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Haec Credimus

For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh. —Exodus 20:11

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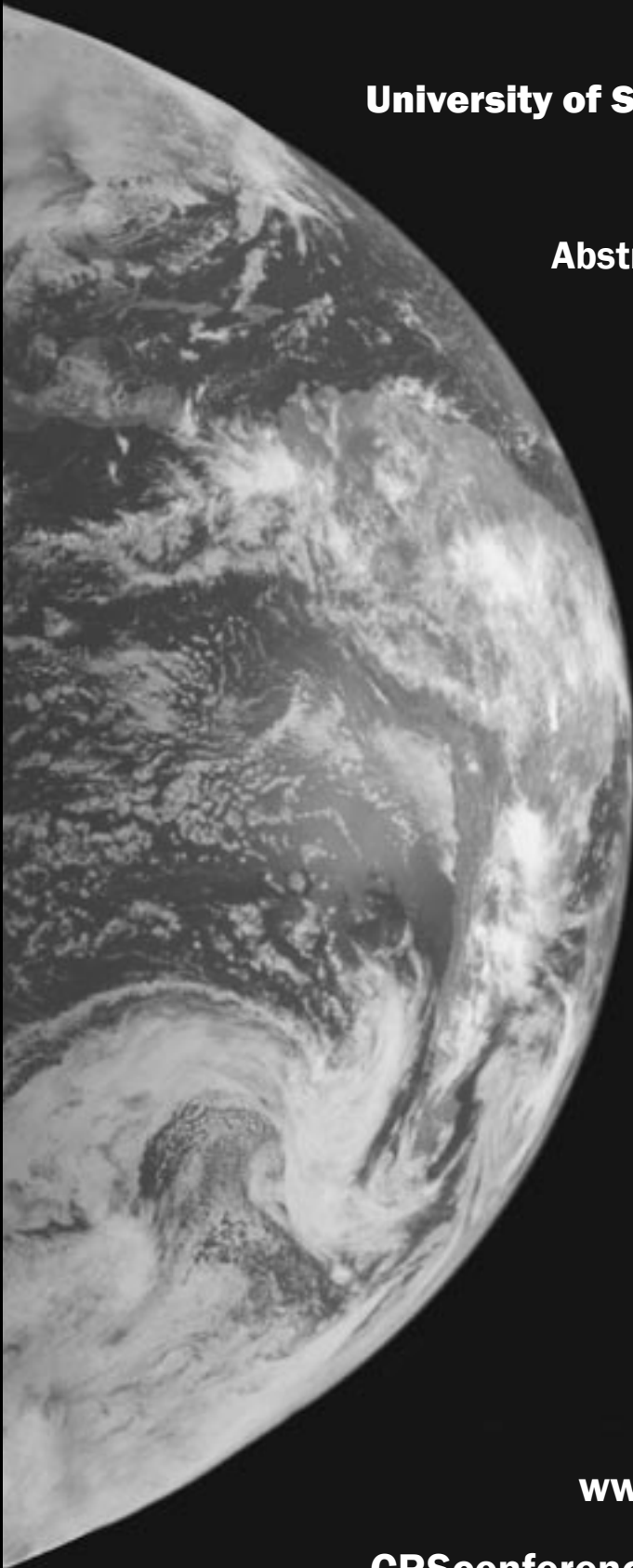
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Editorial

The Wonderful Unscientific Teaching of the Creation Research Society

The Creation Research Society is often criticized for holding grossly nonscientific positions (such as a young Earth, a worldwide Flood, and the special creation of humans). Interestingly, though, this criticism frequently comes from theologians, such as pastors and seminary professors. According to them, the society sacrifices scientific integrity by accepting these “unscientific” views and thereby alienating the scientific community. As a result, we hinder the “church’s” outreach to the intelligentsia.

Of course, members of the society have fairly definite scientific and Biblical reasons for holding these positions. It has always been an interesting point of history that the contemporary creation movement began not in the pulpit but in the laboratory. Scientists, trained to evaluate and understand this physical world, began to see clear evidence of the hand of the Creator (and not all of these scientists were even initially Christians). Using this evidence, they argued that science, in fact, supports rather than contradicts Biblical accounts and claims of creation.

Dr. Gary Parker tells of a time when he was on the faculty of a college’s science department that supported the Biblical creation model while the college’s religion department opposed such a view. Why the opposition? Are some

theologians suggesting that Biblical teaching is contrary to a worldwide flood, the special creation of humans, or even a young Earth? If so, then we appear to be reading two different Bibles. Are they suggesting that God lacks the power to create galaxies, planets, and humans or needs extensive amounts of time for their creation? I am more inclined to conclude that their position is based on a perception of the scientific evidence; namely, that these concepts are not popular in the scientific literature, thus they must not be scientific. (This is also a subtle way of saying that since these concepts are not popular, they must not be true.)

Few of these theologians have the scientific training to draw their own conclusions about the data. Instead, they have assigned a certain level of authority to scientists. Not just any scientists, but those they perceive as representing the popular opinion of the scientific community. Ironically, more times than not, these are also scientists who have a very low opinion of Biblical authority and are often agnostic in their views of God.

Unfortunately, many theologians have determined that claims made by the majority of scientists represent scientific facts. In turn, these scientific facts represent ultimate truth, which must then be used to understand Biblical teachings. As a scientist, one “fact”

I have learned is that many so-called scientific facts are really just popular opinions. The supporting evidence can be rather spotty. Even if the “fact” is supported by more substantial evidence, there is often incompleteness to the data and potentially a bias in the conclusions drawn from the data.

This is not to say that scientific investigation does not provide a greater

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understanding of God's creation. Of course it does. I would not be a practicing scientist if I thought otherwise. We have learned an immense amount about the physical world around us during the last 150 years. But scientific claims often can be clouded by human judgment (or lack thereof), be more extensive than the data really allows, or be deceptively incomplete. This seems to be especially true when scientific interpretations strongly interact with our personal worldviews. Objectivity, even among scientists, quickly diminishes. Thus, a warning to my theologian friends: Do all the scientific claims in which you place such great "faith" warrant this confidence? Truthfully, you have to admit that you do not really know if they do or not. In contrast, does the Bible warrant such confidence?

