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Article

Flood Geology's Abominable Mystery

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Flowering plants represent the dominant part of Earth's plant life today. The origin of these plants was once referred to by Darwin as an "abominable mystery" because they appear so late and so abruptly in the fossil record. Flood geologists (creation scientists) seek to explain the origin of fossils and the majority of geomorphic features we see today as resulting from a global deluge. Thus, flood geologists must also be able to explain the observed appearance of flowering plants late in the fossil record.

This article examines the fossil record of plant pollen and spores in light of the predictions of flood and standard geology. Predictions may be made, based on flood geology models, of how pollen and spores would be expected to be distributed in the geological column as the result of a global flood. These predictions may be tested by observations from the fossil record. The fossil pollen and spore record is shown to exhibit features which would not be predicted by modern flood geology theory. Hence, the burden falls to the flood geologist to explain the pattern of pollen and spores in a manner that accounts for the "undeniable reality" of observed fossil succession.

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The earth is covered by thick layers of primarily sedimentary rock sometimes referred to as the geological column. Conventional geological theory interprets these layers as representing events that took place over variable periods of time. In contrast, flood geologists, often referred to as creation scientists, hypothesize that a large fraction of all of these layers of rock resulted from a single universal flood, described in Genesis 6–8, "*by purely natural processes that are capable of being studied to a certain extent in hydraulics laboratories and local flood situations today*."[1] Both parties understand these rock layers to have been formed as part of a real historical sequence of events, albeit, for the latter, possibly augmented by periodic supernatural interventions.

Fossil Succession and the Geological Column

A conspicuous feature of the geological column is the presence of billions of fossils which represent the remains, or evidence of the presence, of formerly living organisms. Equally apparent is that these fossils are found in an ordered sequence and typically distributed only in a limited portion of the geological column. This ordered sequence or succession of fossils is observed as the same sequences of fossil species found throughout stacked layers of rocks around the world. Consequently, any theory claiming to provide an explanation for the origin of the geological

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record must be able to account for this obvious ordered sequence of fossils.

The implications of fossil succession are so staggering and so challenging that many creation scientists have either downplayed or attempted to deny the significance of this record. However, that position has become less common as observed in a published debate between flood geologists John Baumgardner and Michael Oard over competing creationist models of plate tectonics. In this debate, Baumgardner made one of the strongest statements in support of the reality of succession in the fossil record that has been made by any member of the scientific creationist community. While Oard attempted to cast doubt on many aspects of fossil succession, Baumgardner responded, in this extended quote, by summarizing the "facts" that must be accommodated by any flood geology model.

> As a final point, I would like to address Michael Oard's general rejection of the concept of fossil succession in the geological record. Fossil succession represents an undeniable reality of what creationists and evolutionists alike observe in the rock strata. For example, we find no archaeocyathids, a vase-shaped coral-like organism with a double-walled calcareous skeleton, above middle Cambrian strata. We find no pentamerus brachiopods or cystoid crinozoans or psilopsid plants above Devonian strata, no graptolites above Mississippian strata, and no trilobites or rugose corals above Permian strata. On the other hand, we find no birds or angiosperms in strata lower than Jurassic, no mammals in strata lower than upper Triassic, no reptiles in strata lower than Pennsylvanian, and no amphibians in strata lower than Devonian. A similar unmistakable sequence of types also exists in the case of the microfossils.
>
> One can personally examine the actual physical sequence of rock strata with their fossils, starting, for example, at the bottom of the Grand Canyon and continuing up onto the Colorado Plateau at Bryce Canyon. Independent of the names and geological periods that have been assigned to them, these rock units indeed have genuine identity, can readily be tracked laterally for hundreds of miles, and display an unambiguous vertical fossil sequence for anyone who cares to look. Creation tours actually provide this opportunity on a frequent basis. Oard cannot provide a rational defense for his denial of such observable reality. Creationists have long recognized this ordering in the fossil record and have related it to the progressive destruction of ecological habitat as the transgressing waters of the Genesis Flood reached higher and higher topographical regions of the planet. Oard in his mind seems to be equating fossil succession to evolution, not understanding that evolution is merely the interpretation evolutionists are imposing on the observed data. If we as creationists are to make genuine progress in reconstructing the actual history of the Earth in light of God's revelation, we simply cannot afford such denial and misrepresentation of crucially important information.[2]

For Baumgardner, there is no doubt that the fossil record exhibits succession and that many well-known extinct taxa such as dinosaurs and trilobites are found *only* in limited portions of the total geological column.[3] If, as Baumgardner bluntly states, "succession represents an undeniable reality," then this reality begs for an explanation.

Why Fossil Succession?

What are some of the potential explanations for this undeniable evidence of succession in the fossil record? Evolutionary and conventional geological theory was constructed, in part, to provide a framework for understanding the "reality" of the observed fossil succession. These theories state that organisms have changed through time, and during successive stages of organismal evolution, plants and animals became preserved in the rock record. Hence, each layer of rock represents a snapshot of the diversity of organisms that were alive during successive periods of time. In contrast, flood geologists reply that the fossil record represents neither an evolutionary record of organismal change nor a record of vast geological eras.

Regarding the latter view, flood geologists have frequently sought to explain the distribution, abundance, and succession in the fossil record of organisms that are highly familiar to the lay Christian, such as dinosaurs, fish, birds, and trilobites. An example of one of the most common explanations for the origin of these fossils is provided by Whitcomb and Morris in *The Genesis Flood*.[4] They

attribute these characteristics of the fossil record to organisms being drowned in a progressive fashion dictated primarily by their mobility and thus their ability to escape the encroaching waters of the Noachian Flood. Therefore, in their view, amphibians would be the first land animals swept away; followed by reptiles, including the dinosaurs; and then mammals, reflecting the order of fossils in the geological column. Furthermore, Whitcomb and Morris posit that "hydrodynamic sorting along with gravity selectivity of moving water for particles of similar sizes and shapes, together with the effect of the specific gravity of the respective organisms" could account for the pattern of small marine organisms in the fossil record. While roundly criticized by both secular and Christian geologists for being inconsistent with the fossil record, this simplistic model still garners much popular support in the creationist literature as evidenced by the prior quote by Baumgardner.

Any theory that proposes to explain the totality of the fossil record must be able to account for all of the evidence and not just a few of its most obvious features. Both Christian and secular scientists have pointed out serious problems with the Whitcomb and Morris flood geology model, most of which will not be repeated here.[5] Rather, a single challenge to this and all other flood geology models for explaining fossil succession is presented. While not a novel argument,[6] it poses a particular challenge that I refer to here as *flood geology's abominable mystery* for reasons provided below.

