Polystrate Fossils Require Rapid Deposition

Michael J. Oard* and Hank Giesecke

Abstract

Polystrate fossils are one of numerous evidences for the rapid deposition of strata, as opposed to the uniformitarian belief in slow deposition over millions of years. They are briefly described from the Joggins Formation, Nova Scotia; Yellowstone National Park, Montana and Wyoming; Ginkgo Petrified Forest State Park, Washington; the Geodetic Hills of Axel Heiberg Island; the Lompoc diatomite, California; and a diatomite from Peru. Uniformitarian geologists usually ignore polystrate fossils or claim that they represent only local rapid deposition, but they rarely supply any supporting evidence. A new location with polystrate petrified trees is described from open-pit coal mines in Alaska. About twenty upright trees at many different levels support rapid deposition of the strata there. The upright trees can be explained by the creationist log mat model, and evidence from the coal mines supports that interpretation.

Introduction

Uniformitarian scientists believe that most strata were laid down very slowly over hundreds of thousands to millions of years. The rate of deposition may have been on the order of 1 cm per thousand years. Creationists, on the other hand, believe that most strata were laid down very rapidly in the one-year Genesis Flood.

Polystrate fossils demonstrate rapid deposition. Polystrate fossils are fossils that span more than one layer of strata (Rupke, 1970; Morris, 1974; Coffin, 1975; 1983) as indicated by their name; "poly" means many. Most are petrified trees that are perpendicular to the bedding. Polystrate trees commonly are just as well preserved at the top as at the bottom, indicating that the whole tree was rapidly sealed from decay or organism consumption before petrification (Rupke, 1970).

Several locations that display polystrate fossils will be described. The uniformitarian response to polystrate fossils will be analyzed. A study of polystrate fossil trees from open-pit coal mines in Alaska also will be presented as evidence of the weakness of uniformitarian explanations. The article will end by showing that polystrate fossils, as well as coal, can be explained by the log mat model.

Examples of Polystrate Fossils

Polystrate trees were discovered long ago in the coal measures of England and Wales (Ager, 1993). They were found up to 10 m in height in the Lancashire coalfield of northwest England. Ager noted that polystrate trees are known from many parts of the world.

The famous Joggins Formation of Nova Scotia, considered Early Pennsylvanian within the uniformitarian geological column, displays abundant polystrate trees and casts of trees (Coffin, 1975; Morris, 1999; Juby, 2006). At least 76 coal seams ranging in thickness from 0.05 to 1.5 m and 63 "forested" horizons (defined by the levels where vertical trees are found) with vertical lycopsid trees 5 to 6 m tall are known (Waldron and Rygel, 2005). Figure 1 shows one of the trees from the Joggins Formation. One lycopsid cast is as tall as 12 m. Most

* corresponding author. 34 W. Clara Ct., Bozeman, MT 59718.
e-mail: mikeoard@highstream.net

Accepted for publication: November 6, 2006

Figure 1. Polystrate tree several meters tall from Joggins Formation, Nova Scotia. Photo courtesy of Ian Juby.

Figure 2. Four-meter tall petrified tree vertical to layers of volcanic breccia at Specimen Creek, Yellowstone National Park. Photo by David Oard.

of these "forested" horizons are associated with thin organic-rich horizons or mineral soils. Uniformitarian scientists simply assume that these vertical trees grew on the spot. Of course, if this were true, 63 forests must have grown over a long period of time, providing a showcase for uniformitarian long ages.

In fact, the Joggins trees are considered a showcase. The Joggins cliffs are even in the process of becoming a World Heritage Site (Falcon-Lang and Calder, 2004). Charles Lyell considered the Joggins polystrate fossils as the most important verification of uniformitarianism.

> Hailed in 1842 by Charles Lyell (1881, pp. 64–65) as "the most wonderful phenomenon perhaps that I have ever seen," Joggins is mentioned in his *Principles of Geology* (Lyell, 1872) and Darwin's (1859) *On the Origin of Species*. This remarkable section, proposed as a UNESCO World Heritage Site (Falcon-Lang and Calder, 2004), profoundly influenced the young science of geology by serving as a proving ground for the principles of uniformitarianism, in situ botanical origin of coal, and incompleteness of the fossil record (Waldron and Rygel, 2005, p. 337).