The first chapters of Genesis state that God created a man from the dust of the ground and a woman from the man's rib, and He placed them both into a garden named Eden. The popular opinion of the contemporary scientific community is that these Biblical claims are erroneous (to put it mildly). Because of this, a significant number of theologians have decided that either (1) Genesis cannot be taken as a historically accurate document, and/or (2) "dust" does not really mean dust, "created" does not really mean created, and "Eden" was just a mythological place invented to help give the story a more personal appeal. Thus, a clear Biblical account becomes clouded by the idea that it needs to be made more scientifically "palatable."

Do we now interpret Biblical accounts strictly through the lens of popular scientific opinions? What happens when those popular opinions become less popular or even refuted? Has the true lesson of Galileo been lost? (See a previous editorial; Anderson, 2008.) If an idea is not popular in the scientific community, does that also make it not Biblical? Does it even necessarily make it not true?

By definition, a miracle is an event not explainable by natural, normal physical processes. If it were, it would hardly constitute a miracle. The Bible records the occurrence of numerous miracles preformed by God. Many were a function of timing and intensity. When Jesus calmed the sea (Luke 8:22–25), it was immediate and complete. Several of His disciples were no strangers to storms on the sea, and they fully recognized that they had just witnessed a supernatural rather than a natural event (Luke 8:25). However, had Jesus spoken and hours later the storm gradually dispersed and the waves gradually subsided, the result ultimately would be the same—calming of the sea—but from a human perspective there would be a dramatic difference. No longer would even His disciples have viewed the event as miraculous. Rather, they simply would have attributed it to natural weather patterns, the kinds they had seen many times before. As Marvin Lubenow (2004) expresses it, time "can turn a miracle demonstrating Christ's authority over nature into a strictly natural phenomenon" (p. 275).

What is more, time can also give the perception of turning God's miracle of creation into a strictly natural phenomenon. No one would argue that so-called natural forces could form the stars and planets, let alone life, in just six days. Given enough time, though (in the opinion of many people), the natural formation of the universe (including life) not only becomes more likely but almost inevitable. While I would strongly challenge the scientific validity of such a position, for these people time will so sufficiently remove God the Creator that He can be replaced with Nature the Creator.

In contrast, the Psalmist declared that the creation testifies to God's power and glory (Ps. 19:1–3). Paul wrote that it was inexcusable to look upon creation and not see the Creator revealed (Rom. 1:19–20). Peter further added that scoffers will attempt to deny that merely by

the power of His word (*logos*) God created the heavens and the earth (2 Peter 3:3–5). Any idea, teaching, or philosophy that removes or distracts from this "testimony of the creation" contradicts this Biblical claim.

I have never understood how anyone can conclude that evolutionary teaching does not diminish human understanding and appreciation of the testimony of the "creation." Of course it does. I see it constantly among my scientific colleagues. In fact, evolution was intended to do so. The writings of both Charles Lyell and Charles Darwin intentionally sought to replace God with nature. The years since their writings have not changed this intent. If anything, it has been intensified. The popular version of evolution has no need for a creator. It claims sole responsibility for all the astronomical, chemical, and biological origin and transformation necessary to give us the universe as it exists today.

Why would theologians be comfortable with this situation?

Also, the popular trend in the scientific community is to define "science" as strictly pertaining to natural explanations and events (i.e., naturalism). Thus, by this definition, it is impossible for science to attribute the creation to God's power and glory. In fact, science specifically becomes alienated from miracles (especially Creation) and anything involving the interaction of God with His creation. Some would argue that this does not mean miracles have not happened; it simply means they cannot be scientifically verified. This is only partially correct. But even more to the point, from the perspective of contemporary Western civilization, if it is not scientifically verified, it is not real or true. So, by default, a creator becomes unscientific (and therefore unreal) simply by how science is defined.

Why would theologians be comfortable with this situation either?

What is more, the Gospels all proclaim that Jesus arose from the dead.

His resurrection is the core principle of Christianity. In fact, the apostle Paul declared that if Jesus did not really rise from the dead, Christianity has nothing to offer (1 Cor. 15:18–20). The Bible further claims that all those who are in Christ ultimately will be resurrected as well (1 Thess. 4:16). Yet, there are few ideas that are more unscientific than resurrection from the dead. I can easily declare that it is a *scientific fact* that the bodies of dead people do not come back to life. In all the scientific studies and all the empirical trials ever recorded, a dead body has never been found to spontaneously live again.

Therefore, Christianity is clearly built upon a very unscientific claim—the resurrection. It contradicts known scientific fact. If some theologians are so concerned about their “faith” being scientifically acceptable, then they face a hard dilemma. To maintain their need for a “scientifically palatable/acceptable” position, they have no choice but to abandon the Biblical teachings of the resurrection. Yet, without the resurrection,

Christianity is meaningless. There is no salvation by the blood of Christ. There is no promise of eternal life. There is nothing setting Christianity apart from all the religions and philosophies invented by humans. In other words, by abandoning the resurrection, they would have to effectively abandon Christianity.

Realizing this, many theologians accept the resurrection as a necessary part of their Christian faith and hope, while admitting its very unscientific basis. Many others have likely never even recognized this dilemma. And this somehow makes Christianity more scientifically palatable? This does not hinder outreach? By what criteria is the resurrection (and presumably other miracles) not considered a scientific hindrance but the concept of a recent creation is a hindrance? Where is the consistency? Does the scientific community really respect and accept this? Has it responded by saying, “OK, the resurrection is in, but this recent creation stuff is out”? Has it responded by saying that certain miracles are allowable, but other miracles are not?

