Petrified Ideas of the Williston Basin

Part II: Fossil Wood

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Abstract

"Petrified forests" are common tourist attractions, invariably used to promote uniformitarian thinking. One well-known example is in Theodore Roosevelt National Park near Medora, North Dakota, U.S.A. The petrified wood is contained in various strata of the "Paleogene" Fort Union Group in the Williston Basin, but in the park primarily in the lower Sentinel Butte Formation. This formation exhibits much evidence against uniformitarian hypotheses but which fits well with the Genesis Flood. The site shows laterally extensive and vertically limited horizons containing fossilized tree trunks, divorced from fine roots and branches, with no discernible rooting medium such as paleosols, and closely associated with bentonite, iron oxide, and coal. The stratigraphy and sedimentology of the area bespeak continuous, rapid deposition and powerful currents. The uniformitarian scientists also have the problem of how silicification occurs prior to the more rapid normal decay process typical of the supposed swamps which are the interpreted depositional environment for the Fort Union. Burial of vertical trees sinking from log mats and rapid silicification associated with volcanic activity during the Bibilical Flood (responsible for the bentonites) is a more plausible explanation.

Key Words: Petrified wood, Medora, North Dakota, Williston Basin, Fort Union Group, fossilization

Introduction

Many tourists pass through Medora, North Dakota, U.S.A. (Figure 1), each year, nearly all of them on the interstate highway. Many stop at the Painted Canyon overlook to gaze on the badlands (Figure 2). Those interested in seeing the park stop in Medora, and many drive the winding gravel road through colorful, grassy hills and wooded draws sprinkled with oil wells to the "Petrified Forest" (Figure 3). There, as at the highway overlook, they hear the usual story of millions of years and slow geologic processes. But a closer look shows the traditional story to be fiction. The State of North Dakota promotes evolutionary propaganda near Medora and at other locations: "Medora was a very swamp-like environment 55 million years ago. We find anything from crocodile bones,

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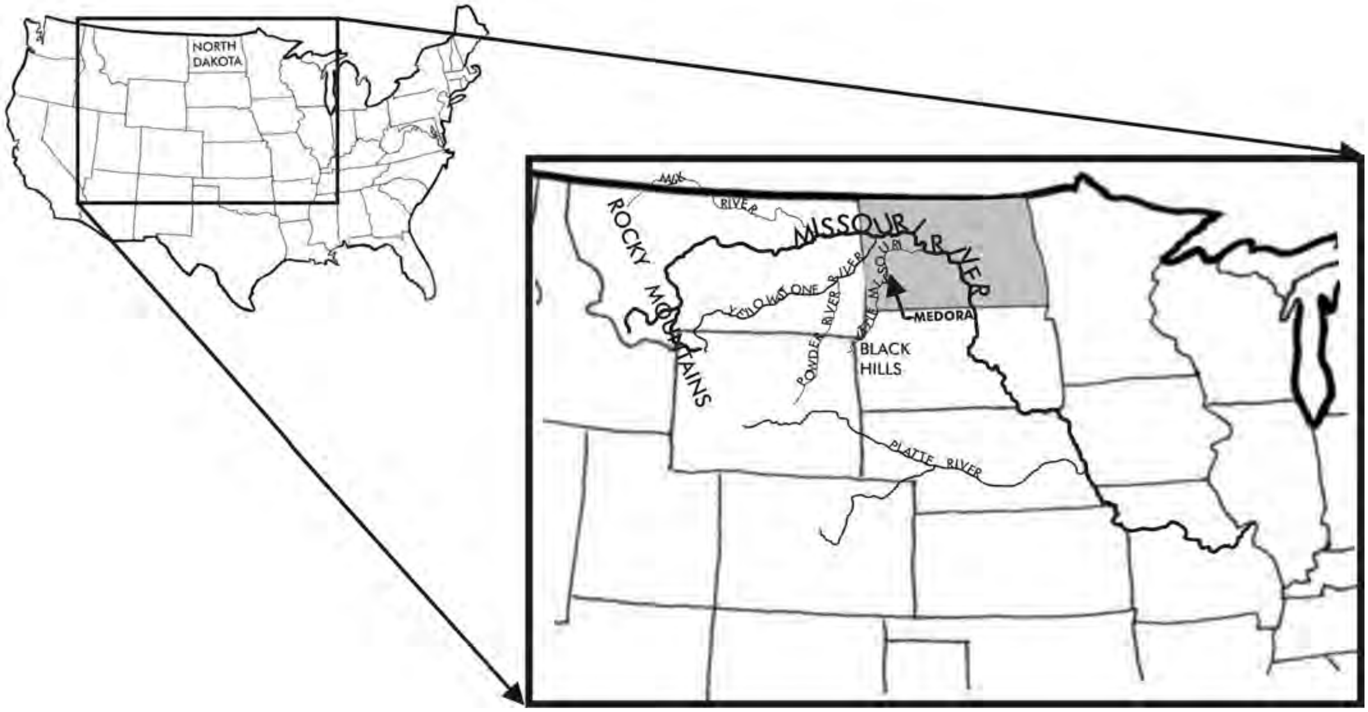

Figure 1. Study Area.

Figure 2. Painted Canyon from the Interstate 94 overlook.