A second well-known area for polystrate fossils is in northern and eastern Yellowstone Park and vicinity, in which multiple layers of vertical trees have been noted in the "Eocene" Absaroka Volcanics since the late 1800s (Figure 2). Above Specimen Creek there are 48 levels of upright trees with 17 organic layers with no trees, representing a total of 65 levels (Coffin, 1997, see p. 9). Organic layers also are associated with the layers that contain vertical trees. However, these organic layers are not paleosols because they lack soil profiles, range from a trace to 20 cm thick, lack sufficient organic matter, and show evidence of water sorting (Coffin, 1997). The layers of trees have been defined as multiple forests that grew in place and were covered by volcanic breccia over a period of many tens of thousands of years, although it is admitted by some geologists that a minor proportion of upright trees were transported in lahars, similar to occurrences at Mount St. Helens (Yuretich, 1984).

The petrified trees of Ginkgo Petrified Forest State Park in Washington, just north of Vantage on Interstate 90 along the Columbia River, represent a third location for petrified trees that cut through more than one layer (Coffin, 1974; 1983; Oard, 1995a). The layers are basalt lava flows of the "Miocene" Columbia River Basalts of eastern Washington separated by thin interbeds. There are over 200 species of trees from widely divergent climatic zones—ranging from tropical jungles to the northern plains of Canada and Alaska. Tropical and subtropical trees include eucalyptus, teak, breadfruit, cinnamon, and gum. The northern temperate trees include spruce and birch. Beck (1945) noted that the trees lack bark and limbs, are associated with pillow lavas, and would have required sufficient water to keep them from burning. A number of petrified trees, some quite large, can be observed on a nature walk at the park. Some of the trees are buried *in the basalt at an angle* and do not appear to be burned.

Axel Heiberg Island at 80°N latitude in the Queen Elizabeth Islands of northeast Canada is a fourth classic example of polystrate fossils (Oard, 1995a). Mummified vertical trees and leaf litters were discovered at a number of levels within lignite (weakly developed coal) seams in the Geodetic Hills of Axel Heiberg Island. The paleoflora is exceptionally well preserved and well studied (Christie and McMillan, 1991). Although dated from the Eocene period in the uniformitarian classification (approximately 45 million years ago), some of the wood is not petrified and can be cut with an ax and burned! Upright trees are up to one m high and one m in diameter. They are water logged and often hollow. The trees have a root mass that flares out at the bottom, providing an in situ appearance. Horizontal logs up to 11.5 m long also are observed. Mummified, as well as petrified, trees also occur on other sites in the Queen Elizabeth Islands.

Large fossils, such as dinosaurs, can be polystrate if they extend into more than one layer of strata, or if they are found in fine-grained, thinly laminated strata, believed to have been deposited slowly. One interesting example is a whale fossil found in "Miocene" diatomite at Lompoc, California (Snelling, 1995). Diatomite is a sedimentary rock containing a high percentage of fossil diatoms, a single-celled type of algae that commonly lives at the surfaces of oceans or lakes. These diatoms sink, collecting on the bottom at very slow rates of a cm/1,000 years. Although this whale was discovered at an inclined position, its long axis is actually parallel to the diatomite layers, which had been tilted to a high angle. But still the whale represents a polystrate fossil because the whale would have become disarticulated and the bones destroyed at the slow rate of diatom deposition observed today. The whale and other fossils found at Lompoc imply rapid deposition of diatomite.

Just recently 346 well-preserved whales and other animals were discovered in "Miocene-Pliocene" diatomite in Peru by creationists from Loma Linda University (Brand et al., 2004; Oard, 2004). The whales covered an area of 1.5 km^2 within an 80-m thick layer of diatomite. These whales are polystrate, and their preservation cannot be explained by the slow sedimentation rates suggested by uniformitarian geologists.

What do Uniformitarian Geologists Say?

Uniformitarian scientists simply dismiss polystrate fossils by stating that they represent *local* rapid deposition. Derek Ager (1993) stated:

> Probably the most convincing proof of the local rapidity of terrestrial sedimentation is provided by the presence in the coal measures of trees still in position of life. (p. 47.)