One of the objectives of the contemporary intelligent design (ID) movement is to separate itself from any theological constraints and focus solely upon the scientific evidence. As a scientist I can appreciate such an attempt. Many theologians have embraced this approach, seeing it as a way that the Christian teachings of origins can accomplish the goal of being more scientifically palatable. Hence, these theologians perceive it as being less of a hindrance to the church’s outreach. Yet, ID is no more popular in the scientific community than young-Earth creation. They are both equally hated. How has this made Christianity more palatable? Even the American Scientific Affiliation’s attempt to promote a form of “Biblical” evolution has been met only by disdain among major scientific organizations. How has this made the church’s efforts of outreach more effective?

The answer is that it clearly has not. The power of Christianity is not in becoming more palatable to the scientific community. The power of Christianity (and its ability to reach not just the scientific community but any group) is the person of Christ and His living Word. It is the power to change the human heart. Attempting to make Christianity conform to or fit with human knowledge (i.e., science) does not give it more power or authority. I have never witnessed anyone becoming convinced of the “truth” of evolution and growing spiritually at the same time, but sadly I have witnessed the opposite many times.

In contrast, understanding how science can provide insight into God’s creation does give power and authority to science. The early seventeenth-century astronomer, Johannes Kepler is credited with saying that as he studied and understood the cosmos, he was “thinking God’s thoughts after Him.” Science that is used for the glory of God can be a powerful tool of human understanding. When convinced that science gives testimony of the Creator, people often grow in their Biblical understanding and spiritual maturity. This I have seen many times as well. This is a situation that should be comfortable to theologians.

Acknowledgement: Several years ago I had a marvelous discussion with Dr. David Menton, which ultimately stimulated much of the thinking I have presented in this editorial.

Kevin Anderson, Ph.D.
Editor

Creation Research Society Quarterly

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**The power of Christianity
is not in becoming
more palatable to the
scientific community.
The power of Christianity
is the person of Christ
and His living Word.**



Book Review

Signs and Seasons: Understanding the Elements of Classical Astronomy

by Jay Ryan

Fourth Day Press, Cleveland,
2007, 265 pages, hardback,
\$40.00.

Author Jay Ryan recognizes a major shortcoming with modern astronomy. Both the media and classrooms present us with an endless stream of impressive images derived from large telescopes and space probes. The latest speculative theories also dominate, extending from the big bang to black holes. Along the way, however, too many citizens have lost the simple joy of stargazing from the backyard.

By classical astronomy, Ryan refers to the traditional practice of observing the sky with the unaided eye. Multiple benefits of this effort include familiarity with the clocks, calendars, and compasses provided by the sun, moon, and stars. Even more important, we learn our humble position while standing beneath the deep skies of our Maker, according to Psalm 19:1–6. Ryan reminds readers that a basic understanding of the heavens was once taught to all students alongside reading, writing, and arithmetic (p. viii). The author maintains a Web site with classical astronomy updates (see references).

Author Jay Ryan is an accomplished artist. Dozens of his popular, educational cartoons have appeared in *Sky and Telescope* magazine under the heading of SkyWise (see references). This volume likewise contains hundreds of helpful new illustrations, many with a distinctive, three-dimensional appearance. Ryan clearly has raised the bar on excellence in astronomy illustration. The book aims at Christian homeschool families and all others interested in observational astronomy. For current news, Jay maintains a Web site and email newsletter (see references).

There is full discussion of such topics as sundials, moon phases, and earth motions. The terms “astronomy” and “astrology” are thoroughly defined and contrasted (p. 77). Less familiar terms also are explained, including “quadrature,” “retrogradation,” and “occultation.” The book provides various observing activities, planet positions through 2020, an eight-page glossary, and a detailed index. I might suggest a more limited and targeted index in

future editions; the word “sun” has 174 page references listed, far too many for usefulness. For the serious student of any age, this book may well ignite a lifelong interest in astronomy. *Signs and Seasons* is a beautifully written book and reminds me somewhat of the classic *The Stars* by H.A. Rey (1952).

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Toppling the Timescale

Part IV: Assaying the Golden (FeS₂) Spikes

John K. Reed*

Abstract

Stratigraphers today claim that chronostratigraphy and geochronology are one and the same, but this presents a problem; they have not found a reliable absolute chronometer for the rock record. To solve this dilemma, a new strategy has been proposed: define the timescale's stages by the arbitrary assignment of each time-stratigraphic boundary. Above the Proterozoic, the beginning and end of each stage is either currently or soon to be represented by a "Global Stratotype Section and Point"—type sections scattered around the world. Below the Phanerozoic, each boundary is defined by a slightly different "Global Standard Stratigraphic Age"—an equally arbitrary numerical standard against which field radiometric dates can be correlated. As a result, the structure of the timescale has now been finalized, not by empirical science, but by the fiat pronouncements of the International Commission on Stratigraphy. Thus, the "scientific" discipline of stratigraphy diverges yet again from empirical science. This bureaucratic solution is a diagnostic symptom of the timescale's erroneous core and a confirmation of decades of creationist critiques of uniformitarian history.

Introduction

Up to this point in this series, we have seen that the geologic timescale is inextricably linked to the worldview of naturalism (Reed, 2008a). Thus it functions as a trans-empirical template to cement uniformitarianism, deep time, and evolution into the rock record, building a bulwark of anti-Biblical history. The chief cornerstone of this fortress is

the deceptively simple, yet powerful stratigraphic assumption that rock units reflect globally correlative synchronous time periods (Reed, 2008b). This assemblage of extra-scientific presuppositions is commonly masked by voluminous empirical studies. But when seen clearly, they are sufficient to show that the geological timescale is incompatible with Biblical Christianity.