What makes one theory better than another? Stephen Hawking provides a response to this question by stating that "a theory is a good theory if it satisfies two requirements: it must accurately describe a large class of observations on the basis of a model which contains only a few arbitrary elements, and it must make definite predictions about the results of future observations."[7] Both conventional geological theory and flood geology claim to explain observations and both can make predictions about the distribution and order of fossils in the fossil record. But which theory best accounts for the data and makes predictions that are borne out by further testing? For flood geology, as envisioned by Morris and the majority of scientific creationist writers, the explanations for the observation of fossil succession involve the two mechanisms stated above: (1) progressive destruction of habitats as the waters rose, combined with animal migration and (2) hydrodynamic sorting based on size, shape, and specific gravity of organisms.

Given these mechanisms, flood geology should make predictions about what one expects to see if a majority of the earth's sedimentary rocks were deposited during a short-term universal flood event. The former mechanism, progressive inundation and migration, ignores the evidence that all of the major environments (e.g., marine, freshwater, and terrestrial), along with the animal and plant communities that inhabit them, change throughout the geological record. Thus, it does not even accurately describe the majority of observations. The latter mechanism, hydrodynamic sorting, is the primary focus of this article. Specifically, the two-part question is asked, what do flood geology models predict regarding where plant pollen and spores should be found in the fossil record, and does the evidence support these predictions?

Pollen and Spores

Plants produce a number of specialized reproductive structures. Of these, land plants produce either spores or pollen (Table 1), most of which are transported by wind, water, or insects. Spores are

Table 1. Major Groups of Land Plants and Their Dispersed Reproductive

Major Groups of Land Plants	Examples	Spores or Pollen?
Bryophytes—nonvascular and seedless	Mosses, liverworts, hornworts	Spores
Seedless vascular plants—vascular plants that do not produce seeds	Lycophytes (mostly extinct today) and ferns	Spores
Gymnosperms—vascular plants with seeds but no fruit	Pine, fir, redwood, spruce, Cyprus, etc.	Pollen
Angiosperms—vascular plants with seeds inside fruits	All flowering plants including grasses	Pollen

dispersive reproductive structures produced by plants such as mosses, lycophytes, and ferns (Fig. 1A–C). Spore sizes vary widely. Most are 30–50 mm in size, but some may be much smaller; others reach as large as 600 μm (more than ½ mm in size, see Fig. 1C) and are visible to the eye (e.g., the brown dust on the underside of some fern fronds). Pollen are reproductive structures and are produced by both gymnosperms such as conifers (e.g., pine, spruce, and fir) and flowering plants (Table 1, Fig. 1D–F). Gymnosperm pollen is easily distinguished from flowering plant pollen because of the different architecture of their pollen walls. Both pollen and spores vary greatly in wall thickness, shape, buoyancy, and specific weight. Pollen grains also range in size typically from 10–50 μm with the smallest being 6 μm (forget-me-not pollen grains). Among the flowering plants, there are many unique morphologies of pollen, some of which are highly characteristic of particular groups. For example, grass pollen grains, which are extremely abundant in modern soils, are distinctly rounded with a single pore. They are usually 20–40 μm in size.

Today there are over 300,000 pollen-bearing species of flowering plants. The nonflowering plants, including the bryophytes, ferns, and gymnosperms, account for about 40,000 living species. Spore and pollen production of many of these plants can be extraordinary. For example, a single male pine cone can produce 600,000 pollen grains with a full tree producing 350 million. A typical oak tree can produce over 100 million per year.[8] The production of pollen in a typical forest is several billion per hectare. Indeed, pollen and spore production is so great that they may be found dispersed everywhere on the surface of the earth, in sediments at the bottom of the ocean,[9] and trapped deep inside ice caps.[10] Because of their resistant outer walls, both spores and pollen are readily preserved in the fossil and recent sedimentary record. For example, a single sediment core from a modern or ancient lake