Old-earth theistic geologist Davis Young (1982, p. 83) from Calvin College adds that the recognition of polystrate trees has made no impact on uniformitarian geologists, as if their response invalidates the argument. Their resistance to contrary evidence suggests a strong "faith" component to uniformitarianism. Young follows the example of other uniformitarian geologists and dismisses polystrate trees with the magic wand of *local* rapid burial, even in situations where the trees are allocthonous, or transported into place! Other than the existence of polystrate trees, uniformitarian geologists do not provide evidence for local rapid burial within their paradigm. Moreover, even if rapidly buried, the fossils also must be *rapidly petrified*, otherwise they would eventually rot underground. The scholarly approach would be to examine whether there really is evidence of simple local or more widespread rapid deposition and petrification.

On the Talkorigins (anti-creationist) web site, Andrew MacRae (1997) claimed that polystrate fossils were not a problem for nineteenth-century geologists, again suggesting that modern-day creationists have no case. Although the same as Young's (1982) argument, it is still invalid, depending on "truth by majority vote." MacRae discussed Dawson's early research on the Joggins petrified "forests." Dawson claimed that the trees have extensive root and root systems that penetrate into a coal seam or a paleosol (the underclay). Therefore, he concluded that the trees grew in place and were buried by local rapid deposition. Of course, he does not provide any evidence for such rapid deposition, other than the existence of the polystrate trees. MacRae further claims that in situ trees and "fossil forests" have been documented worldwide. The Joggins example, he claims, solved the polystrate fossil problem over 100 years ago, and creationists are simply out of date for not recognizing it—a typical ad hominem argument. Could it be that most nineteenth-century geologists were wearing uniformitarian blinders? Also, most of the polystrate fossil tree locations discussed show a lack of root balls, limbs, and bark.

Waldron and Rygel (2005, see p. 339) point out that the classical Joggins trees could not have been buried by one catastrophic depositional event. They instead suggest that the trees were buried by frequent, small sedimentation events on the order of 5–12 cm/yr. Thus, complete burial of the trees would have occurred within 100 years (the date likely dependent upon the length of time assumed for the unburied part of the trees to have rotted). However, the multiple, modest depositional events are not supported by any sedimentological evidence.

Ager (1993, see p. 49) calculated that at the average uniformitarian sedimentation rate of the British coal measures, it would take 100,000 years to bury a 10-m-tall tree. However, for the tree to have been buried in 10 years, the sedimentation rate would have to have been one m/year. He believes both estimates are clearly ridiculous and concludes that sedimentation was at times extremely rapid and that other times there was hardly any deposition! But he admits that the strata *look* both uniform and continuous! Ager (1993) candidly admitted that there is no evidence for rapid deposition, other than the trees themselves, and that the strata look like most other strata that are assumed to have accumulated slowly.

The burden of proof lies with the uniformitarian geologists, because there is rarely any evidence of local rapid deposition. It would seem that polystrate fossils in coal would falsify their speculation, since at least the coal is assumed to have formed very slowly.

Polystrate Trees in Alaska Coal Mines

We document another example of polystrate trees that show little or no

Figure 3 (*top left*). Polystrate tree from mine with only one tree. About 3 m of the tree is exposed.

Figure 4 (*bottom left*). Two polystrate trees, up to about 4 m tall, from the third mine. The base of the largest tree is about 0.7 m in diameter.

Figure 5 (*bottom right*). Close-up of polystrate trees in Figure 4.

evidence of locally rapid sedimentation (while writing this article, the lead author discovered that John Mackay [2003] had previously documented some of these fossils). We examined four open-pit coal mines located about 7 km north of Sutton, Alaska, which is 80 km northeast of Anchorage. These coal mines are located within the Matanuska Valley coal field, an eastern extension of the Cook Inlet-Susitna coal province (Anonymous, 1993). The coal deposits occur as part of the Wishbone Hill syncline within the Paleocene-lower Eocene Chickaloon Formation within the uniformitarian geological column. The coal mines are excavated on the north limb of the syncline with the beds generally dipping about 45° to the south. The four mines were all within two km of each other.

One of the mines that we examined had no polystrate trees, and the second mine had only one (Figure 3). We observed eleven polystrate trees at *different* elevations along the excavated cliff face in the third mine (Figures 4–6). The face of the cliff was about 30 m high. Some of the petrified logs had rings, while others did not. The strata are generally contorted adjacent to the logs, but the bedding is undisturbed beyond 2 m from the logs. There are also horizontal petrified trees, one about 8 m long (Figure 7). The trees range in height up to about 4 m tall (Figures 4 and 5). One stump was close to 2 m in diameter.