Since truth is unified across theology, philosophy, history, and science, the theological and philosophical errors inherent in the timescale should be manifested in its science and history. This is, in case, what is seen: in particular, the methods used to define the ages associated with each stage of the timescale are deeply flawed, as is the logic with which they are applied (Reed, 2008c). Since both the chronostratigraphy (relative age) and geochronology (absolute age) of the timescale depend on "clocks" that do not keep time, the timescale itself cannot be calibrated or even logically

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defined. Evolutionary fossil sequences, radiometric dates, magnetic reversal signatures, and sedimentary properties thought to mirror astronomical cycles all fail to deliver objective calendars when examined closely. In an attempt to mask their individual flaws, they are often jumbled together as if their sum would be less flawed than the parts! That logic has never worked; milk that is half sour is not made palatable by adding more of the same from a different cow!

The anti-Christian underpinnings of the timescale reach back to its origin amidst nineteenth-century Enlightenment secularism. It has always been intended as a weapon against Biblical reliability. After all these years, its time-worn cloak of scientific respectability has grown increasingly threadbare as the model fails again and again.

Undaunted, stratigraphers still claim that the timescale is an observed phenomenon, and they point to parts of the rock record, like strata in the walls of the Grand Canyon, to prove their point. But under the glaring light of the axioms, this supposedly seamless transition from rocks to history looks less self-evident. Instead, growing knowledge shows that more and more rock units are better defined as products of catastrophic deposition. If so, either “deep” time is much shallower than currently believed or the rock record is the equivalent of a few random minutes on a calendar, and thus not very useful as a historical record. And if the rock record cannot provide a reliable history at a given location, how can the everyday global extrapolations made by stratigraphers be trusted? Despite the appearance of a well-established scientific “fact,” the timescale faces two recurring problems: (1) a tenuous link to the empirical rock record, and (2) a persistent inability to present an accurate global record of history.

Because the vocal advocates of stratigraphy understand that the old reliable method of drawing time lines at the bedding planes of local-to-re-

gional rock units is no longer feasible and since fossil zones have proven no better (Gradstein, 2004), they have selected a new method to maintain their grip on history. They have used their academic authority to force a definitive set of “golden spikes” to mark every age boundary in the timescale by establishing type locations. Because these “Global Stratotype Section and Point” (GSSP) markers are hammered into the rock record by the International Commission on Stratigraphy (ICS), they are assumed to be definitive, cementing a nonBiblical history into place. And in a logical sleight of hand, they imply that the global distribution of these individual points ensures the global reach of the timescale throughout history. Thus, instead of fossil zones, radiometric dates, or magnetic polarity chrons, it is really these GSSPs that prove a global timescale. Any lingering doubts are brushed aside by reminders that the work is sanctioned by the prestigious ICS, part of the International Union of Geological Scientists and the European counterpart of the North American Commission on Stratigraphic Nomenclature.

But do these new spikes really bind the rock record to an evolutionary and uniformitarian version of history, or are these new golden spikes really a “golden fleece” that cons the gullible public into yet another faulty scheme to define Earth’s past in opposition to a growing confidence in the accuracy of the Biblical record? After we grasp the nature of these GSSPs, the latter possibility appears much more likely.

What are GSSPs?

Nineteenth-century stratigraphers believed that specific European rock units, as defined by lithology and/or fossil content (e.g., the “Cretaceous chalk”), defined time lines of Earth’s history. Most people who are not professional stratigraphers still believe that to be the case. But stratigraphers have long recog-

nized that these “stratotypes” are inexact at best and need replacing.

This concept of a Global Stratotype Section and Point (GSSP) has replaced the earlier usage of “stage stratotypes,” and has enabled compilation of an international stratigraphic chart.” (Gradstein et al., 2004, p. 21.)

This new system identifies a single GSSP for each age boundary at a single locale, much like a roadside marker at an outcrop reading, “Base of Devonian.” The goal is to have one definitive GSSP for each age boundary. Once all the boundaries are marked by these stone tablets, stratigraphers believe that the timescale will finally be the textbook of history they have long hoped for.

Since the global chronostratigraphic scale is ultimately defined by a complete sequence of GSSPs, the limits of chronostratigraphic units (stages) are fully defined in time. (Gradstein et al., 2004, p. 41.)

Given their importance, these points are not chosen haphazardly. Each GSSP must meet two essential criteria: (1) it must be located within a geological section that shows continuous sedimentation, and (2) the boundary must be recognizable so it can be correlated around the world. While impressive at first glance, these criteria are much harder (if not impossible) to meet. As of 2004, only 18 of the 50 boundaries for the Cenozoic and Mesozoic had defined boundaries and only 28 of the 44 for the Paleozoic (Gradstein et al., 2004, p. 25). Thus, of the 94 boundaries in the Phanerozoic, only 46 of them were identified. Given the innumerable man-hours spent on field stratigraphy since the first geological congress in 1878 in Paris, it seems strange that so few type locations are available. But Gradstein et al. (2004) note that

difficulties in identifying global correlation criteria, problems introduced by biogeographic provincialism, and the occasional need

to abandon stage concepts based on historical regional usage have slowed assignment of GSSPs in some periods. (p. 24)

One wonders whether “insurmountable” belongs at the beginning of that sentence.

The geographic and stratigraphic locations of defined GSSPs are shown in Gradstein et al. (2004, pp. 28–40), and can be found on the ICS Web site. Most are based on biostratigraphic criteria such as first appearances or extinctions of some index organism. Some are based on geomagnetic polarity reversals, and a few on isotopic excursions thought to reflect astronomical cycles. Of course, most are directly or indirectly calibrated by radiometric methods. Although some creationists assert that the chronostratigraphic and geochronologic facets of the timescale are separable (e.g., Snelling et al., 1996; Tyler and Coffin, 2006) and thus useful for diluvial interpretation, this new stratigraphic tide is ebbing in the opposite direction.

We consider that the practice of Chronostratigraphy today defines the time framework of Geochronology, because intervals of geological time are now being precisely defined within rock successions by GSSPs. The effect of this is that Chronostratigraphy and Geochronology should become one and the same discipline (Gradstein et al., 2004, p. 41).