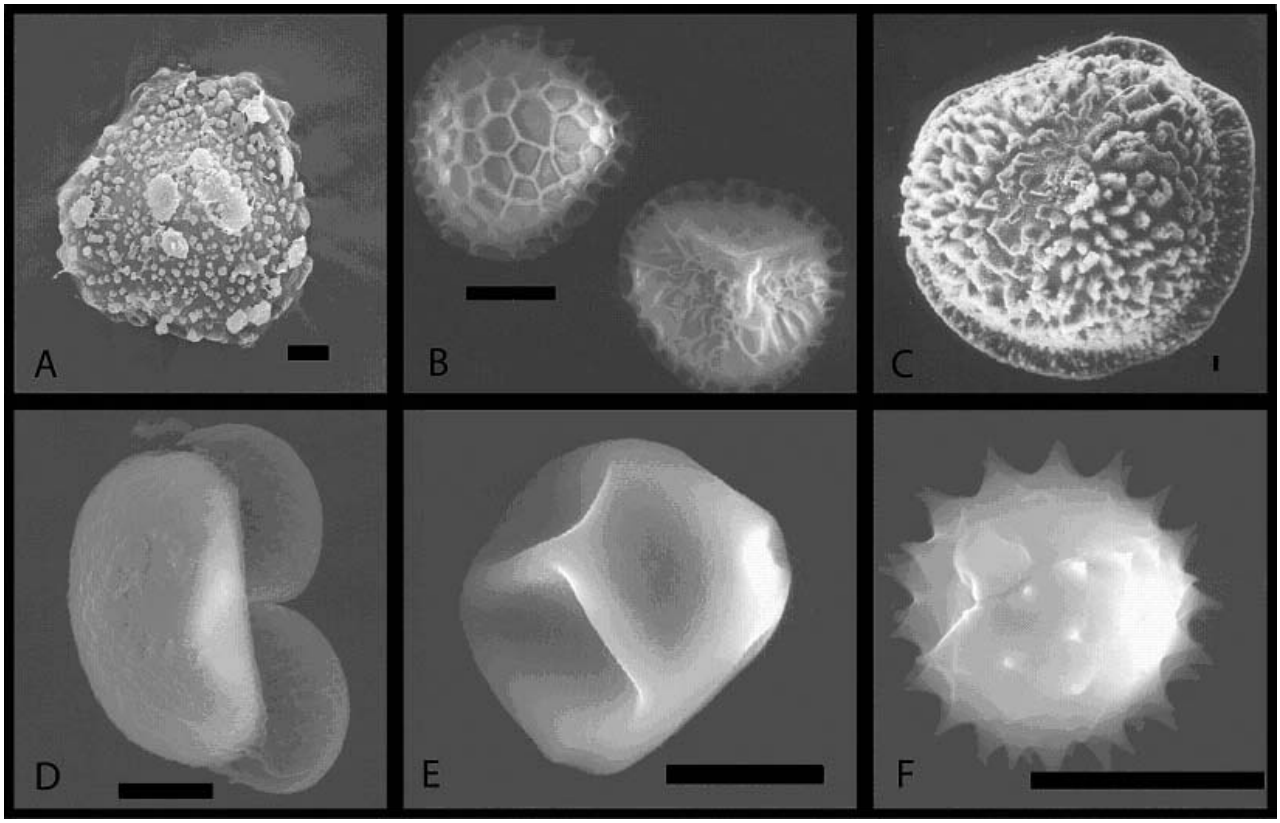

Figure 1. Scanning electron microscope images of representative spores and pollen. For each image the black bar represents 10μm. All images taken by Duff. (A) Spore of *Megaceros*, a hornwort which is a member of the bryophytes which are nonvascular spore-bearing plants. (B) Spores from *Lycopodium*, a seedless vascular plant similar to ferns. (C) Megaspore of *Isoetes*, a seedless vascular plant similar to ferns. These plants produce two types of spores which differ greatly in size. Megaspores are 200–600 μm in diameter whereas the microspores are similar to the *Lycopodium* pictured in B. (D) *Pinus* pollen grain; all pines produce pollen with similar features as pictured here. (E) *Betula* (beech tree) pollen grain. (F) *Solidago* pollen grain; all sunflower plants produce spiny pollen.

can yield hundreds of thousands of preserved pollen grains and spores, some of which originated far from the edge of the lake itself.[11] Likewise, pollen can survive even the harsh conditions of the digestive tract of mammals and become preserved in feces.[12]

Flood Geology Predictions

There is some dispute among flood geologists about what portion of the geological column should be considered the direct result of the Noahic Flood. At a minimum, it is assumed that all layers of rock, as recognized by conventional geology from at least the Cambrian (540 MYA—million years ago) to the end of the Cretaceous (65 MYA), were deposited by the catastrophic forces of the Noahic Flood over a short period of time.[13] Therefore it can be reasonably deduced that any plant or animal remains found in these layers of rock represent organisms that were part of the biota of the world either before or at the time of the initiation of the Flood event. Given this expectation of the geological record by flood geologists, three predictions about the distribution of pollen and spores may be made.

1. Pollen was present in the pre-flood world.

Pollen would have been present in the pre-flood world and can be expected to have been preserved in pre-flood soils and lake sediments during the traditionally defined 1,656 years between creation and the Flood. The Book of Genesis contains no specific references to pollen or spores and so we have no direct revelation that plants at that time produced such structures. However, it is not unreasonable to infer that pollen-bearing plants and thus pollen were present. For example, references to fruit in the Garden (Gen. 3:2), the coverings made of fig leaves (Gen. 3:7), the grain offering of Abel (Gen. 4:3), the "gopher wood" used to construct the ark (Gen. 6:14), the olive leaf plucked by the dove (Gen. 8:11), and the vineyard Noah planted immediately following the flood (Gen. 9:20), all appear to refer to plants that produce pollen. The manner in which these plants are referred to, as if they were part of the common experience of the original audience, gives no reason to invoke a pre-flood world in which plants displayed completely foreign means of reproduction, such that pollen was unnecessary. Furthermore, as will be shown, both the fossil record and their own models restrict the flood geologists' ability to speculate regarding the diversity of pre-flood vegetation.

2. Pollen and spores should be found throughout the geological column.

Flood geologists believe that the billions of tons of coal found in the geological column were the result of rapidly buried pre-flood vegetation.[14] The presence of vast amounts of vegetation prior to the Flood reasonably requires abundant spore and pollen production prior to the commencement of the Flood. For example, large numbers of pine and other conifer trees, all of which produce copious wind-dispersed pollen grains today, are found in the fossil record. Furthermore, since pollen grains and spores

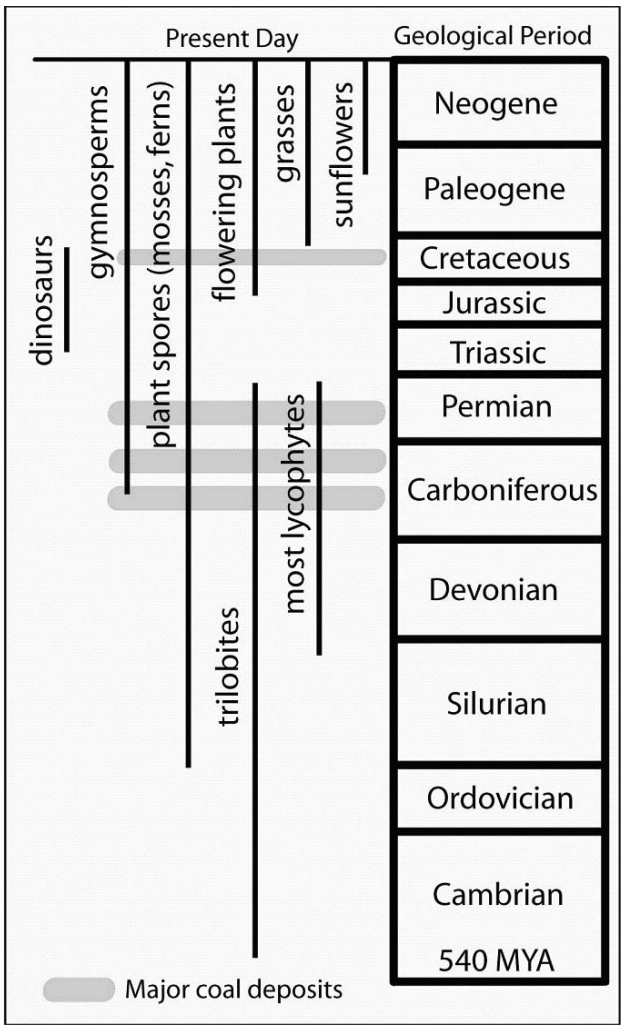

Figure 2. The distribution of some groups of fossils in the geological column. Geological periods are not to scale. Lines show extent of first appearance to last appearance of the fossils. However, densities of fossils during each geological period may vary greatly. The distribution of plant groups represents both pollen/spores and vegetative material, though pollen/spores may appear somewhat earlier than vegetative material.[18] Only the position of major coal seams are shown. Standard geological dates from the 2004 International Commission on Stratigraphy (www.stratigraphy.org/gssp.htm) for the end of the following geological periods are: Silurian, 418 MYA; Carboniferous, 306 MYA; Permian, 260 MYA; Cretaceous, 65 MYA; Paleogene, 33.9 MYA.