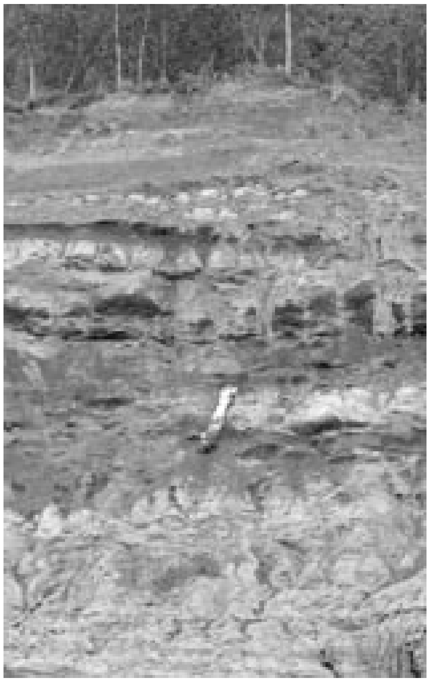

Figure 6. Another 3-m tall polystrate tree in the third mine.

Figure 7. An 8-m long horizontal log.

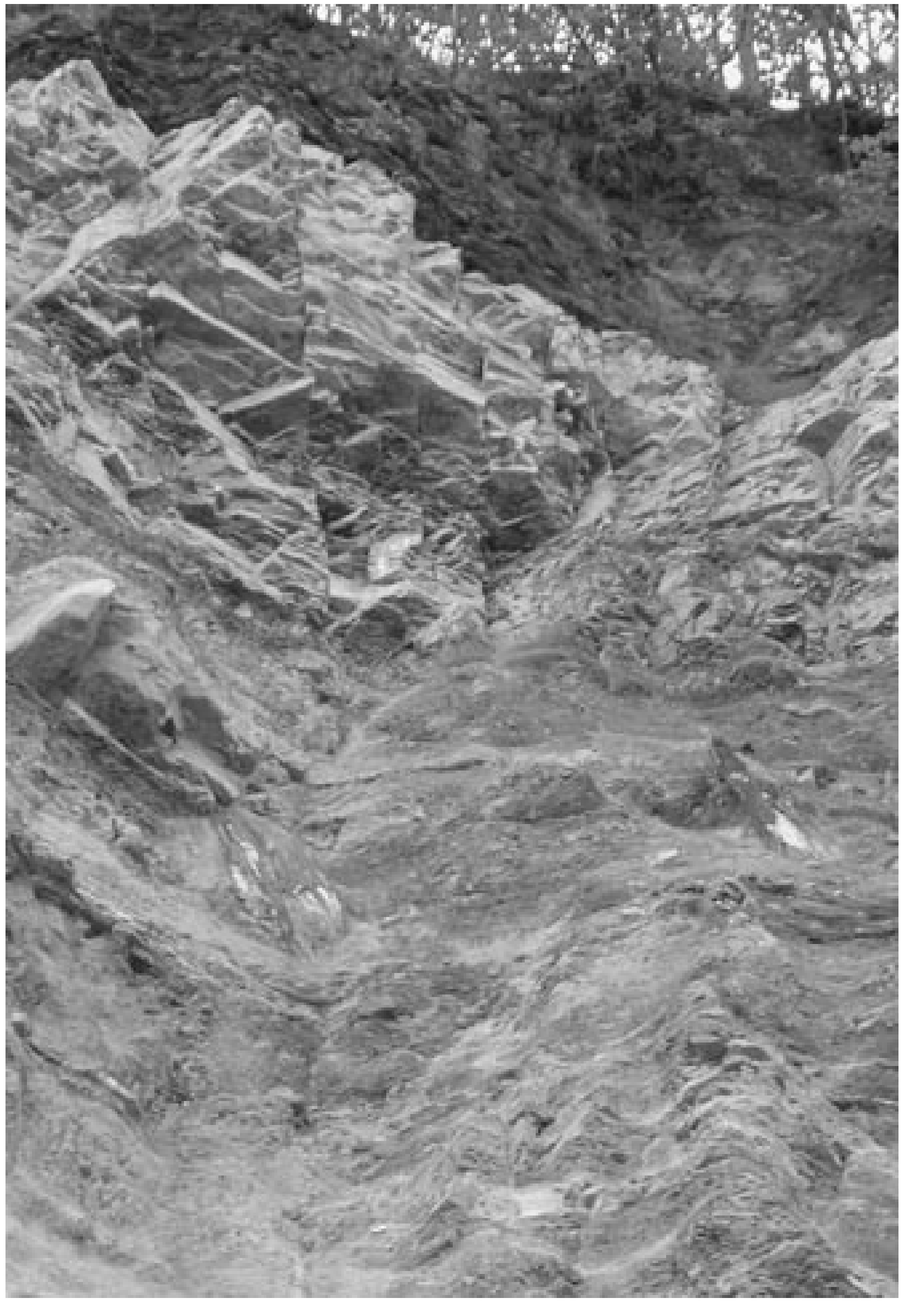

Figure 8. Two polystrate trees oblique to bedding in the fourth mine. About 1.5 m of the trees are exposed.

The fourth coal mine was similar to the third, but did not allow close access to the petrified trees in the approximately 40 m high cliff face. We observed about eight polystrate trees at several different levels on the cliff (Figures 8–12). A few of these logs were at an oblique angle to the bedding (Figures 8 and 11).

The strata were fairly evenly bedded in all four mines and consisted of alternating beds of coal, black shale, volcanic ash, sandstone, and pebble conglomerate (Conwell et al., 1982; Anonymous, 1993). Figure 13 shows an approximately 500-m long panorama of the third open-pit coal mine. There were a few minor faults, highlighted on the figure. So, if uniformitarian scientists want to appeal to local rapid deposition, *all* the strata had to be rapidly deposited across the whole area. However, the uniformitarian model of coal formation and the presence of multiple coal seams demand slow deposition. The uniformitarian geologists usually assume that peat built up in a swamp and was covered slowly

Figure 9. Polystrate tree from the fourth mine with about 3 m exposed.

Figure 10. Another polystrate tree from the fourth mine with about 2 m exposed.

Figure 11. The end of a polystrate tree sticking out of the strata and tilted at an angle to the bedding in the fourth mine with about 0.5 m exposed.

Figure 12. Two more polystrate logs in the fourth mine. The log on the left is about 2.5 m. The thinner polystrate tree to the right has about 1 m exposed.