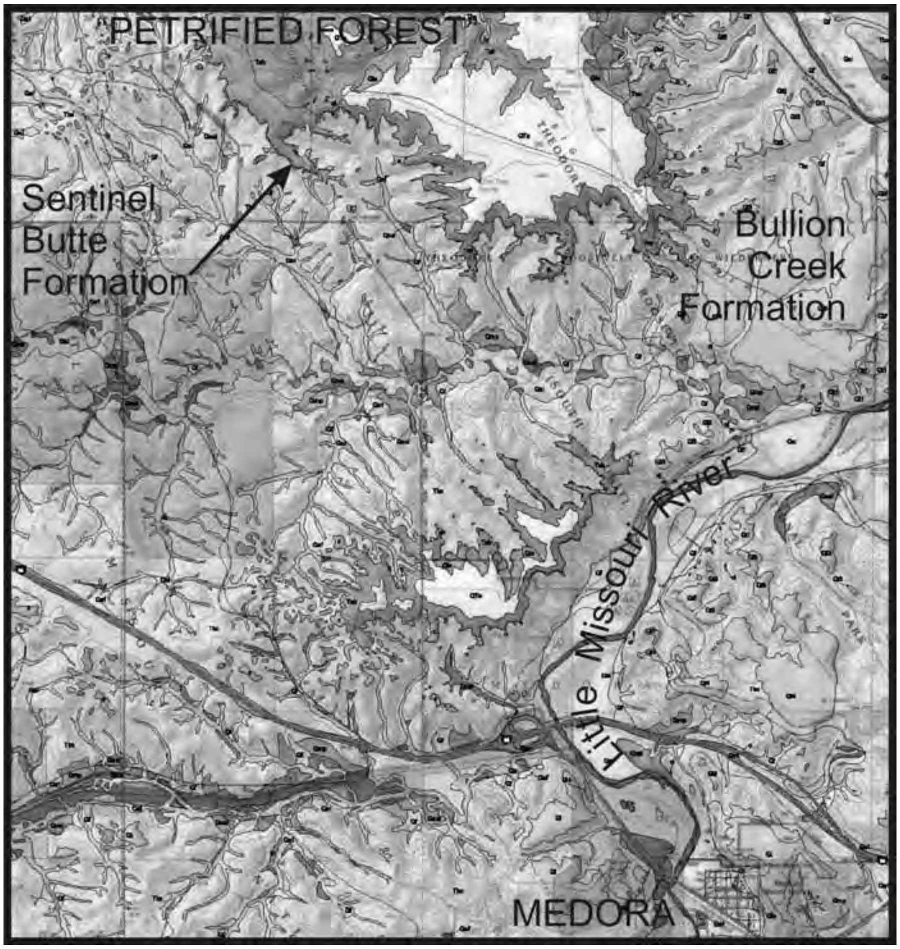

Figure 3. Portion of geologic map centered on Medora and the "Petrified Forest" (from Gonzalez and Biek, 2003). The Petrified Forest is located on the exposed Sentinel Butte strata (dark gray) on the west flank of the light-colored butte (Big Plateau) at the top of this figure.

fish, salamanders, turtles, champsosaurs, bald cypress branches and cones, snails, clams, mammals, and birds" (North Dakota Geological Survey, 2020). But were these plants and animals living here, or do the fossils only show that they died and their remains were buried here?

When visiting national parks, monuments, or other natural tourist areas, it is a good idea to put on one's "baloney detector," as advocated by the late Phillip Johnson (1997), one of the founders of the Intelligent Design Movement. When reading interpretations of geological observations, one should be skeptical, even as a uniformitarian. This study provides yet another example of why skepticism is in order whenever one reads "official" interpretations of local geology.

As another example, consider Devils Tower National Monument, Wyoming, U.S.A. Road signs propose that the hardened lava of the tower was exposed anywhere from over 40 million years to 2 million years ago, during which, hundreds of feet of material was eroded from the surrounding plains (Oard, 2008, 2009). But since the tower itself is eroding rapidly by block fall, it is strange that it has hardly changed diameter or height in all that time. It is more likely that the timeframe is wrong. Many have found numerous contradictions with uniformitarian interpretations at national parks and monuments. We often have better explanations from studying the geology of the Biblical Flood than is seen in government propaganda (Vail et al., 2008; Oard et al., 2010; Hergenrather et al., 2012).

A conference at Medora (Figure 4) during the summer of 2018, sponsored by the Institute for Biblical Authority (www.IBA777.org), Institute for Creation Research (www.storeICR.org), Montana Origins Research Effort (www.creationsciencedefense.org), and the Glendive Dinosaur & Fossil Museum (www.creationtruth.org), offered an opportunity to examine two spectacular Flood evidences in the badlands of Theodore Roosevelt National Park in southwest North Dakota. These are 1) well-rounded quartzite rocks likely spread from Idaho (Klevberg and Oard, 1998; Oard and Klevberg, 1998) and 2) vertical, petrified trees. The area, like the Badlands National Park (Figure 5) in northwest South Dakota, is famous for its badlands topography (Figures 4 and 5).

Theodore Roosevelt National Park, North Dakota, was named after President Theodore Roosevelt, who ranched in the area in the late 1800s and lost everything to droughts and blizzards. But, it prepared him to be president of the United States. As president, he was a conservationist and established numerous national parks and monuments in the United States.

We have already described the geology of the area in Part I (Klevberg and Oard, 2021), including general knowledge of the Williston Basin and its rate of sediment accumulation in both uniformitarian and diluvial models. We briefly described the geology of the Paleocene Fort Union Formation that contains this "Petrified Forest." Previously,

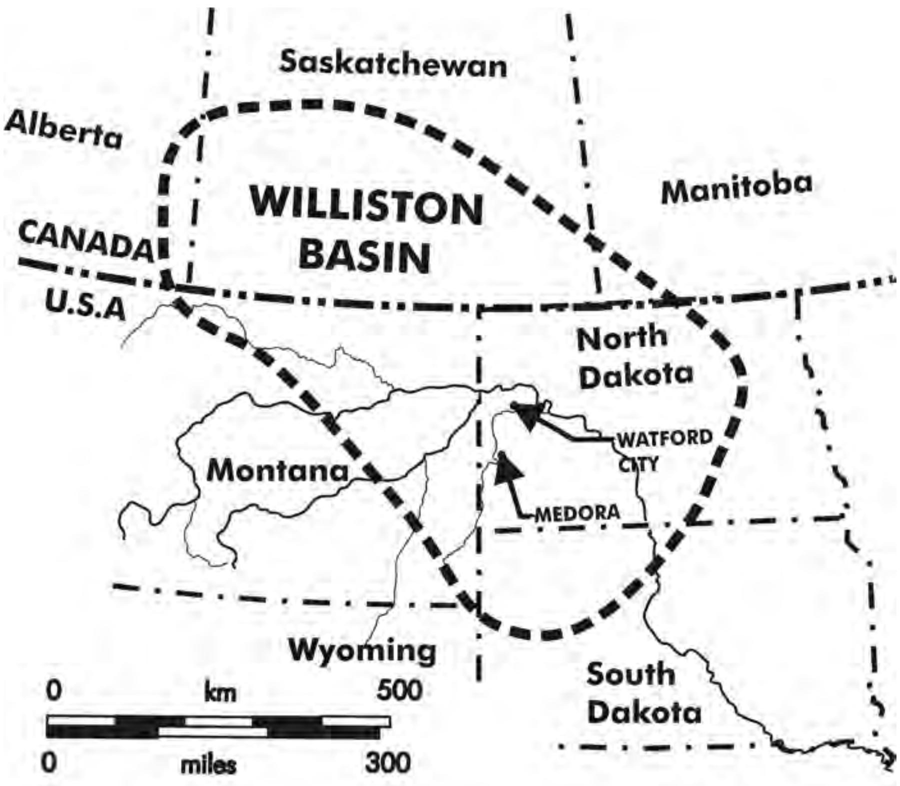

Figure 4. Map of the Williston Basin, the center of which is in western North Dakota. Medora, North Dakota, is located near the southern edge of the basin.

we emphasized the geomorphology of the area, including planation surfaces and well-rounded quartzite rocks likely transported from distant sources. This part will examine the "Petrified Forest" in Theodore Roosevelt National Park. The "Petrified Forest" has much to teach us far beyond the vicinity of Medora.