The next logical step would be to proclaim that the rock record and the timescale are one and the same empirical phenomenon, followed by the conclusion that the empirical study of rocks “proves” uniformitarian history.

It is interesting that although GSSPs are proposed as a means to escape the inconsistencies and uncertainties of individual dating methods (cf., Reed, 2008c), stratigraphers cannot escape these techniques. In other words, it appears that GSSPs are camouflage; the faulty methods are still applied, but they

are applied surreptitiously rather than out in the open.

Thus, GSSPs are really nothing more than the latest in a long line of schemes by stratigraphers to rescue their uniformitarian and evolutionary vision of the past from the repeated failures of their methodology. Their patience with the timescale is amazing in the face of the cold, hard reality of the rock record. Despite the demonstrated and admitted failures of biostratigraphy, radiometric dating, magnetic polarity ages, and sedimentary isotopic curves (correlated to astronomical cycles), stratigraphers will go to any lengths to preserve a vision of a history that excludes Creation, the Flood, and the God who brought them to pass. Rather than reconsider their model, they rescue their flawed methods by fiat proclamation. Unfortunately, this presents numerous and obvious problems to a so-called scientific worldview.

Problems with GSSPs

GSSPs do not solve any problems; they merely package all of the existing flaws in modern stratigraphy and then add more. First and most obvious is the oldest problem for the “empirical” study of prehistory—uncertainty rising from our as-yet-imperfect understanding of the rock record in all of its detail. A sparse record provides little certainty. And GSSPs add a new dimension to this problem. One wonders how a purely empirical mind-set could reconcile itself with the concept of GSSPs, since they are by definition a permanent and final delineation of a rock record that is not fully known and understood. A true empiricist would spurn such an effort, since he would expect today’s spikes to require repositioning with tomorrow’s research. Only someone who believed in an authoritative version of the past would dare to drive permanent spikes—and is it not that type of thinking that secular science claims to despise?

In addition to that methodological tension (Christians of course have no problem with authoritative history as delivered by God), the GSSP scheme falls short in several other important areas.

Precambrian Boundaries

An unscientific aspect of GSSPs is the *arbitrary* assignment of time zone boundaries. The most glaring example of this problem is the fiat pronouncement of golden spikes for the Precambrian. Though the timescale has been generally unchanged for many decades, geologists continue to struggle to assign exact historical dates to specific rock units. This becomes even more difficult in the case of detailed time periods for the Precambrian. The successive failure of various methods finally led them to simply impose age boundaries. GSSPs do essentially the same thing for the Phanerozoic, but a kaleidoscope of fossils, magnetic zones, and isotope excursions offer an attractive disguise. But the naked audacity with which the Precambrian is defined staggers the imagination. When the smoke has cleared, it is simply a case of “Thus saith the committee!”

The scope of this problem becomes clearer when we recall that uniformitarians hide most of their history in the basement. Nearly 90% of the supposed historical record is represented by that part of the earth’s crust that is composed predominantly of igneous and metamorphic rocks. These are not layered in any stratigraphic sense (with rare exceptions), they contain no “index” fossils, and they are relatively poorly explored. Attempts to define the Precambrian stratigraphically have historically met with frustration.

The “Precambrian” is not a formal stratigraphic term and simply refers to all rocks that formed prior to the beginning of the Cambrian Period. The task of establishing a rigorously defined and globally acceptable time scale for the Precambrian is an exceedingly difficult, and often

frustrating, exercise. The reason for this is related to the fact that studying the Earth becomes increasingly difficult and uncertain the further one goes back in geological time (Robb et al., 2004, p. 129).

But difficult or not, the committee has found a solution. They simply define eons, eras, and periods; give them impressive sounding names; pick boundaries out of the proverbial hat; and assume that the imprimatur of the ICS will suffice: "By contrast, Precambrian stratigraphy is formally classified chronometrically...the base of each Precambrian eon, era, and period is *assigned* a numerical age" (Gradstein, 2004, p. 3, emphasis added). You have not misread this quote; as strange as it sounds that is exactly how the committee operates.

Due to the fact that most Proterozoic and Archean rocks lack adequate fossils for correlation, a different type of boundary definition was applied for subdividing these eons into eras and periods... For these two eons, the assigned boundary, called a Global Standard Stratigraphic Age (GSSA), is a chronometric boundary [based on radiometric ages] and is not represented by a GSSP in rocks, *nor can it ever be*" (Gradstein et al., 2004, p. 26, emphasis and brackets added).

Once we wade through the terminology, this boils down to the committee defining the vast majority of the historical record in a fashion so blatantly dogmatic that the stereotypical medieval theologian would turn green with envy, if it were not such a deadly sin! Of course, the committee did show some consideration; they made their construct easier to remember by rounding off the boundary dates for convenience.

By contrast, the Archean and Proterozoic time scales are currently defined chronometrically, with subdivisions into eras and periods being defined and allocated boundaries in terms of a round number of millions

of years before present (Robb et al., 2004, p. 129).

Some of these flaws are obvious.

This Precambrian time scale...has a few major problems. First, a purely chronometric definition...is not, and cannot be, located precisely in the stratigraphic record [i.e., empirically].... Definition of boundaries in terms of arbitrary, round, absolute ages, although superficially appealing, is therefore naïve.... Second, boundaries within the Precambrian scale are defined by a completely different method to the Phanerozoic time scale, in which boundaries are based on GSSPs in stratigraphic sections.... Third, the formal or proposed subdivisions...of the current Precambrian time scale are either not being used or are used inconsistently.... Fourth, the present time scale is incomplete, leaving the lower boundary of the Archean undefined (Bleeker, 2004, pp. 141–142, brackets added).

