The Puzzle of the Petrified Trees

How can we explain, within a short biblical chronology, fifty superimposed layers of petrified trees in apparent position of growth?

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For years geologists and paleontologists have made certain assumptions that on the surface seemed safe but that later have been shown to be erroneous or flawed. Included among these is the assumption that all erect petrified trees are in position of growth (autochthonous). Because evidences of upright trees in the fossil record have strongly influenced the development of the geological time scale, creationists who believe in a universal flood and a short chronology for life on earth need to study this phenomenon carefully.

Historical Review

During the 18th and the first half of the 19th centuries, deluge geologists, who accepted the biblical narrative of a worldwide flood, found their colleagues deserting them philosophically because of perceived evidences of long ages in the geologic record, especially as suggested by vertical tree stumps in the Carboniferous period of Europe and Canada.[1] Coal beds could not have been deposited by the biblical flood if trees *in situ* are found within or between the coal seams.

Charles Lyell saw erect petrified trees as strong evidence for significant time in the history of earth, a major consideration that he successfully promoted in his famous *Principles of Geology*.[2] This dominant view, which developed during the latter half of the 19th century (that erect trees in coal beds were in a growth position), was challenged for a few years near the close of the century when Henry Fayol, a French geologist working for a coal company, published his research on the flotation of plants and trees which he had carried out in coal-washing ponds.[3] More recent studies, limited to the horsetail (*Equisetum*) gave similar results.[4]

During most of the 20th century, uniformitarian thinking has dominated geology, and little consideration has been given to the allochthonous (transported) origin of coal or petrified trees.

Characteristics of a Living Forest

Is it possible to determine whether the trees found in a petrified forest are in a position of growth or were transported—whether they are autochthonous or allochthonous? The answer to this question is best reached by first noting certain features of living forests.

1. A growing forest produces a soil cover unless the ground is too steep and subject to erosion. A soil profile usually consists of coarse, dark, poorly decayed humus at the top, which grades downward into light-colored, finely decayed organic matter.
2. When trees are mature, leaves, needles, flowers, pollen, cones, and seeds are scattered by wind, water, and insects. Usually there will be an inverse relationship between the abundance of plant parts in the soil and the distance from the tree that produced them.
3. Trees that experience similar climatic and environmental conditions tend to have similar growth responses. Drought is usually reflected in the production of narrow growth rings; whereas the availability of plenty of moisture usually causes the formation of broad rings. This is especially evident in trees growing under stress.[5]
4. In a mature forest growing on a flat surface, dead trees in varying stages of decay lie scattered around on the ground. Piles of bark accumulate at the bases of dead snags. The roots of standing living trees are intact and unbroken.
5. Most forests in temperate regions are dominated by a few species of trees. Ecological constraints such as temperature, seasons, and precipitation favor certain tree species and inhibit the growth of others.

The Yellowstone Petrified Forests

The most striking feature of the petrified trees found in Yellowstone National Park is the erect position of many of the stumps. Without doubt, this is the strongest argument for the trees being *in situ* (Figure 1). At least 48 superimposed forests have been counted. Growth of this many successive forests one above another would require a minimum of 15,000 years. This estimate is based on 300 rings as an average size of the oldest tree for each level, a conservative figure derived from the Specimen Creek Petrified Forest at Yellowstone

Park. Dorf allowed 200 years for the commencement of reforestation and 500 years as average largest tree size for each level.[6] For 27 levels in the Fossil Forest area, he gave an approximate figure of 20,000 years. Using these calculations, the Specimen Creek Petrified Forest, with more than twice as many tree levels, would require more than 40,000 years. The cliffs and slopes where the petrified trees are exposed represent erosion of more than 1,200 vertical meters (3,400 ft.). By normal geological processes this much erosion could actually represent a more severe time problem than the growth of the trees.

Fig. 1. A portion of the Specimen Creek Petrified Forest in Yellowstone National Park. Note several petrified upright stumps visible on this eroded slope.