Figure 5. The badlands of Badlands National Park, southwest South Dakota.

Theodore Roosevelt National Park Petrified Forest

Southwest North Dakota and northwest South Dakota are famous for abundant petrified wood. Vertical petrified trees, called "petrified forests" by uniformitarians, occur in this area, another great location being the Black Hills Petrified Forest near Rapid City, South Dakota (Figure 4).

Fossil wood is plentiful throughout the North Dakota badlands, and the largest single fossil in North Dakota is a Bald Cypress stump (Figure 6) that was obtained from a location outside the two units of Theodore Roosevelt National Park. While on a field trip during the 2018 Medora creation conference, at the entrance to the south unit of the park, we discussed the plentiful information available on the "Petrified Forest." Here is an excellent representation of the Fort Union strata in the Williston Basin (Biek and Gonzalez, 2001), including the area near the north unit of the park where Klevberg has spent considerable time doing field research. We therefore reserve the term "Petrified Forest" for the west side of the Big Plateau (also known as Petrified Forest Plateau) on the west side of the Theodore Roosevelt National Park South Unit rather than other scattered deposits in the area. The Big Plateau includes the light-colored area at the top of Figure 3 (see Figure 4 for location of Medora, which is in the southeast corner of Figure 3).

Model Predictions

Uniformitarian geology would predict that vertical trees at Theodore Roosevelt National Park, as well as many other areas in the world, grew in place:

> Horizons of petrified wood are found in both units of the Park, and although they are all in the lower Sentinel Butte Formation, it is not known whether the horizons are truly correlative. They do indicate

Figure 6. North Dakota's single largest fossil is this petrified Bald Cypress stump exhibited in the Long X Visitor Center in Watford City (location of Watford City shown on Figure 4).

> that conditions favorable for the development and preservation of flood-plain forests were more favorable in early Sentinel Butte time than in earlier or later times. (Biek and Gonzalez, 2001, p. 17)

So, the standard uniformitarian explanation is that the forests grew in place for hundreds of years.

Since it appears that many, if not practically all, the vertical, petrified trees in the world are in strata from the Genesis Flood, diluvial geologists would predict that they did not grow in place as the required timescale would be much longer than the one-year period of the Biblical Flood. Instead, the trees fell through the Floodwater to sink vertically, with the heaviest, root end down, into the rapidly accumulating muddy sediments below, as demonstrated empirically at Spirit Lake by Morris and Austin (2003).

Is the "Petrified Forest" Really a Forest?

As we hiked in for a close examination of the "Petrified Forest," we discovered that indeed there were numerous petrified trees, many still vertical (Figure 7). Because of the intense erosion of the badlands, the bottom of the trees and presumably the material the trees grew in were well exposed. Many once-vertical trees were likely toppled because of this erosion. There were probably hundreds of trees represented at this location, which was one of two areas of abundant vertical petrified trees on the west side of the south unit of the park. Some trees exist in distinct layers.

The trees had a bulbous base and are Bald Cypress (*Taxodium distichum*), sequoia, or perhaps *Metasequoia glyptostroboides* (Dawn Redwood). Bald Cypress is native to the Mississippi Valley and eastern states. Sequoia trees

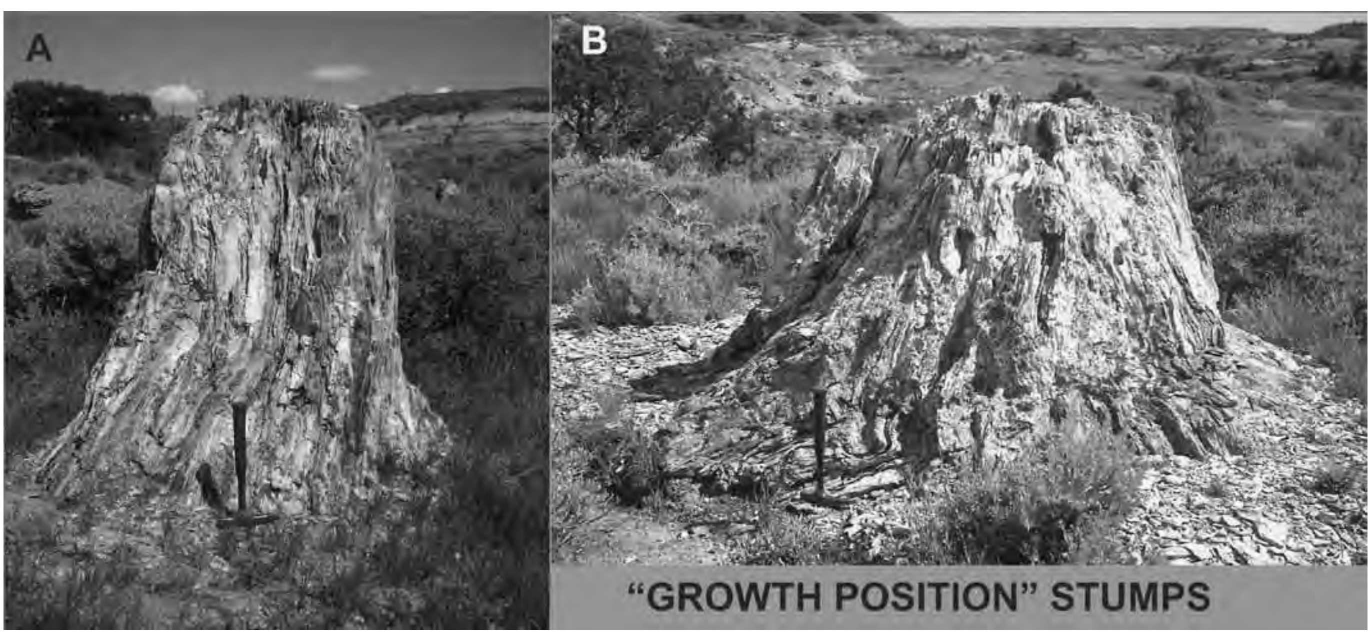

Figure 7. A: A vertically oriented stump from the "fossil forest" of Theodore Roosevelt National Park. While this looks very convincing, closer examination shows no soil or roots below the stump. B: View southeast from the center of the "Petrified Forest" showing one of the most convincing "in situ" stumps in the foreground with many petrified trees, some vertical, of the upper layer, northwest Theodore Roosevelt National Park, South Unit.

are limited to California today. Dawn Redwood is a common type of tree found as a fossil. It is interesting that at one time the Dawn Redwood was thought extinct—the latest it was thought to have lived was the Pliocene, over 2.5 million years ago—but it was found alive in 1941 growing in a remote area of southern China (Bartholomew et al., 1983). It is considered a 'living fossil,' and the question can be asked: Where are the remains of this common fossil tree between 2.5 million years ago and today? The same can be said for other living fossils.