are readily preserved and have a wide range of sizes, shapes, and densities which overlap with one another, hydrological sorting mechanisms would not be expected to be able to distinguish between most spores and pollen or even between types of pollen, on a global scale. Thus, it can be inferred that flood geology theories would predict that pollen grains and spores, as a group, should not be found limited to specific portions of the record, but, rather, they should be found throughout the geological column. In other words, there is no known environmentally mediated mechanism by which spores and pollen can be completely separated from one another on a global scale.[15]

3. The location and abundance of pollen and spores should not be exclusively associated with the presence of related macroscopic plant material.

Granted that countless pollen grains and spores would already have been dispersed from the plants that produced them during the pre-flood period, flood geology models can be inferred to predict that a massive worldwide flood would be expected to distribute pollen and spores far, both laterally and vertically, from their progenitors. As a result, pollen and spores should be found frequently with unassociated macroscopic plant material throughout the geological column. For example, if it were claimed that flowering plant vegetation (e.g., oak trees) had greater buoyancy than nonflowering plant vegetation (e.g., pine trees), it could be argued that the former might be deposited in the upper portions of the rock record. However, even if such a hypothesis were warranted, there would be no reason to believe that the pollen (10–100 μm in size) associated with those plants should segregate in close association with the vegetative material (millimeters to meters in length) of the plants that produced them. Thus, flood geological models would predict that pollen and spores would not sort themselves out in the fossil record in direct relationship to macroscopic plant remains.

Pollen and Spores in the Fossil Record

Where have plant spore and pollen fossils definitively been observed in the geological column? Pollen and spores are found primarily in sedimentary rocks that also include land plants and animals. They are not found, or are very rare, in limestone formations and other marine sedimentary rock formations that include fossils such as brachiopods and crinoids. Like the well-known record of fossil succession in animals, plant fossils (which include both macroscopic plant material and microscopic spores and pollen) are also found in a distinctly successional pattern. For example, plants such as the lycophytes and ferns are first found in lower, though not the lowest, layers of the rock record with their first appearance in the Silurian (Fig. 2).[16] The first remains of members of the gymnosperms (conifers including pine trees) are found in early Carboniferous era rocks but do not become abundant until the Upper Carboniferous. It is only within those layers conventionally dated at 140 MYA and younger, beginning in the early Cretaceous era, that flowering plant fossils of any kind have been identified.[17] Hence, a majority of the geological column found worldwide from the Devonian through the beginning of the Cretaceous, has been found to contain only macroscopic (vegetative and reproductive parts) and microscopic (spores and pollen) fossils of ferns and gymnosperms to the exclusion of any evidence of flowering plants. This portion of the geological column can account for many thousands of feet of sedimentary rock on some continents (e.g., a large portion of the Grand Canyon). In addition, the spore and pollen record has been broadly observed to be associated with the macroscopic fossil record of plants with spores and pollen, sometimes being found in rocks just below the first vegetative remnants of plants.[19]

A few examples of data collected from specific locations around the world will serve to demonstrate the absence of flowering plant pollen in large portions of the geological column. A study of the pollen and spores found at Petrified Forest National Park in Arizona reveals spores identified from more than fifty different fossil fern and lycophyte species and pollen from more than eighty species of gymnosperms.[20] To date, no pollen grains of any flowering plants have been identified nor are any of the fossilized trees, which make the site famous, the remains of flowering plants. Rather, the majority of the fossilized trees are a type of extinct conifer. These petrified trees are found in a layer of rock called the Chinle Formation that is found spread across Arizona, Nevada, Utah, and western Colorado. The rocks from this formation are considered to be of Triassic age or older, as dated by a number of other methods not reliant on pollen or spore data.

To date, no flowering plant fossils have been found in any part of this formation. Thus these rocks are from the same part of the geological column which, in other locations around the world, consistently exhibits no flowering plant pollen.

Another example comes from Antarctica where a study of somewhat older Permian age rocks (250 MYA) revealed abundant spores of more than twenty distinguishable fern species, and pollen of about the same number of gymnosperms, but no evidence of any flowering plant pollen.[21] This study also compared pollen and spores from rocks of similar ages from South Africa and Australia and found that spores of the same species were present in those locations as well. In addition, the study showed a correlated pattern of extinction from the fossil record. Similarly, a study of sedimentary rocks at the Triassic-Jurassic boundary (about 215 MYA) in rock formations in Spain revealed more than forty-five species of ferns and gymnosperms but no flowering plant fossils.[22]

One last example involves the study of trapped plant material in amber. Many trees, especially conifers, ooze a sticky sap that can trap insects and catch pollen and spores. When this sap falls to the ground, it may become buried and preserved in a hardened "fossilized" state called amber. While rather abundant in the upper portions of the fossil record, amber (sometimes called fossil resin) is very rare throughout most of the fossil record and is unknown in rocks prior to the Devonian, which is notably when the first tree-like plants capable of producing resin are found in the fossil record. One famous rock formation, dated to the Triassic in southern Italy, is where some of the oldest known amber has been found. In a study of this amber, Roghi et al. were able to collect over 50,000 very small (1–10 mm in diameter) preserved drops of amber from crushed sandstone from specific strata of rocks in two locations more than 100 km apart at the base of the Southern Alps.[23] Microscopic examinations of preserved bits of plant vegetation, spores, and pollen found in these small amber drops revealed predominantly conifer pollen and plant parts with smaller numbers of fern and lycophyte spores. Once again, no pollen or vegetative parts of flowering plants could be identified from this material.

Many more examples of studies of pollen and spores collected from rock layers around the world could be presented with similar results: a conspicuous lack of flowering plant pollen from a large, and stratigraphically consistent, portion of the fossil record. Overall, the spore and pollen fossil record is demonstrated to be one of ordered succession. In addition, spores and pollen are often found preserved in rocks which may contain little or no macroscopic plant remains yet the types of spores and pollen found in these rocks are not unexpected given the macroscopic plants found in other rocks of the same age from other locations. This strongly supports a correlation between observed macroscopic plant succession and microscopic plant succession in the fossil record. This succession consists of only spores and spore-bearing plants found in the lower layers, followed by spores and gymnosperm pollen in rocks that have only fern-like plants and gymnosperms, and then, in the upper portions of the fossil record, spores and pollen from gymnosperm and flowering plants in association with vegetative material of the same plants.