But these do not begin to address the most serious failures of Precambrian GS-SAs. The most immediate is practical. Under the ICS scheme, a geologist can only correlate his field area to the time-scale by radiometric dating. Not only are there serious questions about the results of any given date (Vardiman et al., 2000; 2005; Woodmorappe, 1999), but the continued "improvements" in dating methods also render older dates—the vast majority of actual ones—ever more questionable. Furthermore, correlation by radiometric dating is impractical except for well-funded research programs. A geologist must spend thousands of dollars to obtain even one result, which even if correct would represent the age for only that individual piece of rock. The exigencies of budget force him to extrapolate his results more widely than may be justified. Third, most Precambrian rock bodies are not layered like sedimentary strata, so even the illusion of physical correlation along time lines

is lost. For that reason, the fine divisions of the timescale are essentially meaningless in the field—true correlation would require a closely spaced grid of radiometric results.

Even if radiometric dating was correct, and correlation was possible, what criteria would define the historical eras for which these time boundaries have been established? The Mesozoic is the "age of dinosaurs;" perhaps the Proterozoic could be the "age of algae." But even where these fossils are preserved in rare Precambrian sediments, they offer no time differentiation.

Surprisingly, perhaps, stromatolites are just as common in late Archean as in Proterozoic strata.... Cyanobacteria are particularly widespread in Proterozoic cherts and shales, but their record strongly suggests early diversification followed by the long persistence of little varying lineages. In consequence, cyanobacterial fossils tend to provide better indicators of environment than age (Robb et al., 2004, p. 136).

In their own terminology, stratigraphers are left with both chronostratigraphic and geochronological problems. And given that the chronostratigraphy of the Precambrian is defined by geochronologists, it is not even clear which set of problems should take precedence! But there is a problem of logic too. One cannot define an era without the dates, but one cannot look for beginning or ending dates without having some criteria to define the era. At least with fossiliferous sediments, there is a lithological or faunal appearance or extinction to mark a distinct historical period (granted the assumption that rocks represent globally correlative, synchronous time periods). With igneous and metamorphic rocks there is not even that—in the end there is only the naked authority of the committee.

If nearly 90% of the historical record can be subdivided by fiat and justified with a wave of the hand at radiometric

dates, then why bother with the fossils, magnetic polarity chrons, astronomical cycles, and so on for the remaining fraction? Why not just admit that the entire timescale is an arbitrary construct? Why not just have the ICS make pronouncements and save everyone else the expense of field investigation? Obviously, their solution does not appeal to everyone.

Contrary to historical practice, however, and against the specific critique of many leading scholars in the field...the Subcommittee on Precambrian Stratigraphy chose a purely numerical basis of absolute ages for subdividing over 4000 million years of geological history.... The ages assigned to the boundaries of Proterozoic periods are not uniformly distributed, but were theoretically chosen to delimit principal cycles of sedimentation and tectonics....The resulting time scale is "convenient" in terms of round numbers, but is divorced from key events in the stratigraphic record (Bleeker, 2004, p. 141).

But the problems of arbitrary age assignments are not restricted to the Precambrian. They are just more obvious than the "dating" of the Phanerozoic. That portion has its own problems; its GSSPs appear to be empirically based, but upon closer analysis they are just as arbitrary as the Precambrian GSSAs, though perhaps for different reasons.

The Authoritative (or Is It Authoritarian?) Committee

Though the rest of the timescale is not as blatant as the Precambrian, in the final analysis it is no less arbitrary. Cambrian and younger strata are predominantly sedimentary rocks with bedding boundaries. They contain fossils, measurable magnetic signatures, minerals that can be radiometrically dated, and chemical signatures that supposedly can be correlated to astronomical perturbations. However, the quantity of the data does

not guarantee its inherent historical accuracy, especially given the failure of these methods to establish reliable chronologies (Reed, 2008c). It appears that they essentially provide nothing more than superior camouflage for the nonempirical imposition of an absolute timescale. Even the language used by the timescale guardians is bureaucratic, not scientific.

Suitable GSSPs with full documentation are *proposed* by stratigraphic subcommittees or working groups under ICS; undergo *approval voting* through ICS and *ratification* by IUGS; and then are published (Gradstein et al., 2004, p. 24, emphasis added).

True empirical facts are reproducible and often self-evident. Sir Isaac Newton did not require committees to determine whether or not his principles of optics were valid. No working group is needed to assess whether water really does consist of hydrogen and oxygen; anyone can perform a variety of tests to verify the fact. Bureaucracies establish rules; scientists verify existing truth. So why do the "empirical" GSSPs require this bureaucratic boost? The approach seems to reflect more of the present European political and social climate than the sober application of the scientific method!

As noted above, these problems point back to those with the underlying presuppositions. Uniformitarians believe that their investigations into the past are science. Failing to see that natural history is (1) a subset of history rather than science, and (2) a mixed question (Reed, 2001), it is unsurprising when their attempts to force their task into the framework of science results in frustration. One difference between science and history is the level of confidence that can be placed in the outcome. Rather than accept that diminished certainty of historical investigation, uniformitarian stratigraphers continue to be bedeviled by empirical challenges, such as the

missing parts of the rock record. They recognize on one hand that their sparse data present problems.

However, the geologic record is discontinuous, and these stratotype-based chronostratigraphic units are an imperfect record of the continuum of geologic time.... How can one standardize such fragmentary and disparate materials as the stratigraphic record? (Gradstein et al., 2004, pp. 20, 21).

But rather than stop and consider the implications of this question, they pretend that a blue-ribbon panel of experts can provide the certainty of experimental science by driving a series of fully ratified golden spikes.

Sometimes creationists get caught in the same net. Desiring empirical relevance, they opt to cover their confusion with meaningless verbal distinctions, such as "operations science" versus "origins science." In doing so, they miss a golden opportunity to demonstrate the inconsistency of attempting to create a purely empirical history. The point of revelation and historical records is to illustrate that history is much larger than empiricism—a lesson the Biblical emphasis on historical accounts ought to have driven home. Forensic investigation within the domain of history may seem similar to "empirical" history, but the framework is quite different (Reed, 2001) and presents an apologetic line of attack that has not yet been fully exploited.