When we examined the petrified trees, we notice that they were overwhelmingly stumps that were about 1 to 2 m tall. But the trees were truncated at the bottom with no roots (Figure 8) and the tops were also truncated and had likely been sheared off (they would be expected to be hollow or more irregular had they rotted). We might add that in other areas within southwest North Dakota and northwest South Dakota, many logs occur without stumps.

Moreover, since many of the petrified stumps were still on pedestals, as erosional remnants, we could see what material was below the stumps. It was the same altered volcanic ash as most of the rest of the badlands, and a recognizable soil profile was absent. With no roots and no soil, the area does not represent in situ tree growth, and the uniformitarian explanation is falsified. Uniformitarian scientists also acknowledge this lack of roots:

> The petrified stumps are up to about 6 feet high and 4 feet in diameter at chest height, but most are between 2 to 4 feet tall and 2 to 3 feet wide. Virtually all have fluted bases, and where in place, rest on a thin lignite or carbonaceous shale; no roots have been observed. Somewhat flattened trunks are less commonly found. The stumps were preserved where buried by flood-plain deposits; the upper parts of the trees simply rotted away. (Biek and Gonzalez, 2001, p. 19)

Paleosols are alleged to be present at the "Petrified Forest," and the two horizons are interpreted as "…two successive coniferous forests that developed on flood-plain sediments…" (Biek and Gonzalez, 2001, p. 21). The iron staining is interpreted as evidence of ponded water and remains of bivalves as evidence of continual submergence. Coal is, of course, interpreted as evidence of swamps. Examination of outcrops, however, shows no fossil soil profiles but rather distinct iron horizons and concretions associated with bentonite beds (altered volcanic ash) as illustrated by Figure 9. While in general, their observations are accurate (Figure 10), uniformitarians seemed to emphasize those associations of fossil wood and high-carbon sediments, even though the "Fossil Forest" does not rest on such shale. The problems with the "petrified forest" interpretation are similar to those found at Yellowstone (Coffin, 1997).

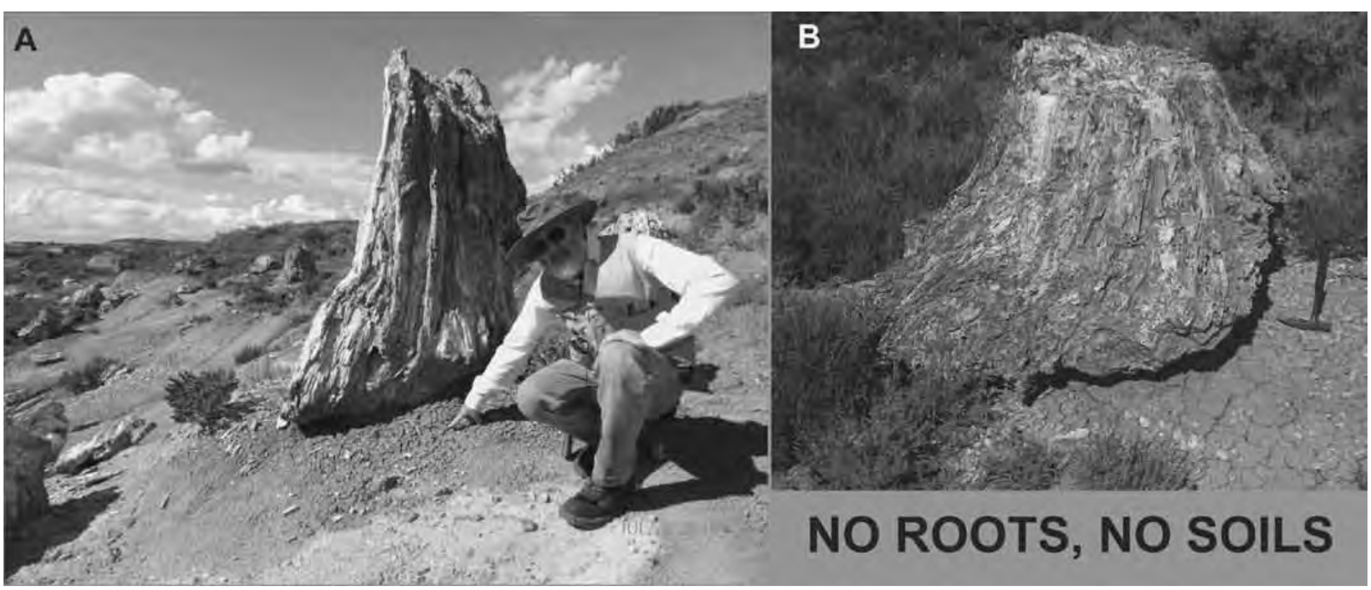

Figure 8. A: Portion of one layer of vertical petrified trees in the "fossil forest" of Theodore Roosevelt National Park. Peter Klevberg pointing to the lack of a soil under the vertical tree stump. B: Close up showing no soil below a stump from the overlying stump layer, which also had no roots.