The Pollen and Spore Record and Flood Geology

Given the record of observations of spore and pollen fossils throughout the geological column, are all the predictions based on the flood geology model borne out? Clearly, they are not! In fact, the pollen and spore record is the antithesis of what, a priori, flood geology models would predict. Even the first hypothesis that pollen was present in the pre-Flood world is only partially supported. Yes, there is undisputed evidence of the presence of gymnosperm and flowering plant pollen as well as preserved flowers and cones, in sediments of proposed flood origin. This logically compels the flood geologists to maintain that flowering plants and gymnosperms must have been part of the pre-Flood biota in order to have been preserved by the Flood. However, the presence of these plants and the evidence that they produced abundant pollen, combined with the observation that these plant remains are restricted to a small portion of the geological record, presents a conundrum to flood geologists. If pollen-producing plants were present prior to the Flood, why are those plants and their pollen not found in the lowest layers of the fossil record that represent the presumed earliest stages of the Flood?

Compounding this mystery is the observed order of other plants in the fossil record. While there is missing pollen in lower strata, many spore types associated with many extinct lycophytes and tree-ferns are found in those layers but then disappear in the upper layers of the fossil record.[24] These spores are identified by characteristic patterns on their surface but are very similar in size and shape to other spores found in other portions of the fossil record. No known hydrological sorting mechanism can be employed to tease these spores apart on such a global scale. Transport and depositions of spores have been shown to result in some sorting of pollen based on shape and size.[25] However, these studies find that such sorting occurs primarily on a local or regional scale. Furthermore, even in a local setting such as a stream or estuary, sorting is far from 100% efficient. Pollen are sorted only very roughly into size and shape classes but are still found intermixed. Even less efficient sorting would be expected in a global Flood with its much greater predicted turbulence.

If pollen-producing plants were present prior to the Flood, why are those plants and their pollen not found in the lowest layers of the fossil record that represent the presumed earliest stages of the Flood?

What about the flood geology expectation that spores and pollen grains should be found throughout the fossil record? The studies reviewed above demonstrate that neither pollen nor spores are randomly distributed in the fossil record, nor are they always found together. Spores are clearly found in the lower layers of rock, with pollen restricted to the upper portion of the geological column.[26] Flowering plant pollen also comes in many forms, some of which are distinctive of particular groups of plants.[27] For example, the grasses, which include all of the major grain crops such as wheat, corn, and rice, are nearly ubiquitous on the face of the earth today. These plants all produce spheroidal pollen with a single round pore that is very similar across all grass species and yet quite distinct from other flowering plants. These features allow these pollen to be easily identified in the fossil record. Grass pollen and evidence of grass vegetation are first found preserved in rocks of the late Cretaceous.[28] Flood geologists recognize these same sediments as either the last of the sediments to have been deposited during the Flood or as the result of post-Flood processes. Thus, the geological record of the Flood either suggests that grasses originated after the Flood or that their vegetative and reproductive parts escaped preservation in Flood sediments around the world until the very last sediments were laid down. How could Abel have brought a grain offering to the Lord (Gen. 4:3) and yet evidence of any form of grass (including all forms of cereals) be absent from the pre-Cretaceous portion of the fossil record?

While grass pollen are found in strata as far back as the Cretaceous, pollen from one of the largest families of flowering plants, the Asteraceae (sunflower family) with over 20,000 living species, are only first recorded in the late Paleocene epoch (60 MYA)[29] and do not become common until the Miocene epoch (23 MYA). Miocene sediments are attributed, by most flood geologists, to completely post-Flood events.[30] Either flood geologists must propose that (1) the members of this large family evolved rapidly after the Flood, either from some other plant group or that some member was present but very rare before the Flood and then evolved rapidly afterward; (2) some unknown mechanism (e.g., supernatural intervention) prevented these plants or their pollen to be trapped in the Flood sediments; or (3) evidence of their presence has somehow been overlooked despite studies of hundreds of well-preserved, spore-bearing sediments around the world.

Consider also the characteristics of coal formations as a testimony to the unique succession of plant material in the geological record. The majority of coal-bearing formations are found in geological strata identified to the Carboniferous Era (Fig. 2, p. 170). These coal formations, found worldwide, are always associated with ferns and lycopods and are surrounded by sedimentary rocks which contain evidence of spores of these and other spore-bearing plants.[31] In the Upper Carboniferous, spores for tree ferns and pollen of primitive gymnosperms first appear in coal seams. Absent from these locations is any evidence of flowering plant vegetation or pollen. However, there are coal formations, found higher up in the geological record from the late

Cretaceous (about 100 MYA), that do contain abundant flowering plant vegetation and spores.[32]

To account for the billions of tons of coal in the fossil record, flood geologists have suggested that nearly the entire surface of the pre-Flood earth was covered by dense forests and that much of the ocean surface was potentially covered by a floating forest. They propose successive burial of these forests to form individual coal seams.[33] However, these models do not account for, nor even acknowledge, the unique flora and successive order of fossil coals found worldwide including the lack of flowering plant wood or pollen in the lower coal layers.[34] The mount of coal-containing flowering plants and associated pollen suggests that the pre-Flood vegetative environment was populated by flowering plants. Yet, this only accentuates the mystery of the lack of any evidence of flowering plant material in billions of tons of coal found in the Carboniferous strata. It strains reason to advocate that whole communities of plants were completely devoid of flowering plants prior to the Flood. Nor would it seem likely that pollen from wind-pollinated plants such as oaks and birches would never have fallen into these communities or have mixed with them during a cataclysmic flood event. Without invoking supernatural intervention, how could waters of the Flood sort both macroscopic and microscopic parts of flowering plants from nonflowering plants?

Two Possible Objections

1. Might the pollen record be biased due to differential preservation?

There is no evidence to suggest that flowering plant pollen would be more susceptible to degradation than gymnosperm pollen or spores once trapped in the sedimentary column together. Interestingly, it can be inferred that flood geology models should predict that pollen and spores should be equally preserved in the fossil record simply because they propose that all of the fossils represented in the geological column are the result of rapid burial. Fossil preservation bias is not expected. Therefore, any bias in the fossil record requires explanation. For example, grass pollen appears to be exceptionally well preserved whenever found, which begs the question, "Why would they not be found throughout most of the geological column, if grasses were quickly buried in a global Flood?"