If the trees were washed out of a growing forest and transported to their present locations, some of the roots, especially the large roots, would be broken. When trees are bulldozed out of the ground in forest-clearing operations their smaller roots are usually intact, but the larger roots are often broken. I have found several examples of abruptly terminating "broken" roots associated with upright petrified trees in Yellowstone. Many other examples suggest sudden root terminations, but a positive field identification of this feature is often difficult because of post-petrification breakage and the difficulty of digging into the hardened rock in order to expose the roots. Digging around the petrified trees is forbidden in the national park.

Fig. 2. A small petrified stump sits on an organic level. Note the size of the boulders surrounding the tree. Could a small tree remain in its growth position in the face of a mud slide containing such massive boulders?

Successive levels of upright stumps are sometimes only a foot apart vertically. On occasion, a stump arising from a lower level extends through or into the "forest" level above it. In such a case the top of the stump would be exposed during the growth of the trees in the upper level. Had the trees been in a position of growth, one would expect to see decay in the top of the "overlapping" stump, but such decay has not been observed.

Originally more than 100 species of plants were identified in the Yellowstone Petrified Forests,[7] but more recent studies of fossil pollens have increased the figure to over 200.[8] The ecological diversity represented by the species is unexpected if the trees are in position of growth. Species range from temperate (pines, redwoods, willows) to tropical and exotic (figs, laurels, breadfruit, catsura), and from semidesert to rainforest types. This diversity may be an indication that the Fossil Forests are an artificial assemblage of stumps, leaves, and pollen transported from several ecological zones.

If the growth rings of petrified stumps on the same level match, they could have grown contemporaneously where they now are exposed, or they could have grown elsewhere at the same time and then been transported to their present positions. On the other hand, if stumps on different levels have matching ring patterns, they must have grown contemporaneously elsewhere and later been transported to their current locations.

A few trees have signatures (patterns of ring characteristics) that match.[9] Some of these trees are on the same levels, while others are on different levels. These results complement the data that strongly suggest a transported (allochthonous) origin of the petrified forests of Yellowstone.

Characteristically, neither bark nor limbs are preserved on the trees. Some of the large prostrate logs originally had limbs a foot or more in diameter, but now only scoured knots are left. If subaerial volcanic mud slides were sufficiently strong to break off the limbs and strip away the bark from rooted trees, why were the small trees not bent or broken? Yet in some locations one finds small upright trees of only three centimeters in diameter. The boulders in the surrounding conglomerate are sometimes much larger in diameter than are the trees against which they rest. However, of the hundreds of petrified trees examined over the years, only two have been found with a greenstick fracture (evidence of having been broken by horizontal shear). If the trees were transported, that is, if they were moved with the mud or were floated in and dropped down onto the mud and rocks in which they are buried, they would not have been subjected to horizontal shear.

The Organic Levels

Up to this point in our discussion, we have considered only the stumps in the petrified forests of Yellowstone. Associated with the erect stumps at root level are bands of organic matter consisting of leaves, needles, and plant debris that have been interpreted as the forest floors on which the trees grew (Figure 2). However, study of these levels indicates in almost every specific detail that they are atypical of true growth levels.

There is a total absence of differential decay from top to bottom in these organic zones in the petrified forests of Yellowstone. Most of the Yellowstone organic levels have no clear soil profile. That is, organic matter is mixed into the sediments with no prevailing order of density or with the greatest accumulations of organic matter at the bottom in contrast to modern soils.[10]

Nearly 200 thin-section slides of organic horizons have been examined. The evidences of water action are striking. Normal grading (from coarse to fine soil matter upward) is obvious in nearly half of the slides. Reverse grading (fine to coarse soil matter upward) is not uncommon. There also is size sorting of organic material in some levels, showing a relationship between the size of the ash sediment and the size of the organic material—fine sediment, fine organic matter; coarse sediment, coarse organic matter. There is even size sorting of the inorganic particles between leaves, needles, and plant debris. Only the simultaneous settling of ash and leaves from a fluid suspension could achieve this phenomenon.

There is a lack of taxonomic agreement between the fossils preserved in the organic levels and the dominant trees arising from the same levels. One would expect to find many Sequoia needles and some cones, since most of the upright trees are Sequoias. However, large numbers of broad leaves and only a few needles (mostly not Sequoia) are seen in the organic levels. Cones of any type are rare.