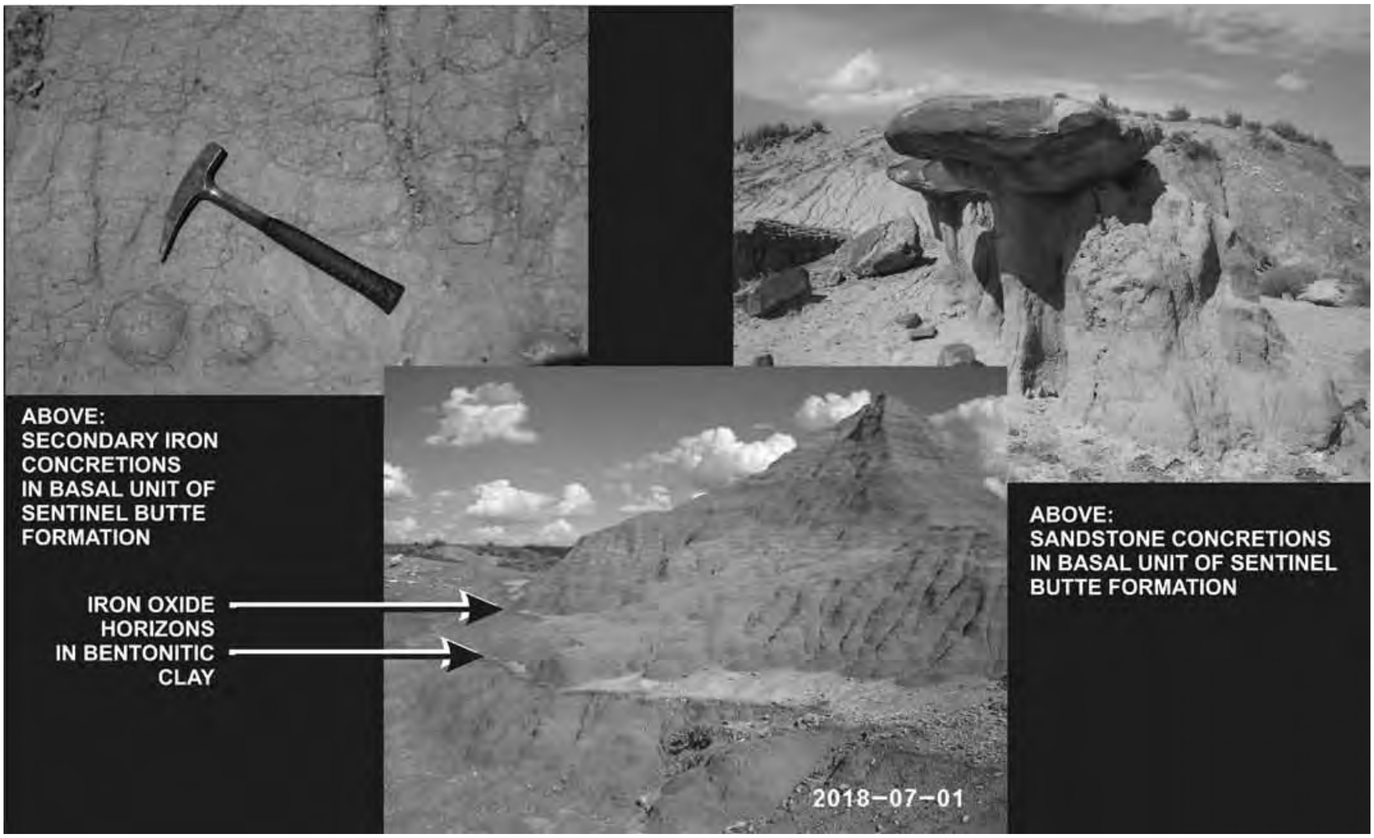

Figure 9. Iron oxide is notable in distinct horizons in bentonite beds and as concretions in sandstone and claystone. These examples are from the basal Sentinel Butte Formation in the "Petrified Forest" of Theodore Roosevelt National Park, South Unit.

The Yellowstone "Petrified Forests"

We have observed other areas with vertical, petrified trees that are almost always considered an in situ fossil forest. The so-called Yellowstone fossil forests probably represent the best example for secular scientists. In several steep to near-vertical slopes, numerous vertical and horizontal trees can be observed. As many as 65 layers of trees are claimed at Specimen Creek, northwest Yellowstone National Park (Figure 11). It is claimed that they represent tens of thousands of years of successive forests, much too long for the short timescale of the Biblical Flood. Some anti-Christian skeptics, once young-Earth creationists, claim they lost their Christian faith because of the Yellowstone "petrified forests" and consider them definitive proof against the Bible (Numbers, 2006).

In examining this and any other challenge, we must first examine the data, like a detective gathering clues in a forensic reconstruction. This forensic approach to geology must be used because no one was present to observe the events being studied. As unique, unobserved events, indirect clues are the best available evidence. As an aside, this is where Earth history and pure science diverge (Reed and Klevberg, 2014a, 2014b). Science investigates the timeless principles of the Universe; Earth history uses science indirectly, forensically. Without the ability to run controlled experiments or multiple observations, we are left with an inherent uncertainty, although the scientific method is still used in these forensic investigations. So, the analogy of detective work is widely accepted.

The first striking feature is the association of the trees and host rocks. The petrified trees are found in volcanic debris flows, called *lahars*. Numerous stacked trees are found in about a dozen locations with isolated trees in between. These rocks are the Absaroka Volcanics of the Absaroka Range, a thick series of volcanic breccia flows of mostly reworked andesite outcropping in northern and eastern Yellowstone Park and adjacent areas. (Breccia is a cemented rock composed of broken angular fragments. Andesite is a type of igneous rock, intermediate between black basalt and

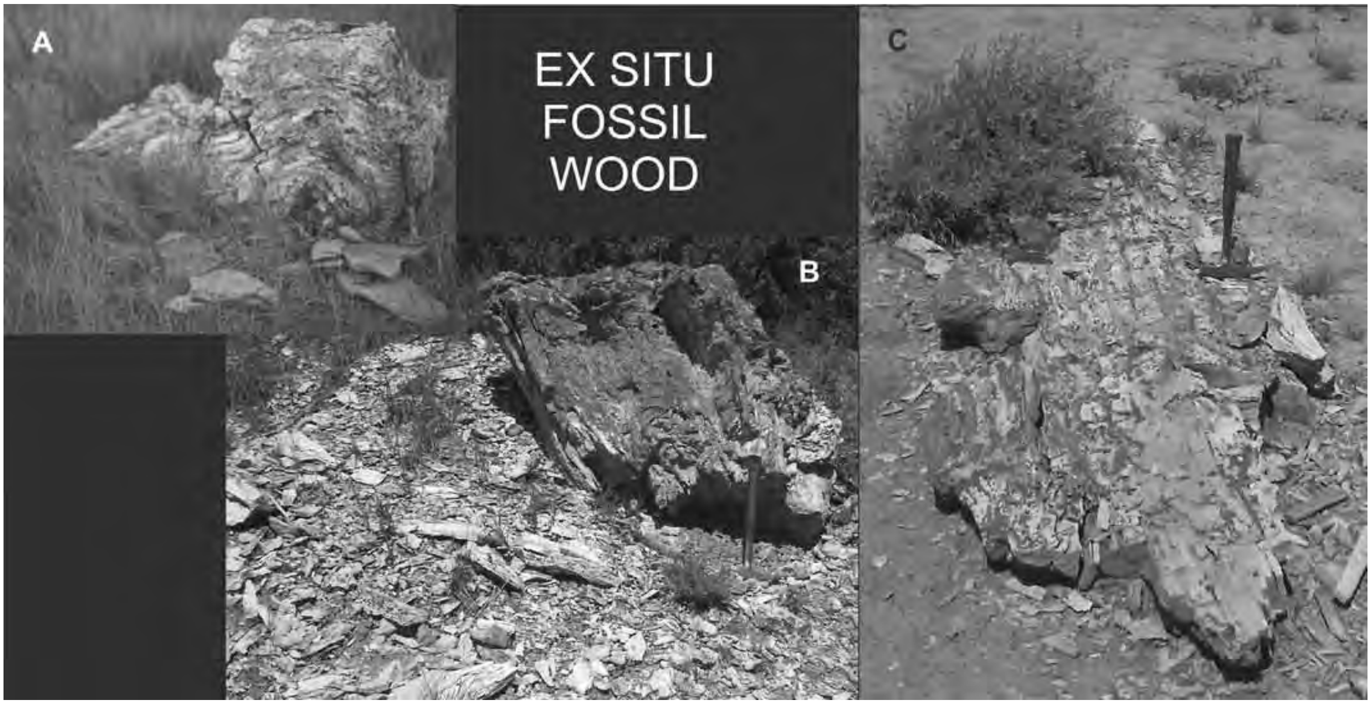

Figure 10. Other than stumps, petrified wood is found as: A. large pieces of stumps or burls, B. other fragments, and C. flattened logs. These are clearly not in growth position. Note Rock hammer for scale.