by sediments. Much later, the peat is compressed to about $^1/_7$ of its original thickness and slowly turned to coal. So, the coal seams must represent thousands to tens of thousands of years of peat deposition to uniformitarian geologists.

But the polystrate trees defy this time interpretation and instead imply rapid deposition of all the strata. This, in turn, casts significant doubt on the uniformitarian coal model. Otherwise, the trees would have rotted prior to burial.

Polystrate Tree Explanation

How would diluvialists explain these upright trees, as well as other polystrate fossils? One explanation is that trees dropped vertically into the strata from a log mat floating on the water during the Genesis Flood (Coffin, 1983; Austin, 1987; Woodmorappe, 1999). During the Genesis Flood, vegetation dislodged by rising waters would float. Many trees would float in a vertical position because of their heavy root ball (Coffin, 1983). The floating log mat model has been applied to the upright trees in Yellowstone National Park (Coffin, 1997), as well as the polystrate trees in the alternating coal seams and other sediments from Axel Heiberg Island (Oard, 1995b). This model requires rapid emplacement of sedimentary beds, lava flows, and mass flows while trees sank.

This model was illustrated during the 1980 eruption of Mount St Helens that dumped a million logs into Spirit Lake (Coffin, 1983; Morris and Austin, 2003). Some of these trees sank to the bottom in a vertical position over time, mimicking the formation of polystrate trees at different levels.

This type of deposition of vegetation fits the evidence found at the open-pit coal mines in Alaska. For instance, leaf litter from both deciduous and evergreen trees is abundant along some bedding planes and shows little or no decay (Figure 14). Rapid sedimentation also would be required to preserve this litter.

