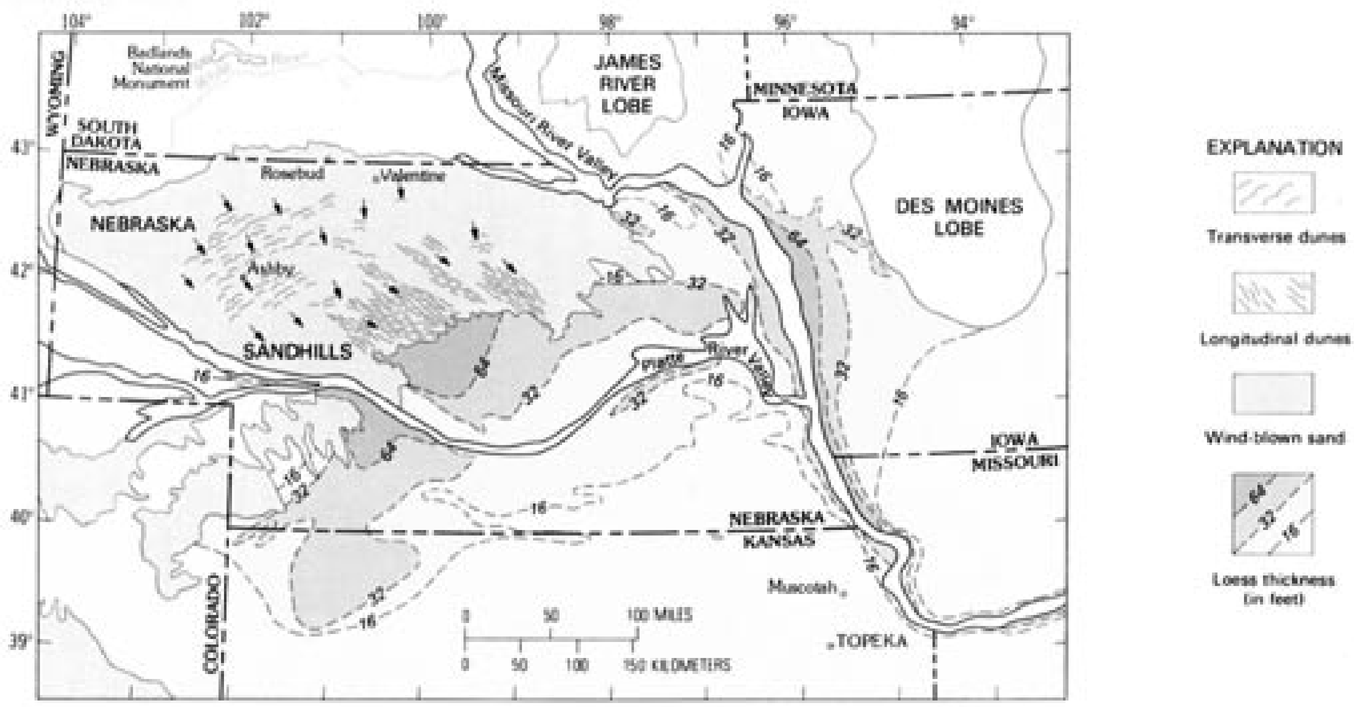


Figure 13. Map of the Nebraska Sand Hills showing large extent and inferred direction of "paleowinds" from the northwest (from Trimble, 1990, p. 31). The elevation decreases northwest of the Sand Hills and there is no known source of sand.

the terrain dips about 1,000 feet (305 m) northwest of the Nebraska Sand Hills into the White River badlands. Also, the Ice Age was too short to have deposited this much sand. Instead, it seems most likely that the Nebraska Sand Hills were deposited at the very end of the Flood and then reworked by Ice Age winds.

These four lines of evidence, added to those in Table I, suggest that the Ash Hollow Formation and its unique fossils were deposited by the Flood. The application of multiple lines of evidence reinforces this conclusion.

How Are the Post-Flood Indictors Explained?

If the Ash Hollow Formation were deposited during the Flood, how are we to explain the post-Flood indicators, such as prints, coprolites, grass, babies, unlithified sediments, and unpermineralized bones?

Although the volcanic ash is unconsolidated, the Ash Hollow Formation is well lithified (Akridge and Froede, 2005). This is often the case with ash beds in Mesozoic and Cenozoic strata of western North America. It is likely that the degree of lithification of the ash is more dependent on diagenetic factors than on the depositional environment.