pale rhyolite, typically emitted by stratovolcanoes, or cone-shaped volcanoes.) Because breccia indicates reworking, the original andesite flow probably formed over a very large area nearby before breaking up and being redeposited in volcanic debris flows. The Absaroka Volcanics accumulated horizontal layers over more than 23,000 km^2, and the formation contains a volume of rock of about 30,000 km^3 (Feely and Cosca, 2003). The formation's thickness exceeds 1,830 m (6,000 ft.) in places (Sundell, 1993). This environment of deposition would be extremely inhospitable for tree growth.

Once again, the hypothesis of "petrified forests" is negated by the evidence. Forests are commonly rich ecosystems with a diversity of organisms and much organic matter in various states of decay. This is not what is observed in the fossil material. In examining the trees in depth, one finds that there are no soils, bark or

Figure 11. Numerous layers of vertical petrified trees at Specimen Creek, extreme northwest Yellowstone National Park.

Figure 12. Vertical tree with no roots in Absaroka Volcanics on Mount Hornaday, northeast Yellowstone National Park (David Anderson provides the scale).

Figure 13. Broken long root from a vertical stump at Specimen Creek, northwest Yellowstone National Park. (Perry Fishbaugh pointing to the end of the root.) The root of a growing tree crosses perpendicularly over the petrified root.

branches, long roots are mostly missing, there are no animal fossils. Tree rings correlate *between* different layers (Arct, 1979, 1991), and the 200 species of trees grow in widely divergent climates (Oard, 2014). Figure 12 shows a petrified tree within a lahar in Yellowstone National Park with no roots, while Figure 13 shows a rare example of a long root from a vertical petrified stump. The late Dr. Harold Coffin, who had extensively examined the Yellowstone petrified trees over dozens of years, thought they were best explained by sinking trees from a floating log mat during the Genesis Flood, similar to what has been observed on Spirit Lake north of Mount Saint Helens (Coffin, 1997). Figure 14 shows a schematic of the process. The analogy extends to volcanism also, which seems to be commonly associated with many of the fossil wood localities that appear to be diluvial in origin.

Other "Petrified Forests"

Oard has examined several other "petrified forests," such as at Ginkgo Petrified Forest State Park, near Vantage, Washington (Figure 15); a coal mine near Sutton, Alaska (Figure 16); massive stumps at Florissant, Colorado (Figure 17); and upright petrified trees in the western Bighorn Basin, Wyoming (Figure 18) (Oard, 2014). Many other areas of the world show such vertical petrified trees. The vertical trees near Sutton, Alaska, and Florissant, Colorado, have no roots and soils, just like the vertical trees in Theodore Roosevelt National Park.

The Problem of Silicification

Wood is petrified predominantly by various forms of silica (Hellawell et al., 2015). Petrification normally is the same as *replacement*—the complete replacement of the organic material by inorganic chemicals. But, in petrified wood, the organic structures often are not totally replaced. Some scientists believe that we should not use precise definitions for the state of the wood (Hellawell et al., 2015). Regardless, there is usually little organic matter left in petrified wood (Grimes et al., 2015). The numerous, huge logs in Petrified Forest National Park in Arizona (Figure 19) are a major exception in that the logs are just permineralized and not replaced (Akahane et al., 2004). *Permineralization* is the addition of silica or other lithification agents into the spaces between cells and within cells without replacing the organic matter. A minor form of petrification is by pyrite (FeS_2), but it requires very special conditions and must happen rapidly (Grimes et al., 2001).

Some claim that petrification should take millions of years, but like many slow processes observed today, time is only one variable (Daniels and Dayvault, 2006, p. 209). Moreover, could a log remain in the ground for millions of years without decaying away? It is now known that under the proper conditions *at present*, petrification can occur in years (Akahane et al., 2004). But of course as petrification proceeds and porosity decreases, the time to petrify increases, and this is where uniformitarian scientists still believe petrification must take a long time (Daniels and Dayvault, 2006, p. 181). Reed (personal communication) has observed worked wood from the Colonial Period settlements of the 18th century along the Black River Swamp in South Carolina that petrified within three centuries (Figure 20).

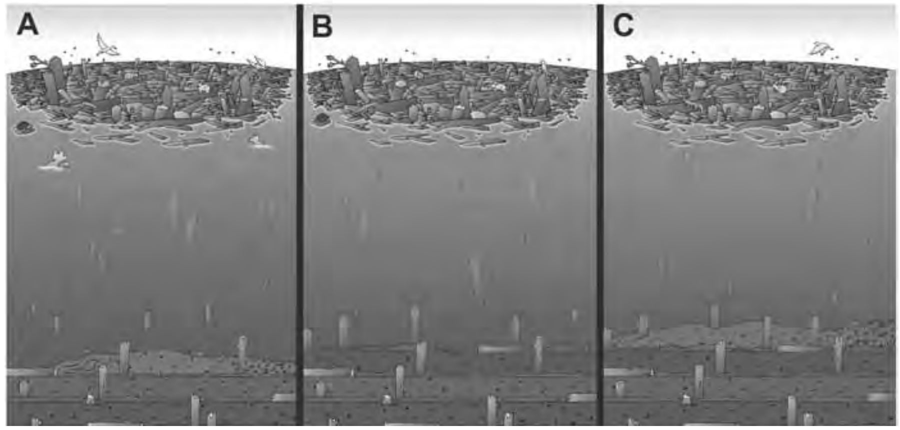

Figure 14. A log mat with trees sinking vertically to the bottom, while the bottom is collecting deposits horizontally from volcanic debris flows (courtesy of Keaton Halley). 'A' shows a log mat with many trees sinking vertically to the bottom. 'B' shows the vertical trees after sediment had been deposited. 'C' shows the next pulse of sediment spreading along the bottom of the Floodwaters.