2. But are pollen and spores not used sometimes to date rocks? Maybe it only appears that older rocks lack pollen because the lack of pollen is being used to define the rocks as old?

While it is often claimed that the dating of the geological column involves circularity, this argument does nothing to assuage the pollen evidence. One only has to look at the fact that coal formations which lack flowering plant pollen are found in layers below those that do contain flowering plant remains.[35] Regardless of the names of the geological periods or dates determined by radiometric dating, the succession of fossils is still apparent in the fossil record and a serious challenge to flood geology.

The Abominable Mystery

Darwin once referred to the origin of the flowering plants as an "abominable mystery" because they appeared so late and so abruptly in the fossil record known to him. While no longer such a mystery, debate still exists over the details of the origins of the flowering plants, such as the evidence regarding the first definitive flowering plant vegetation and pollen in the fossil record.[36] However, while flood geologists continue to point to the persistent discussion of flowering plant origins as evidence of a problem for evolutionary theory, the observed, and widely recognized, lack of flowering plant fossils in the bottom two-thirds of the fossil record presents an ongoing and even greater abominable mystery for flood geology.

While the distribution of pollen and spores is seldom directly acknowledged as a problem for flood geology, there have been some attempts by flood geologists to demonstrate that there may be fossils, such as pollen, preserved in rocks near the bottom of the geological record. For example, a claim was made by Clifford Burdick in the late 1960s and early 1970s that fossil pollen from flowering plants had been found in Precambrian rocks deep in the Grand Canyon conventionally dated more than 500 MYA.[37] If true, these fossils would be found in sediments dated to more than 350 million years before flowering plants were thought to have evolved and thus present a serious challenge to evolutionary theory. However, this claim, roundly rejected by the scientific community, has even been disputed by some flood geologists who tested the claims and concluded that they were the result of contamination with modern pollen.[38] Nonetheless, some flood

geologists continue to claim that they have reaffirmed the original study.[39]

The reports of fossil pollen from these sites are interesting and unexpected. But what is even more surprising is that, considering that millions of fossils have been carefully catalogued with respect to location in the geological column during the past two hundred years, flood geologists can only point to a few possible examples of fossils that do not fit the well-established general patterns of distribution. Rather than the very rare exception, flood geologists should expect and would predict out-of-place fossils to be the rule rather than the exception. Consider the presence of multiple-sized droplets of amber within specific rock formations. A hydrological sorting hypothesis is unlikely to explain the presence of drops of amber of different shape, size, and weight all in a single, thin layer of rock to the exclusion of their presence in surrounding rock. An a priori expectation of flood geological models should be that these amber droplets would be found scattered throughout the geological column and would not necessarily be associated solely with a rock formation that also includes plants which are very likely the source of the amber. If sap formed and fell to the ground prior to the Flood, then these resin droplets would have become disassociated from their source in the catastrophic flood waters and been subjected to sedimentary processes that potentially would have left them far from their source trees. To complicate the matter, if amber were sorted by some sort of hydrological process, why would the spores and pollen found in them resemble the spores and pollen found separately preserved in the same strata of the geological column? This would seem to require that amber and spores/pollen would co-sort with one another. Again, this seems extremely unlikely and certainly not expected.

Standard geological and evolutionary theories provide a robust explanation for the succession of fossils in the geological column. As Baumgardner points out, these theories represent *"the interpretation evolutionists are imposing on the observed data."*[40] However, it must be recognized that those interpretations are quite capable of accommodating the observed data in the fossil record. In contrast, flood geology models do not predict the co-sorting of pollen and plants or the restriction of specific pollen or spore types to a single portion of the geological column. The consistency of the various independent lines of fossil and geological evidence in support of conventional geological and evolutionary explanations for the origins and distribution of pollen and spores through time and space is remarkable. As a result, the burden is placed on the flood geologist to explain the pattern of pollen and spores in a manner that accounts for the "undeniable reality" of observed fossil succession. ⊙

Notes

[1]J. C. Whitcomb, *The World that Perished,* rev. ed. (Grand Rapids, MI: Baker Book House, 1988), 68. Whitcomb explains that God normally does not do miraculously what he can do through ordinary providence. Thus, he argues that aside from some specific miracles that were necessary to begin and terminate the Flood, the events of the Flood should be viewed as natural outcomes of the massive flood. This minimization of the miraculous is a common theme in creation science literature.

[2]J. Baumgardner, "A Constructive Quest for Truth," *Journal of Creation* 16 (2002): 79–81.

[3]Flood geologists are not all convinced of Baumgardner's "undeniable reality" of fossil succession as witnessed in his debate with Oard. However, a large number do acknowledge the apparent succession of fossils in the geological record. Thus it represents at least a common viewpoint within the creation science community.

[4]J. C. Whitcomb and H. M. Morris, *The Genesis Flood: The Biblical Record and Its Scientific Implications* (Philadelphia, PA: Presbyterian and Reformed Publishing, 1961); also see Whitcomb, *The World that Perished,* 178; G. E. Parker and M. M. Parker, *Dry Bones and Other Fossils* (Colorado Springs, CO: Creation-Life Publishers, 1995). This last book is a children's book that explains the origin of fossils from a flood geology perspective. Chapter 4 explains very clearly how flood geologists perceive how fossils became sorted during the flood through hydrological processes and by successive flooding of ecological zones.

[5]D. Young, *Christianity and the Age of the Earth* (Grand Rapids, MI: Zondervan, 1982); D. Young, *The Biblical Flood: A Case Study of the Church's Response to Extrabiblical Evidence* (Grand Rapids, MI: Eerdmans, 1995); G. R. Morton, *Foundation, Fall and Flood: A Harmonization of Genesis and Science* (Dallas, TX: DMD Publishing, 1995).

[6]Morton, *Foundation, Fall and Flood*. See also M. Isaak, "Problems with a Global Flood," 2d ed. (1998) at www.talkorigins.org/faqs/faq-noahs-ark.html.

[7]S. Hawking, *A Brief History of Time* (New York: Bantam Books, 1988).

[8]R. H. Ho and J. H. Owens, "Microstrobili of Lodgepole Pine," *Canadian Journal of Forest Research* 3 (1973): 453–6.