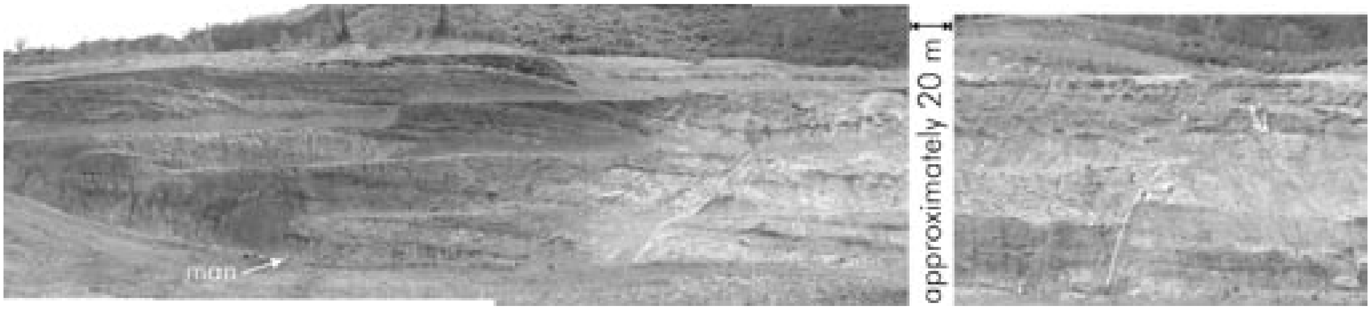

Figure 13. Panorama of the third coal mine starting from east and moving westward. Man for scale standing at the bottom of the excavated cliff at lower left. Note that the strata are evenly bedded with a minor fault toward the right. The section is about 30 m high and 500 m long.

Figure 14. Coalified leaves and needles showing little if any decay. Lens cap for scale.

Figure 15. Polystrate tree about 3 m tall from the third mine showing no roots and a slight bowing downward of the strata.

Furthermore, the bottoms of some of the petrified trees showed *no roots* (Figures 15 and 16). Notice also in these figures that the tree seems to have pushed the strata *downward*. In Figure 16, the strata were bowed downward a distance of about 0.5 m. This would be unlikely if the trees grew in place. However, if the trees sank from a floating log mat, then soft strata would have been depressed into a bowl shape upon impact.

It is interesting that some of the petrified logs are both permineralized and coalified. Some logs were petrified on the interior, but coalified on the exterior. Figure 17 shows one of the numerous trees left by the miners after excavation of the third coal mine. The tree is coalified on the outside, but coalification only locally penetrates into the interior of the tree. In some of the trees with rings, the rings alternated between petrified and coalified (Figure 18). We do not understand the meaning of this pattern. Depending on the concentration of silica, other minerals, and the temperature of the Floodwaters, during and after burial of the trees, a combination of petrification, carbonization, and mummification can affect trees and other vegetable matter.

Figure 16. The lower portion of the left polystrate tree shown in Figures 4 and 5. Notice that the tree has no roots and bows the strata down about 0.5 m.

Figure 17. A petrified tree with a coalified rim that locally penetrates into the tree. There were numerous trees left by the miners in the third mine.

Figure 18. Alternating rings of petrified and coalified wood. The coalified part was narrow compared to the petrified part of the rings. The finger provides scale and points at the exposed part of one coalified ring.

Summary

Polystrate fossils are a strong indication of rapid sedimentation. A number of examples of polystrate fossils were briefly listed. Uniformitarian scientists simply appeal to local rapid deposition to account for polystrate fossils, but they rarely if ever have any evidence for rapid deposition, other than the trees themselves, that is consistent with similar sediments with no polystrate fossils. Thus, polystrate fossils are both positive evidence for rapid deposition and negative evidence for the validity of the uniformitarian paradigm.

Particularly difficult to explain are polystrate fossils found in coal mines. The uniformitarian "swamp" model emphasizes long periods of time. With this in mind, we examined four open-pit coal mines northeast of Anchorage, Alaska. There were about 20 polystrate trees, mainly in two of the mines. The trees were at different levels in the mines, indicating rapid deposition of all the strata, including the coal. The strata were generally evenly bedded in all four coal mines, and the mode of deposition would have been similar over the entire area.

Acknowledgements

We thank North Star Bible Camp of Willow, Alaska, for their generous hospitality in providing housing, meals, and wheels for the study of the open-pit coal mines north of Sutton. We appreciate Ian Juby supplying Figure 1 of a polystrate tree from the Joggins Formation of Nova Scotia. Two anonymous reviewers added helpful comments. This research was conducted with the aid of a grant from the Creation Research Society.

References

CRSQ: *Creation Research Society Quarterly*

Ager, D. 1993. *The New Catastrophism—The Importance of the Rare Event in Geological History*. Cambridge University Press, Cambridge, UK.

Anonymous, 1993. *Alaska's High Rank Coals*. Information circular 33, Alaska Department of Natural Resources, Anchorage, AK.