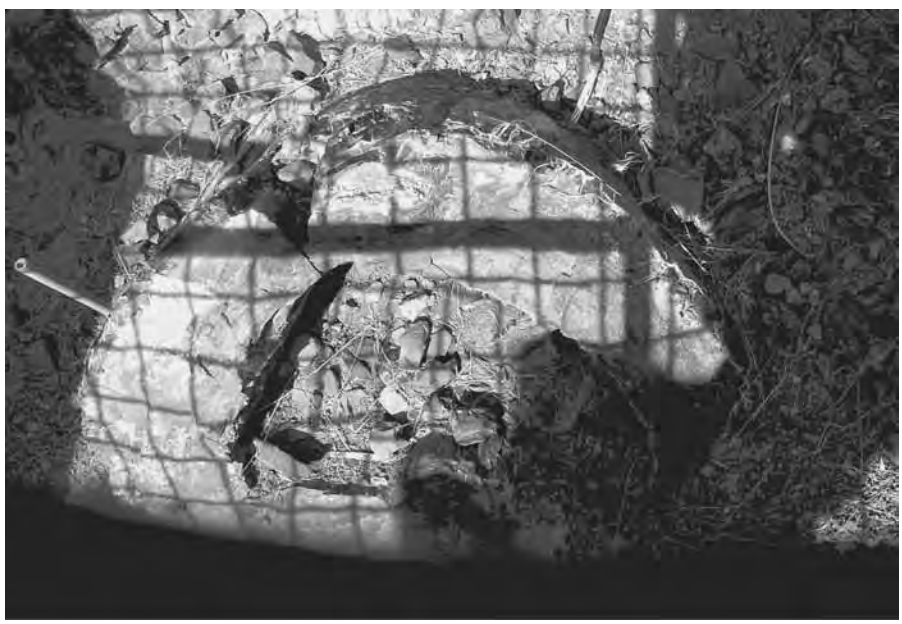

Figure 15. Tilted petrified log in a wire cage within the Columbia River Basalts at Ginkgo Petrified Forest State Park, Vantage, Washington. The log is hollow with rubble in it.

The specific way wood becomes petrified is not precisely known, but researchers are starting to understand it better (Mustoe, 2008). Hellawell et al. (2006, p. 79) exclaim: "Despite considerable progress made in the past, many details of fossilization by silicification remain unanswered…" One of the issues is to understand why silica is the predominant petrifying chemical. Researchers claim it is because wood has an affinity for silica (Ballhaus et al., 2012). Apparently, the shape of the wood first becomes 'templated' by amorphous silica, called opal-A (Mustoe, 2008). Then opal-A is replaced by opal-CT and chalcedony, other forms of silica, making opal-A actually rare in petrified wood. Some researchers had thought chalcedony replaced opal-CT, but apparently that is not the case. Quartz is also found in some petrified wood (Mustoe, 2008).

Figure 16. Two petrified trees, up to 4 m tall, from a coal mine north of Sutton, Alaska. Notice the lack of roots or a fossil soil profile.

Figure 17. Vertical Redwood tree at Florissant Fossil Beds National Monument in Florissant, Colorado. Some of the stumps in the area were over 3 m in diameter. Notice the lack of roots or a fossil soil profile.

Although researchers today are discovering that petrification does not take millions of years, they still believe it takes years to thousands of years or a long time (Daniels and Dayvault, 2006). Some admit that the time factor is still unknown. However, there are indications in the fossil record that the process can be much faster than researchers are willing to admit:

> The time scales of silicification cannot be quantified, but the silica precipitation rates observed and the excellent preservation states of cellular details in Chemnitz (Rößler, 2001) do suggest that much of the mineralization was accomplished within weeks to months after deposition of the pyroclastics. (Läbe et al., 2012, p. 841)

Chemnitz is a so-called fossil forest at Chemnitz, Germany. An experiment within hot springs in Yellowstone National Park, Wyoming, showed that significant silicification had already begun within one year (Channing and Edwards, 2004).

The fossil wood of the Rhynie chert, Scotland, with exceptionally preserved fossils in a supposed early Devonian chert, must have been petrified within a matter of weeks (Ballhaus et al., 2012). Petrification was so fast that "metabolic processes" were preserved:

> Silicification also replaced the organic cellular tissue with SiO_2; so thoroughly that many silicified trees consist of close to 100% SiO_2, so delicately that the minutest structural details of the wood cells are retained..., yet so rapidly (cf. Rhynie chert) that even metabolic processes on the subcellular scale can be arrested in time and then reconstructued.... (Ballhaus et al., 2012, p. 62)

Preservation of cells with visible details, including lack of decay, would require very fast fossilization indeed. Daniels and Dayvault (2006, p. 188) state:

Figure 18. One of many vertical petrified tree trunks at Dry Creek Petrified Environmental Education Area, about 24 km east of Buffalo, Wyoming. This metasequoia tree trunk is almost 1.5 m in diameter.

> The crystallization process overwhelms and obliterates antecedent components. So too do the microscopic details of the original wood diminish as the quartz crystallizes. It is remarkable that any original wood textures remain, much less that many microscopic cellular structures persist.

Very rapid petrification in the Rhynie chert wood also includes the petrification of very delicate plant structures (Kerp et al., 2004). Ballhaus et al. (2012, p. 63) even state:

> Finally, the amazing biological details preserved by the silica-rich hydrothermal solutions that formed the Lower Devonian Rhynie chert … is feasible only if the replacement

Figure 19. A petrified tree in Petrified Forest National Park, Arizona (Kumar Appaiah, Wikipedia-Commons CC-BY-SA-2.0).

Figure 20. Observed worked wood from the Colonial Period settlements of the 18th century along the Black River Swamp in South Carolina that petrified within a few centuries (photograph courtesy of John Reed).

> by silica occurred within a matter of weeks.

Some researchers think that silicification is aided by hot water in the environment (Läbe et al., 2012). The water possibly was in the vapor phase, since there are no fluid inclusions. In fact, silica is more soluble the higher the temperature and pressure (Manning, 1994), but of course dissolution of silica in ground water only works in rocks with high silica content in the first place such as volcanic ash (Davis, 1964), abundant in Theodore Roosevelt National Park. On the other hand, hot environments cause more rapid degradation of the wood, which also helps silica penetrate better (Channing et al., 2012). So, if hot silica-charged water or vapor is responsible for petrification, then the process must operate extremely fast before the wood degrades.

We have observed little, if any, degradation of the wood in petrified trees, reinforcing the rapidity of petrification. One would expect to see much rotting of the wood if the petrification process took even the thousands of years necessary for the uniformitarian model. Given the lack of silica in today's ground water, except in local areas such as volcanic areas or hot springs (Davis, 1964; Daniels and Dayvault, 2006), it is a mystery why so much well-preserved wood, showing little decay, even exists. Moreover, modern examples of wood petrifying are rare and show that the wood is only partially silicified, even in very special environments, such as the silica-rich hot springs of Yellowstone National Park (Hellawell et al., 2012). However, Yellowstone National Park really does not answer the question of why there is an abundance of petrified wood:

> Clearly, the Yellowstone Park situation is special and perhaps not generally applicable to the majority of environments in which silicified logs or wood are found in the fossil record. Fundamental parameters for silicification appear to be elevated concentrations in SiO_2 aqueous species and the rapid burial of a tree to isolate it from aerial oxygen. (Hellawell et al., 2012, p. 86)

Such a deduction would also apply to Theodore Roosevelt National Park trees.