At root, one's view of history is driven by one's worldview. In a sense, creationists are content to acknowledge this and work to integrate forensic investigation with Biblical accounts. In their zeal to displace the Bible's authority in culture, Enlightenment thinkers proclaimed freedom from any authoritative system and so thought they had no worldview, as illustrated by the hard positivism of the nineteenth century. Early uniformitarians were caught up in this zeal and developed a timescale that reflected

that thinking (Mortenson, 2004; Reed et al., 2006). But worldviews are like birthdays—everybody has one. And the secular worldview has come full circle; after decades of effort, stratigraphers have discovered authoritarianism—but now it is that of the academic elite rather than the Christian elite. The supposed Enlightenment preference for science over dogma has (inevitably) lost out to a new dogma—that of naturalism. Its adherents, many modern scientists, prefer their worldview to the reality of scientific information. Their nineteenth-century façade of “science” has become virtually transparent, yet they still act as though it covers their naked commitment to naturalism.

This tendency to choose power over science is seen in the hostile takeover of chronostratigraphy by geochronology. The former at least maintained a connection to the empirical rock record in spite of its errors, but it seems now that even that tenuous hold on empirical reality is being discarded. Since the committee has now both defined the eras and the ages of their upper and lower boundaries, what they did overtly in the case of the Precambrian is being done surreptitiously for the Phanerozoic. The ages now *are* the column, not a tentative addition to stratigraphic divisions well established in the field by empirical properties of the rocks.

The two concepts of geochronologic and chronostratigraphic scales are now united by formally establishing markers within continuous intervals of the stratigraphic record to define the beginnings both of each successive chronostratigraphic unit and of the associated geochronologic unit. This concept of a Global Stratotype Section and Point (GSSP) to define each stage has replaced the earlier use of “stage stratotypes”... In some respects, the concept of the beginning of each chronostratigraphic unit being bound by an isochronous surface defined at a GSSP has made

the dual nomenclature unnecessary for the units of the geologic time scale (Gradstein et al., 2004, pp. 20–21).

Thus, GSSPs do not summarize current empirical knowledge; they dictate both local and global correlation. This illustrates the importance of the foundational assumption of globally synchronous correlative time (Reed, 2008b), which must be true for these golden spikes to define history.

A GSSP is the precise definition of the base of a stratigraphic boundary in a rock sequence, but that boundary is defined only at one point on Earth. Assignment of the chronostratigraphic boundary within other stratigraphic sections requires correlation to the GSSP (Gradstein et al., 2004, p. 27).

Failing Basic Geometry

A true timescale would not only be empirically evident in the rock record, but it would be so worldwide. But in the

new stratigraphy, there is a breakdown in both logic and in elementary geometry. GSSPs fail the “global test” because they are *points* in the three dimensional crust. Since the flow of time is the same at all points on the earth, the correlation of a particular time horizon throughout the rock record should approximate a sphere (Figure 1). Vagaries in deposition and preservation make the actual rocks too discontinuous to provide such obvious global time markers, and so geologists have spent decades finding ways to correlate as many points (from outcrops, wells, and seismic data) as possible to extrapolate or interpolate the spherical horizon that represents a time marker. One could even argue that the essence of stratigraphy is correlation. Gradstein et al. (2004, p. 23) got it right in theory:

Without correlation, stratigraphic units and their constituent boundaries are not of much use, and devoid of meaning for Earth history.

But GSSPs are points, not spheres, and therefore they cannot define *global*

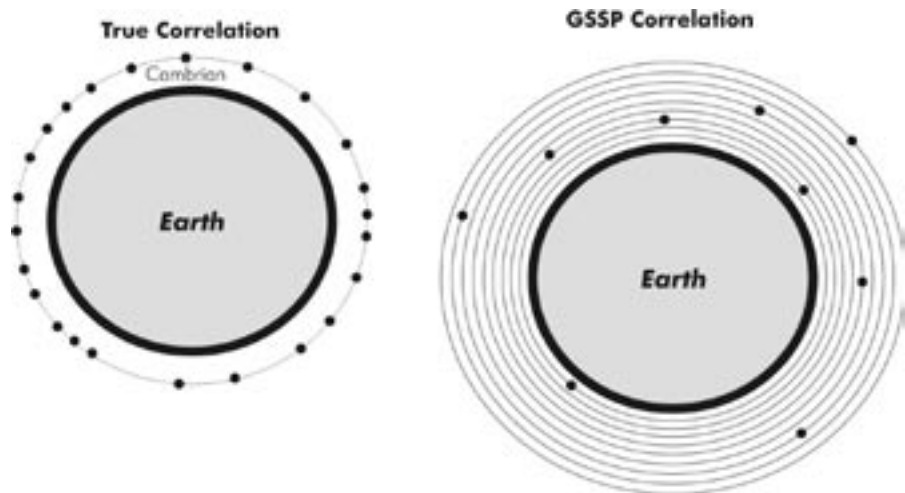


Figure 1. Correlation requires numerous points along one particular horizon as shown to left. Greater certainty requires denser spacing; commercial applications often require dozens of points within a few acres. The ICS proposes to radically redefine correlation. GSSPs correlate by reference to only one point per horizon. Note that the multiplicity of horizons leads to a multiplicity of scattered points along the spherical surface, creating the illusion that correlation coverage is adequate. Note also that this two-dimensional illustration drastically understates the true extent of the problem.

time markers. Strangely, this seems to have escaped the stratigraphers.

Ideally these “key events” should be observable globally, but at a minimum should be significant in one well-preserved section (Bleeker, 2004, p. 142).

Not so! If something defines a *global* horizon, then it should be observable at regular points all over the world. Something that exists in only one “well-preserved” section can only be correlated to itself. It seems that stratigraphy has given up on global correlation by empirical means. The assumption of global synchronous correlative time (Reed, 2008b) is so ingrained that people no longer believe that correlation must be empirical.

The approach adopted by GTS2004 places more emphasis on the relative stratigraphic position of the few samples for which precise age dates are available (Agterberg, 2004, p. 106).