Austin, S.A. 1987. Mount St. Helens and catastrophism. In Walsh, R.E. (editor), *Proceedings of the First International Conference on Creationism*, volume I, pp. 3–9. Creation Science Fellowship, Pittsburgh, PA.

Brand, L.R., R. Esperante, A.V. Chadwick, O.P. Porras, and M. Alomía. 2004. Fossil whale preservation implies high diatom accumulation rate in the Miocene-Pliocene Pisco Formation of Peru. *Geology* 32:165–168.

Beck, G.F., 1945. Ancient forest tree of the sagebrush area in Central Washington. *Journal of Forestry* 43(5):334–338.

Christie, R.L., and N.J. McMillan (editors). 1991. *Tertiary Fossil Forests of the Geodetic Hills, Axel Heiberg Island, Arctic Archipelago*. Geological Survey of Canada Bulletin 403. Ottawa, ON.

Coffin, H.G. 1974. The Ginkgo petrified forest. *Origins* 1(2):101–103.

Coffin, H.G. 1975. Research on the classic Joggins Petrified trees. In Howe, G.F. (editor), *Speak to the Earth—Creation Studies in Geoscience*, pp. 60–85. Presbyterian and Reformed Publishing Company, Philadelphia, PA.

Coffin, H.G. 1983. *Origin by Design*. Review and Herald Publishing Association, Washington, DC.

Coffin, H.G. 1997. The Yellowstone petrified "forests." *Origins* 24(1):5–44.

Conwell, C.N., D.M. Triplehorn, and V.M. Ferrell. 1982. *Coals of the Anchorage Quadrangle, Alaska*. State of Alaska Department of Natural Resources Special Report 17, Anchorage, AK.

Falcon-Lang, H.J., and J.H. Calder. 2004. UNESCO world heritage and the Joggins cliffs of Nova Scotia. *Geology Today* 20(4):139–143.

Juby, I. 2006. Photographic essay—the fossil cliffs of Joggins, Nova Scotia. *CRSQ* 43:48–53.

Mackay, J. 2003. The evidence from polystrate tree fossils. www.amen.org.uk/cr/evidence/polystrate.pdf (as of November, 2006).

MacRae, A. 1997. "Polystrate" tree fossils. www.talkorigins.org/faqs/polystrate/trees.html (as of November, 2006).

Morris, H.M. (editor). 1974. *Scientific Creationism*. Master Books, Green Forest, AR.

Morris, J.D. 1999. The polystrate trees and coal seams of Joggins fossil cliffs. *Acts and Facts Impact #316*, pp. i–iv. Institute for Creation Research, El Cajon, CA.

Morris, J., and S.A. Austin. 2003. *Footprints in the Ash: The Explosive Story of Mount St. Helens*. Master Books, Green Forest, AR.

Oard, M.J. 1995a. Mid and high latitude flora deposited in the Genesis Flood part I: uniformitarian paradox. *CRSQ* 32(2):107–115.

Oard, M.J. 1995b. Mid and high latitude flora deposited in the Genesis Flood part II: creationist Hypotheses. *CRSQ* 32 (3):138–141.

Oard, M.J. 2004. Dead whales: telling tales? *Creation* 26(4):10–14.

Rupke, N.A. 1970. Prolegomena to a study of cataclysmal sedimentation. In Lammerts, W.E. (editor), *Why Not Creation?* pp. 141–179. Baker Book House, Grand Rapids, MI.

Snelling, A.A. 1995. The whale fossil in diatomite, Lompoc, California. *Creation Ex Nihilo Technical Journal* 9(2):244–258.

Waldron, J.W.F., and M.C. Rygel. 2005. Role of evaporite withdrawal in the preservation of a unique coal-bearing succession: Pennsylvanian Joggins Formation, Nova Scotia. *Geology* 33:337–440.

Woodmorappe, J. 1999. A diluvian interpretation of ancient cyclic sedimentation. In *Studies in Flood Geology: A Compilation of Research Studies Supporting Creation and the Flood*, second edition, pp. 201–220. Institute for Creation Research, El Cajon, CA.

Young, D.A. 1982. *Christianity and the Age of the Earth*. Zondervan, Grand Rapids, MI.

Yuretich, R.F. 1984. Yellowstone fossil forests: new evidence for burial in place. *Geology* 12:159–162.