[9]S. R. Ekman, "Pleistocene Pollen Stratigraphy from Borehole, Devil's Hole Area, Central North Sea," *Quaternary Science Reviews* 17 (1998): 855–69; S. Van der Kaars and P. De Deckker, "A Late Quaternary Pollen Record from Deep-Sea Core Fr10/95, GC17 Offshore Cape Range

Peninsula, Northwestern Western Australia," *Review of Palaeobotany and Palynology* 120 (2002): 17–39.

[10]Ice cores from ice caps such as those on Greenland, in Canada, and in Antarctica have been shown to contain numerous modern pollen grains. J. C. Bourgeois, R. M. Koerner, K. Gajewski, and D. A. Fisher, "A Holocene Ice-Core Pollen Record from Ellesmere Island, Nunavut, Canada," *Quaternary Research* 54 (2000): 275–83.

[11]Hundreds of studies have been conducted on cores of sediments from lakes to determine the pattern of spore and pollen trapped over time as a means of reconstructing past climates and vegetation patterns. An overview of the significance of these studies and the types of data that can be recovered are found in the following paper: B. Vad Odgaard, "Fossil Pollen as a Record of Past Biodiversity," *Journal of Biogeography* 26 (1999): 7–17.

[12]G. K. Kelso and A. M. Solomon, "Applying Modern Analogs to Understand the Pollen Content of Coprolites," *Palaeogeography, Palaeoclimatology, Palaeoecology* 237 (2006): 80–91.

[13]D. J. Tyler, "Flood Models and Trends in Creationist Thinking," *Creation Matters* 2 (1997); A. A. Snelling, "Special Symposium: Where Should We Place the Flood/Post-Flood Boundary in the Geological Record?" *Creation ex Nihilo* 10 (1996): 29–31.

[14]T. Walker, "Coal: Memorial to the Flood," *Creation ex Nihilo* 23 (2001): 22–7; A. Snelling, "Coal Beds and Noah's Flood," *Creation* 8 (1986): 20–1.

[15]P. T. Moss, A. P. Kershaw, and J. Grindrod, "Pollen Transport and Deposition in Riverine and Marine Environments within the Humid Tropics of Northeastern Australia," *Review of Palaeobotany and Palynology* 134 (2005): 55–69; R. G. Goodwin, "Pollen Taphonomy in Holocene Glaciolacustrine Sediments, Glacier Bay, Alaska: A Cautionary Note," *PALAIOS* 3 (1988): 606–11; G. L. Chmura and D. Eisma, "A Palynological Study of Surface and Suspended Sediments on a Tidal Flat: Implications for Pollen Transport and Deposition in Coastal Waters," *Marine Geology* 128 (1995): 183–200; G. S. Brush and L. M. Brush, "Transport of Pollen in a Sediment-Laden Channel: A Laboratory Study," *American Journal of Science* 272 (1972): 359–81.

[16]P. Steemans, "Silurian and Lower Emsian Spores in Saudi Arabia," *Review of Palaeobotany and Palynology* 89 (1995): 91–104. Steemans describes spores found preserved in well core sections more than 13,000 feet below the surface. These sections are dated to the Silurian and Lower Devonian (420–395 MYA). In these sections, spores are found to the exclusion of pollen, just as they are in rocks of the same age in other locations.

[17]G. Sun, J. Qiang, D. Dilcher, S. Zheng, K. Nixon, and X. Wang, "Archaefructaceae, a New Angiosperm Family," *Science* 296 (2002): 899–904. In the late 1990s, a number of fossil finds in the late Jurassic became the earliest evidence of flowering plants in the fossil record. As predicted by evolutionary theory, evidence of the first flowering plants consists of vegetation and pollen in the fossil record that is not diverse when it first appears, but in successive layers above the late Jurassic and lower Cretaceous, flowering plant fossils including types of pollen become increasingly abundant and diverse.

[18]Moss et al., "Pollen Transport and Deposition in Riverine and Marine Environments within the Humid Tropics of Northeastern Australia"; Goodwin, "Pollen Taphonomy in Holocene Glaciolacustrine Sediments, Glacier Bay, Alaska"; Chmura and Eisma, "A Palynological Study of Surface and Suspended Sediments on a Tidal Flat"; Brush and Brush, "Transport of Pollen in a Sediment-Laden Channel."

[19]The occurrence of fossil pollen and spores in somewhat older (i.e., lower) strata than their vegetative counterparts is not unexpected. Modern paleontological and evolutionary theory predicts that the more easily preserved parts of plants such as pollen and spores will be found first in the fossil record since it is assumed that the first plants that evolved these features would at first be scarce and their vegetative or floral parts rarely fossilized.

[20]R. J. Litwin, "The Palynostratigraphy and Age of the Chinle and Moenave Formations, Southwestern USA," (PhD diss., The Pennsylvania State University, 1986); R. J. Litwin, A Traverse, and S. R. Ash, "Preliminary Palynological Zonation of the Chinle Formation, Southwestern USA, and Its Correlation to the Newark Supergroup (Eastern USA)," *Review of Palaeobotany and Palynology* 68 (1991): 268–81.

[21]K. Larsson, S. Lindstrom, and D. Guy-Ohlson, "An Early Permian Palynoflora from Milorgfjella, Dronning Maud Land, Antarctica," *Antarctic Science* 2 (1990): 331–44.

[22]E. Barron, J. J. Gomez, A. Goy, and A. P. Pieren, "The Triassic-Jurassic Boundary in Asturias (Northern Spain): Palynological Characterization and Facies," *Review of Palaeobotany and Palynology* 138 (2006): 187–208.

[23]G. Roghi, G. Eugenio, and P. Gianolla, "Triassic Amber of the Southern Alps (Italy)," *PALAIOS* 21 (2006): 143–54.

[24]B. Lugardon, L. Grauvogel-Stamm, and I. Dobruskina, "The Microspores of *Pleuromeia Rossica* Neuburg (Lycopsida; Triassic): Comparative Ultrastructure and Phylogenetic Implications," *Earth and Planetary Sciences* 329 (1999): 435–42; C. H. Wellman and J. Gray, "The Microfossil Record of Early Land Plants," *Philosophical Transactions of the Royal Society of London B* 355 (2000): 717–32. There are many groups of plants in the fossil record for which there are no living species today. Many of these fossils are found early in the plant fossil record and neither the plants nor their spores are found in any strata that contain flowering plants.

[25]Tyler, "Flood Models and Trends in Creationist Thinking"; Snelling, "Special Symposium: Where Should We Place the Flood/Post-Flood Boundary in the Geological Record?"