Diagenetic factors also may explain the lack of permineralization in the fossils too. If insufficient silica were moving through groundwater, then the bones would not be mineralized. This has been observed in dinosaur bones in Montana, which practically all creationists believe died in the Flood. Schweitzer et al. (1997a; 1997b) reported unfossilized bone and organic molecules, possibly even from red blood cells, in a *Tyrannosaurus rex* from sandstone in eastern Montana. This unfossilized skeleton is now located in the Museum of the Rockies at Bozeman, Montana. If dinosaur bones can exhibit soft tissue (Asara et al., 2007; Schweitzer et al., 2005; 2007), then the lack of fossilization at the ashfall site should not be surprising. However, this is a problem for uniformitarians. *Science* quotes Schweitzer as saying, "It was totally shocking. I didn't believe it until we'd done it 17 times" (Stokstad, 2005, p. 1852).

What Is the Flood Timing?

If the ashfall strata were deposited during the Flood, can we deduce when during the Flood that occurred? I believe so but recognize that the conclusion will be difficult for some creationists to accept. The key line of evidence is the presence of mammal prints at the site. This is diagnostic of deposition during the first 150 days of the Flood (Walker, 1994). Thus, the animals probably died late in the early part of the Flood.

This is supported by the lithification of the Ash Hollow Formation. This suggests a fair amount of overburden compressing the formation. If so, that sediment was later eroded. However, that would be expected during the retreating stage of the Flood and should not be surprising. I suspect that the real issue is the unconscious reliance on the geologic column, which suggests that Miocene strata should be late in the Flood or even after it. But our understanding of the Flood is at a rudimentary stage. We should remember Sherlock Holmes's suggestion: "Eliminate all other factors, and the one which remains must be the truth" (Doyle, 1890, p. 92).

Briefly Exposed Flood Sediments

Therefore, any realistic model of the Flood needs to account for local variations in tectonics and eustasy that would probably cause the emergence of land, explaining the development of short-lived refuges, leading to the formation of dinosaur tracks, eggs, nests, and unique features of dinosaur graveyards (Oard, 1995; 2009). Small regional changes could result in dramatic local falls in relative sea level, exposing sediments already deposited by the Flood (Figure 14). Terrestrial creatures surviving for a short time in the water or on nearby high ground, could occupy the newly raised area for a short time, leaving tracks and laying eggs. Dead or dying animals washed up onto a newly exposed section could create bonebeds when returning waters covered them again. Given enough time, there would be scavenging of bodies or eggs, as deduced from teeth marks and similar indicators. There are at least four mechanisms that would cause sea level to oscillate locally or regionally.

Figure 14. Location of postulated strip of land or series of shoals in western United States generally parallel to the crest of the Rocky Mountains. There are four megatracksites in black; the newly discovered one in Wyoming contains two megatracksites on different beds (from Oard, 2002, p. 6).

I believe the ashfall site is similar to the unique features observed at Agate Fossil Beds National Monument in western Nebraska (Oard, 1998). Unique spiral burrows—some containing fossil beavers—have been found there (Figure 15). Mammal tracks are also present. Other similar sites include Toadstool Geologic Park in northwest Nebraska and some valleys in the Rocky Mountains (Lockley and Hunt, 1995). Based on these observations, we must conclude that large regions of the western United States were briefly and periodically exposed before the peak of the Flood at Day 150. This would explain the various tracks, eggs, nests, and bonebeds found in the area. It also would suggest the subsequent erosion of vast thicknesses of sediment that once overlaid these beds.

Therefore, *most of the Tertiary strata of the Rocky Mountain valleys and High Plains are from the inundatory stage of the Flood*. This deduction may be a shock to those creationists who believe the tertiary is late Flood or post-Flood. But it is primarily a shock because many creationists assume that the geological column is a reliable time sequence. According to that yardstick, the tertiary should be late Flood or post-Flood.

But on further thought, maybe it is not such a difficult idea. One would expect the majority of sedimentation *early* in the Flood, since it was most violent during those early stages. The retreating stage, especially over the higher regions of western North America, was a time of vast, rapid erosion, called the "Erodozoic" by Holt (1996). Therefore, by elimination, the strata remaining—even if dated "tertiary" by uniformitarian geologists—are from the inundatory stage of the Flood.