Fisk's palynological study (analysis of pollen and spores) found little pollen of sycamore that is well represented by fossil leaves.[11] Wind-transported pollen such as sycamore should have left a rich pollen record in the forest floor. In another palynological study DeBord studied four levels intensively.[12] He found no positive correlation between fossil pollen abundance and the proximity of possible source trees. Pine pollen, for example, was underrepresented in three of the four levels analyzed. The same lack of a positive correlation has been shown for woods.[13]

Trace element studies of the individual beds of volcanic ash and conglomerate indicate similarity of beds. Four distinct signatures repeat and alternate along the

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Fig. 3. Upright stumps make up part of the giant log raft that floats on the surface of Spirit Lake near Mount St. Helens. Those that extend only a few centimeters above the water surface are not visible in this photo.

Fig. 4. This large stump, its top only a meter below the water surface, sits on the bottom of Spirit Lake. It was washed into the lake by the eruption of Mount St. Helens in 1980. As many as 20,000 such stumps are on the bottom of the lake.

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whole 73 levels of petrified trees and organic zones of Specimen Creek Fossil Forest. If hundreds or thousands of years transpired between one bed and the laying down of the next one, each bed should have a different trace element signature. This research, conducted by Clyde Webster of the Geoscience Research Institute, is currently in progress.

Despite their appearance, the Yellowstone Petrified Forests are probably not in position of growth. When all the facts are considered, a catastrophe involving much water and many floating trees is a more satisfactory explanation.

An Explanation

At present, I propose the following model as best accounting for all the data gathered. Volcanic activity in the Yellowstone region occurred while the area was at least partially under water. Trees, some vertical, floated in the water along with organic debris. As trees and vegetable matter became water saturated, they settled down onto the bottom. Within a relatively short time (days or weeks), another slide buried the trees and organic debris. Before each succeeding flow more trees and organic matter settled to the bottom. Thus layer upon layer, trees and organic zones were built up in a relatively short period of time.

After the burial of the trees and organic debris, the water receded and/or the land was uplifted. Petrification occurred quickly before decay became pronounced. As the water drained, erosion on a large scale sculptured the landscape and exposed the petrified trees. In the course of time, glaciation also left its mark on this mountainous region.

Other fossil forests, less well studied, also suggest an allochthonous or transported origin. The petrified forest of North Dakota is atypically devoid of prostrate trees. Roots are absent from the upright stumps. The giant fossil trees of Florrisant, Colorado, are located in lake muds. There is no typical soil level and some roots appear to terminate abruptly. Giant lycopods in the coal deposits of Nova Scotia, Canada, sometimes sit on sterile shale. Marine fossils are asociated with them. Undecayed fossils are located under the bases of some stumps. The general orientation of plant parts clearly suggests water transport.[14] Two forests of Patagonia, Argentina (Sarmiento and Jaramillo), exhibit abruptly terminated roots, water transported twigs, and parallel orientation of horizontal logs.

The Case of Mount St. Helens

When Mount St. Helens erupted in 1980, a giant log raft was created on the surface of adjacent Spirit Lake. Many of the logs floating in the lake, especially those with roots systems, turned upright (Figure 3). Eventually most of these upright floating stumps settled to the bottom of the lake where they now sit in an upright position. Sediments brought down by streams are even now slowly burying these stumps. Another eruption could greatly hasten the process. Based on side-scan sonar search of the bottom, as many as 20,000 erect stumps may now be located on the lake bottom (Figure 4).[15]

This modern example of the transport and deposition of trees in an upright position is useful in evaluating the history of petrified trees. Any catastrophe (such as a volcanic eruption, major flooding, or tsunami) that eroded trees from their growth positions and transported them by or into water could be the mechanism for creating a standing fossil forest that is not *in situ*.

It is unwarranted to assume *a priori*, as in the past, that all upright petrified trees had grown in the place where they are now found. The transport of trees and their deposition in an erect stance is not as unlikely or as rare as might be expected. Upright fossil trees within the geological column are compatible with a Flood model. Actually, when all factors are considered, a catastrophe involving water and many floating trees is a more satisfactory explanation for their origin.◇

NOTES

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