[26]Moss et al., "Pollen Transport and Deposition in Riverine and Marine Environments within the Humid Tropics of Northeastern Australia"; Goodwin, "Pollen Taphonomy in Holocene Glaciolacustrine Sediments, Glacier Bay, Alaska"; Chmura and Eisma, "A Palynological Study of Surface and Suspended Sediments on a Tidal Flat"; Brush and Brush, "Transport of Pollen in a Sediment-Laden Channel."

[27]M. E. Collinson, M. C. Boulter, and P. L. Holmes, "Magnoliophyta ('Angiospermae')" in M. J. Benton, ed., *The Fossil Record* 2 (London: Chapman and Hall, 1993): 809–49; S. M. Magallón-Puebla and J. Sanderson, "Relationships among Seed Plants Inferred from Highly Conserved Genes:

Sorting Conflicting Phylogenetic Signals among Ancient Lineages," *American Journal of Botany* 89 (2002): 1991–2006.

[28]W. L. Crepet and G. D. Feldman, "The Earliest Remains of Grasses in the Fossil Record," *American Journal of Botany* 78 (1991): 1010–4.

[29]M. Zavada and S. de Villiers, "Pollen of the Asteraceae from the Paleocene-Eocene of South Africa," *Grana* 39 (2000): 35–45. The sunflower family is the second-largest family of flowering plants, second only to the Orchid family. Common members include the asters, daisies, sunflowers, goldenrod, and lettuce. The first occurrence of Asteraceae in the fossil record appears after the Cretaceous, which places this entire family in sediments after the disappearance of the dinosaurs.

[30]J. H. Whitmore,"The Green River Formation: A Large Post-Flood Lake System," *Journal of Creation* 20 (2006): 55–63; C. R. Froede, Jr. and J. K. Reed, "Assessing Creationist Stratigraphy with Evidence from the Gulf of Mexico," *Creation Research Society Quarterly* 36 (1999).

[31]E. Cortland, F. Greb, F. Stephen, and D. A. Williams, "The Geology and Palynology of Lower and Middle Pennsylvanian Strata in the Western Kentucky Coal Field," *International Journal of Coal Geology* 47 (2001): 189–206; R. Peppers, "Palynology of the Lost Branch Formation of Kansas—New Insights on the Major Floral Transition at the Middle-Upper Pennsylvanian Boundary," *Review of Palaeobotany and Palynology* 98 (1997): 223–46. These are just two of many papers that document the palynological evidence of Carboniferous coal seams. Even the Carboniferous coal seams around the world show a transition from lycopod-dominated vegetation and spores in coal to coal that is composed of fern, seed-ferns, and some gymnosperms.

[32]D. J. Nichols, "The Role of Palynology in Paleoecological Analyses of Tertiary Coals," *International Journal of Coal Geology* 28 (1995): 139–59.

[33]C. Wieland, "Forests That Grew on Water," *Creation* 18 (1995): 2–24; A. Snelling, "Coal Beds and Noah's Flood," *Creation* 8 (1986): 20–1. The fundamental difficulty that the Flood geology model faces with coal is that even if every plant alive today were preserved as coal in a flood it would only account for a very small portion of the coal reserves on earth. Hence, it is argued that the pre-Flood world was globally tropical, had a larger land mass and potentially large floating forest on the pre-Flood seas.

[34]S. E. Nevins, "The Origin of Coal," *Impact* 41 (1976). Most creation science articles that discuss coal have similar elements as this newsletter article from the Institute for Creation Research. There is discussion about how the standard theories will not work and a trumpeting of flood geology to explain some odd features of coal seams. In this article, Nevins does acknowledge that certain lycopods and ferns are commonly found in Carboniferous age coal beds but neither Nevins nor other creationist authors tell their audience that these coal beds have no flowering plant component. Because they have chosen to ignore this obvious fact of the fossil record, they do not attempt to provide an explanation.

[35]This is not to say that some spores and pollen are not found in the "wrong" rock layers. At times pollen and spores may be found in rock layers younger than any known evidence of the plants. This can happen if ancient rocks with pollen and spores erode and pieces of those rocks get incorporated into new sedimentary layers. These layers are much younger themselves but may include very ancient fossils. This is expected to occur and is found in the geological record. What is not expected is to find pollen and spores in rocks that are much older then the first record of the plants themselves. For example, pollen found in Cambrian rocks would be an extremely challenging finding to modern paleontological theories.

[36]M. S. Zavada, "Angiosperm Origins and Evolution Based on Dispersed Fossil Pollen Ultrastructure," *Annals of the Missouri Botanical Garden* 71 (1984): 444–63; N. H. Hughes, *The Enigma of Angiosperm Origins* (Cambridge: Cambridge University Press, 1994); D. Dilcher, "Toward a New Synthesis: Major Evolutionary Trends in the Angiosperm Fossil Record," *Proceedings of the National Academy of Sciences* 97 (2000): 7030–6.

[37]C. L. Burdick, "Microflora of the Grand Canyon," *Creation Research Society Quarterly* 3 (1966): 38–50; C. L. Burdick, "More Precambrian Pollen," *Creation Research Society Quarterly* 11 (1974): 122–3.

[38]A. V. Chadwick, "Grand Canyon Palynology—A Reply," *Creation Research Society Quarterly* 9 (1973): 238; ——, "Precambrian Pollen in the Grand Canyon—A Re-examination," *Origins* 8 (1981): 7–12. Arthur Chadwick is a young-earth creationist who followed up on Burdick's research. He re-created Burdick's research and concluded that Burdick's findings were the result of contamination with modern pollen. Chadwick's conclusions were not well received by many in the creationist community, and additional follow-up tests were done by another group of creationists which were claimed to vindicate Burdick's original claims (see following note).

[39]G. F. Howe, "Creation Research Society Studies on Precambrian Pollen: Part I—A Review," *Creation Research Society Quarterly* 23 (1986): 99–104; W. E. Lammerts and G. F. Howe, "Creation Research Society Studies on Precambrian Pollen—Part II: Experiments on Atmospheric Pollen Contamination of Microscope Slides," *Creation Research Society Quarterly* 23 (1987): 151–3; G. F. Howe, E. L. Williams, G. T. Matzko, and W. E. Lammerts, "Creation Research Society Studies on Precambrian Pollen, Part III: A Pollen Analysis of Hakatai Shale and Other Grand Canyon Rocks," *Creation Research Society Quarterly* 24 (1988): 173–82.

[40]Baumgardner, "A Constructive Quest for Truth," 81.

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