If great thicknesses of strata were eroded late in the Flood, where did they go? The answer is to the east. Erosion in the elevated areas of North America led to the eastward and southward

Figure 15. Devil's corkscrew from Agate Fossil Beds National Monument, western Nebraska.

transport of vast amounts of sediment, which were deposited as the coastal plain and continental shelf sediments of the eastern seaboard and the Gulf of Mexico. Some probably were even carried far out onto the abyssal plains (Oard, 2001).

Other aspects of the ashfall site can be explained by this model. Grass found at the site and even in the mouths and stomachs of the dead animals could have sprouted from seeds carried in the atmosphere or in floating vegetation. Grass would sprout quickly under the right conditions.

The presence of fetuses and babies with adults might indicate that these animals rode out the initial violence of the Flood on some high refuge. When lower lands were exposed, they then occupied them together. Coprolites might have been preserved by ash or other rapid burial. There would of course be scavenging and trampling of dead animals before the area was completely re-inundated before Day 150.

The presence of freshwater diatoms needs further analysis. Are they true environmental indicators, or were they transported by Flood currents? Are we sure they are freshwater, or is that simply inferred from a freshwater environment based on the terrestrial fossils at the ashfall site (i.e., circular reasoning)? Since we don't know the chemistry of the floodwaters (which was probably quite variable in space and time), these diatoms may well have been at home in the local conditions.

Contrary to the uniformitarian explanation, Akridge and Akridge (2008) state that Marie's disease or "hypertrophic osteopathy," caused by inhaling volcanic ash, probably was not the cause of death. They cited the time needed for the bone growths to manifest themselves from a single eruption. Uniformitarians correlate the ash at the ashfall site with a volcano 1,000 mi (1,609 km) away in southwest Idaho by chemical tracking. Akridge and Akridge (2008) suggest that "one possibility is the presence of minor eruptions prior to the major eruption that produced the ashfall that killed and buried the animals" (p. 129). In a Flood scenario, the animals on high refugia were likely subjected to multiple ashfalls and particles from meteoric impacts before they were forced to flee. Thus, the development of Marie's disease might have occurred over the early weeks or even months of the Flood before their final demise.

Summary

Some evidence from the ashfall site suggests a post-Flood environment, but the predominance of evidence indicates that these fossils formed during the early stages of the Flood. The lack of permineralized bones and unlithified ash is not conclusive, since similar features are found in other sediments that were clearly deposited during the Flood.

Regional considerations, such as the thin, widespread sediments; the large volume of sediments; a planation surface above correlative strata to the west; pebbles carried from the Rocky Mountains; evidence for large-scale erosion; subtropical fauna inconsistent with an Ice Age climate; and the likely Flood origin of the overlying Nebraska Sand Hills all argue for a Flood origin.

The presence of tracks and other evidence for living animals strongly suggests that the ashfall site was actually buried prior to Day 150 of the Flood, that a significant volume of sediment was deposited atop the area, and that massive erosion during the retreating stage of the Flood eroded the area back down to the level of the ashfall site. This same model can explain other sites throughout western North America that show dinosaur tracks, eggs, nests, and dinosaur and mammal bonebeds. Marie's disease present in the fossils at the ashfall site may well have been caused by early Flood volcanism and/or meteoric impacts, either of which could have generated the lung disease.

References

CRSQ: Creation Research Society Quarterly

JOC: Journal of Creation, Creation Ex Nihilo Technical Journal, or *Technical Journal*

Akridge, A.J., and M.E. Akridge. 2008. Death on the plains of Nebraska. *CRSQ* 45:126–133.

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

Asara, J.M., M.H. Schweitzer, L.M. Freimark, M. Phillips, and L.C. Cantley. 2007. Protein sequences from mastodon and *Tyrannosaurus rex* revealed by mass spectrometry. *Science* 316:280–285.

Carlson, M.P. 1993. *Geology, Geologic Time and Nebraska*. Educational Circular No. 10, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln, NE.

Doyle, A.C. 1890. *The Sign of the Four (1890)*. The Penguin Complete Sherlock Holmes, reprinted, New York, NY, 1981.

Heller, P.L., K. Dueker, and M.E. McMillan. 2003. Post-Paleozoic alluvial gravel transport as evidence of continental tilting in the U.S. Cordillera. *GSA Bulletin* 115:1122–1132.