Trees buried before the last major eruption of Mount Saint Helens only show incipient silicification (Karowe and Jefferson, 1987). Moreover, hot spring "environments" cannot account for the widespread petrified wood in the fossil record:

> However, the percentage of petrified wood that forms in hot spring environments is miniscule compared to the total volume of petrified wood in the world. Wood petrified in hot spring environments is not an accurate representation of the average time required for conversion of wood to stone in a sedimentary basin. (Daniels and Dayvault, 2006, p. 209)

So, the abundance of petrified wood is not readily explained by uniformitarianism. Those of today show rare silicification in hot-spring environments, although many fossil wood sites are associated with volcanic ash or volcaniclastic environments, which are high in silica (Daniels and Dayvault, 2006). However, the silica in the volcanic ash needs to be dissolved by much heat and enter the wood in hydrothermal solutions, since the solubility of quartz does not occur until a temperature of 70°C and increases exponentially above 70°C (Bjørlykke, 2014).

In summary, the petrification of wood requires specific conditions. The wood must first be buried rapidly (Ballhaus et al., 2012). Second, the wood must be buried in a water- or fluid-saturated environment, or else the wood rapidly decays in a matter of a few years (Daniels and Dayvault, 2006). And even if buried in a water-saturated environment, if it dries out, the wood will rot. Third, there must be an abundant source of silica (Daniels and Dayvault, 2006), which could occur in volcanic environments under the right conditions. Metasomatism (fluid-dominated metamorphism) altering igneous and metamorphic rock can also be a source of silica deeper down in the Earth (Manning, 1994), perhaps indicating the source of silica for the silica-rich water is from the mantle. Fourth, there are signs of very rapid petrification, which the researchers seem to downplay, especially since the fossil species are native to moister climates where rapid decay would result. The Genesis Flood provides a superior mechanism, while uniformitarianism does not.

Vertical Trees Explained by Sinking Logs During the Flood

The vertical trees in Theodore Roosevelt National Park and elsewhere cannot be explained by uniformitarianism. But the proposed model of floating log mats during the Biblical Flood (Figure 14), reinforced by the empirical observations at Spirit Lake (Morris and Austin, 2003), provides a good explanation of "petrified forests." The Deluge also appears to have been a time of significant volcanism, which would have provided one source of abundant silica. It also explains many related mysteries of the rocks and fossils, such as coal, insect fossils, amber, insects in amber, warm-climate plants and animal fossils at high latitudes, the mixture of plants from warm and cold climates, and postdiluvian biogeography (Oard, 2014). These log mats, floating on the Floodwaters, would often be of huge scale, both in extent and thickness, since the antediluvian biosphere had roughly ten times the amount of plants and trees, based on the estimated amount of coal (Archer, 2010). And just like at Mount Saint Helens, as the log mats drifted, some logs would have become waterlogged and sunk vertically.

With a focus on the petrified stumps at Theodore Roosevelt National Park, we can also surmise that violent volcanic explosions, such as occurred at Mount Saint Helens, would also blast away most of the trees leaving stumps that could later be transported and deposited. Roots could be lost during transport or by collisions with other trees in the log mats. Such a mechanism would also rub off bark and branches. So, diluvial log mats can explain the vertical petrified trees, including those at Theodore Roosevelt National Park. The trees were buried under hundreds of meters of wet sediments (see Part I). The pressure of the accumulating sediments would force the pore fluids to move under the pressure of compaction. Possibly the sediments became hot, more likely were deposited already hot, so that the silica in the volcanic ash and other sediments dissolved and rapidly moved within the hydrothermal flow. Alternatively, the hot, silica-rich hydrothermal flow could have come from deeper down in the thick sediments. This hot silica would petrify the wood quickly before it rotted.

Conclusions

Two significant evidences of the Genesis Flood have been presented in this series. The first is the nature of the Williston Basin in general and the Fort Union Group in particular. Gravel-capped planation surfaces are found here, as they are in many places of the world, and these indicate diluvial processes significantly different from processes we see today. Only large, energetic currents, such as the retreating Floodwaters, would erode the planation surfaces, and these currents would also be required to round and transport large quartzite clasts over hundreds of kilometers. The laterally extensive strata of the Fort Union Group are themselves a witness to the scale of the depositional event. The second evidence as presented in this paper is the fossil wood. We conclude that these physical evidences provide insight into Earth history.

We have examined a classically-interpreted "petrified forest" in Theodore Roosevelt National Park. Despite the uniformitarian claim of in situ growth, the vertical trees have no roots and no soils. Therefore, they did not grow in situ but can be readily explained by the Deluge. Catastrophic processes (e.g., lahars) probably initially sheared the trees off at about 1 to 2 m high. The stumps could have been subsequently transported, leaving the roots behind, perhaps as they were broken off in transport. If the stumps were uprooted like modern windfalls, most of the roots would be severed at various distances from the trunk. During flood transport, the roots could have been knocked off during turbulence with logs banging into other logs. Then the stumps would have sunk vertically, heavy-end down, from the log mats, as they became waterlogged.

The traditional story taught at Theodore Roosevelt National Park and other "petrified forests" is the growth of a forest over a significant time followed by its preservation and fossilization. However, what we actually observed were stumps that, although upright, lacked root systems and paleosols. While admittedly a matter of historical conjecture rather than scientific observation, the fossils can be evaluated in the light of science. Just as the eruption of Mount Saint Helens in 1980 blasted trees loose from the mountainside and into Spirit Lake, so these North Dakota fossil trees may have originated far from where they are now. While the stumps are of various heights, they are mostly upright. As the trees in Spirit Lake often became waterlogged and sank root-end down, so these stumps probably sank heavy-end first as they became waterlogged. This could explain the abundance of stumps and paucity of logs or smaller pieces in this "petrified forest." Abundant silica from the volcanic ash contributed to their petrification, and that altered ash (bentonite) is what we observe under the stumps. No soil horizons are observed because no soil horizons ever formed. This diluvial explanation fits the facts far better than the traditional story.

These same issues are seen in the "petrified forests" of Yellowstone National Park, as well as those in Arizona, Wyoming, Washington, and Alaska. Ring matches between different levels of fossil trees, polystrate tree trunks, very few roots, absence of bark, many species from different climatic zones–these all indicate that the trees were transported; they did not grow in place. Flood log mats (and in some cases, debris flows) can explain mixed assemblages of fossils and can readily explain the petrified trees, including those at Theodore Roosevelt National Park.

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