Holt, R.D. 1996. Evidence for a Late Cainozoic Flood/post-Flood boundary. *JOC* 10(1):128–167.

Hutchison, J.H. 1982. Turtle, crocodilian, and champsosaur diversity changes in the Cenozoic of the North-Central region of Western United States. *Palaeogeography, Palaeoclimatology, Palaeoecology* 37:149–164.

Lockley, M., and A.P. Hunt. 1995. *Dinosaur Tracks and Other Fossil Footprints of the Western United States*. Columbia University Press, New York, NY.

Markwick, P.J. 1998. Fossil crocodilians as indicators of Late Cretaceous and Cenozoic climates: implication for using palaeontological data in reconstructing palaeoclimate. *Palaeogeography, Palaeoclimatology, Palaeoecology* 137:205–271.

Oard, M.J. 1995. Polar dinosaurs and the Genesis Flood. *CRSQ* 32:47–56.

Oard, M.J. 1996. Where is the Flood/post-Flood boundary in the rock record? *JOC* 10(2):258–278.

Oard, M.J. 1998. Dinosaurs in the Flood: a response. *JOC* 12(1):69–86.

Oard, M.J. 2001. Vertical tectonics and the drainage of Floodwater: a model for the Middle and Late Diluvian period—Part II. *CRSQ* 38(2):79–95.

Oard, M.J. 2002. Newly discovered dinosaur megatracksites support Flood model. *JOC* 16(3):5–7.

Oard, M.J. 2006. The geological column is a general Flood order with many exceptions. In Reed, J.K., and M.J. Oard (editors), *The Geological Column: Perspectives within Diluvial Geology*, pp. 99–121. Creation Research Society Books, Chino Valley, AZ.

Oard, M.J. 2007. Defining the Flood/post-Flood boundary in sedimentary rocks. *JOC* 21(1):98–110.

Oard, M.J., 2008a. Long-distance Flood transport of the Nenana Gravel of Alaska—similar to other gravels in the United States. *CRSQ* 44:264–278.

Oard, M. J. 2008b. *Flood by Design: The Earth's Surface Shaped by Receding Water*. Master Books, Green Forest, AR.

Oard, M. J. 2009. Dinosaur tracks, eggs, and bonebeds. In Oard, M.J., and J.K. Reed (editors), *Rock Solid Answers: Responses to Popular Objections to Biblical Geology*. Master Books, Green Forest, AR, and Creation Research Society Books, Chino Valley, AZ.

Oard, M.J., and P. Klevberg. 2008. The Green River Formation very likely did not form in a postdiluvial lake. *Answers Research Journal* 1:99–108.

Schmidt, K.-H. 1989. The significance of scarp retreat for Cenozoic landform evolution on the Colorado Plateau, U.S.A. *Earth Surface Processes and Landforms* 14:93–105.

Schweitzer, M.H., C. Johnson, T.G. Zocco, J.R. Horner, and J.R. Starkey. 1997a. Preservation of biomolecules in cancellous bone of *Tyrannosaurus rex*. *Journal of Vertebrate Paleontology* 17(2):349–359.

Schweitzer, M.H., M. Marshall, K. Carron, D.S. Bohle, S.C. Busse, E.V. Arnold, D. Barnard, J.R. Horner, and J.R. Starkey. 1997b. Heme compounds in dinosaur trabecular bone. *Proceedings of the National Academy of Science* 94:6291–6296.

Schweitzer, M.H., Z. Suo, R. Avci, J.M. Asara, M.A. Allen, R.T. Arce, and J.R. Horner. 2007. Analyses of soft tissue from *Tyrannosaurus rex* suggest the presence of protein. *Science* 316:277–280.

Schweitzer, M.H., J.L. Wittmeyer, J.R. Horner, and J.K. Toporski. 2005. Soft-tissue vessels and cellular preservation in *Tyrannosaurus rex*. *Science* 307:1952–1955.

Stokstad, E. 2005. *Tyrannosaurus rex* soft tissue raises tantalizing prospects. *Science* 307:1852.

Thornbury, W.D. 1965. *Regional Geomorphology of the United States*. John Wiley & Sons, New York, NY.

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

Walker, T.B. 1994. A biblical geological model. In Walsh, R.E. (editor), *Proceedings of the Third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.