How can we know that an outcrop on the other side of the planet is the same age—especially if the biostratigraphic, radiometric, magnetic, etc. criteria that position the spike are flawed (Reed, 2008c)? It all comes down to faith, which we were once led to believe is the antithesis of science.

And the public (including many geologists) is being misled. They think that age boundaries are determined by the evolutionary stage of fossils. Evidently not.

Even so, the practice continued of treating strata divisions largely as biostratigraphic units, and even today it is an article of faith for many Earth scientists that divisions of the developing international stratigraphic scale are defined by the fossil content of the rocks. To follow this through, however, leads to difficulties: boundaries may change with new fossil discoveries; boundaries defined by particular fossils will tend to be diachronous; there will

be disagreement as to which taxa shall be definitive (Gradstein et al., 2004, p. 21).

The ICS seems to have forgotten the very relevant observation of Gould (1987, pp. 157–158), who noted,

A chronometer of history has one, and only one, rigid requirement—something must be found that changes in a recognizable and irreversible way through time, so that each historical moment bears a distinctive signature.... But life is complex enough to change through a series of unrepeated states. Today we attribute this irreversible sequence to the workings of evolution.

Absent this chronometer, there is nothing with which to tell time. For decades, stratigraphers have pinned their hopes on evolution. If that is not adequate, then one of their most powerful arguments against creation science and diluvial geology has been washed away. Apparently not seeing that danger, they have decided, like Alexander, to simply sever the empirical Gordian knot by brute force.

The traditional stratigraphic scale using stage stratotypes has evolved into a standard chronostratigraphic scale in which the basal boundary of each stage is standardized at a point in a single reference section within an interval exhibiting continuous sedimentation... The global chronostratigraphic scale is ultimately defined by a sequence of GSSPs (Gradstein et al., 2004, p. 23).

Note, too, the logical sleight of hand in the GSSP strategy. Individual points are located all over the world. Therefore, the timescale is “global”—give or take a dimension or two! Less than a hundred points scattered around the earth would be considered woefully inadequate to correlate just one time horizon. How, then, can they define the same number of different time horizons?

Put That Spike Here...No, Here... No, Here...No, Here...

As if these problems were not enough, the committee is faced with the insurmountable task of placing its golden spikes. It seems strange that if natural markers within the rock record were not evident for global correlation to begin with, stratigraphers could confidently place each spike. And if the markers were so evident, why would there be any need for the spikes?

Soldiering on through these difficulties, the committee set two key criteria for placement of each spike. The first is that the chosen outcrop be a section showing continuous sedimentation.

The requirement for continuous sedimentation across the GSSP level and the bracketing correlation markers is to avoid assigning a boundary to a known “gap” in the geologic record. This requirement has generally eliminated most historical stratotypes for stages, which were commonly delimited by flooding or exposure surfaces and formally represent synthemms (Gradstein et al., 2004, p. 23).

As an aside, note once again how the previously assigned stratotypes (on which the timescale has won such wide acceptance) were inadequate due to missing section. There is no explanation of how GSSPs overcome this inherent weakness in the rock record. Furthermore, GSSPs face at least three other problems.

- (1) How continuous does the section have to be, and for how long? In other words, is 2 mm of “continuous” sedimentation on either side of the spike boundary sufficient; or is it 2 cm or 2 m? A thin section can be correlated more precisely but is less likely to extend any great distance. Given that the correlation is to be extended around the world, where does the committee draw the line?

- (2) How can a stratigrapher be assured that sedimentation was “continuous” if there are such things as “paraconformities”? If a paraconformity is defined as missing section visible only by biostratigraphic correlation, then clearly they are nearly impossible to detect in the field. If sedimentologists have been fooled by known paraconformities, how are we to know whether or not they have really found a continuous section for each GSSP? But then again, how are paraconformities defined at all if the old biostratigraphic methods are no longer definitive?

- (3) Furthermore, just what does “continuous” mean? Does it mean sedimentation that is truly uninterrupted? Or maybe that some sediment is deposited every year...every century...every millennium? Given that more and more of the rock record seems to be composed of units that were deposited almost instantaneously, with long periods of non-deposition in between, how can the outdated Lyellian concept of slow, continual sedimentation really be met in practice? Even if theoretically possible, how would we ever really know that it was true historically?

Finally, what happens if subsequent investigations show that the original criteria were not correct? Gradstein et al. (2004) have the perfect answer—ignore the problem!

However, once the golden spike has been agreed, the discovery, say, of *Monograptus uniformis* [the index fossil marker] below the GSSP does not require a re-definition of its position, but simply an acknowledgment that the initial level chosen was not in fact at the lowest occurrence of the particular graptolite. For that

reason, multiple secondary correlation markers, including non-biostratigraphic methods, are desirable within each GSSP section (p. 23. Brackets added.).

Evidently, when the committee speaks with regard to golden spikes, it speaks “ex cathedra.”

The second criterion is that the ideal GSSP section would show characteristics that can be correlated globally. However, once again, if global correlation is evident in the field, then why bother with golden spikes? And if not, how is it possible to establish golden spikes? If traditional biostratigraphy has failed and we need new committee-defined stratotypes, why are most of the golden spikes established by biostratigraphic criteria?

Another difficulty—that of finding sufficient correlative criteria—is factored into the definition but seems a much greater obstacle in nature.

The ideal GSSP would be in a low-latitude highly fossiliferous marine section (for global biostratigraphic correlation) that contains cyclic sediments or interbedded volcanic ash or lava beds (for isotopic dating or measurement of durations), unambiguous magnetic polarity changes (for high-precision global correlation), and one or more geochemical signatures (to provide additional high-precision global correlation markers (Gradstein et al., 2004, p. 27).

But if the defined type locale includes a specific set of environmental parameters, how can all the correlative points around the globe that were not deposited in that particular environment be correctly correlated to the GSSP? This logical breakdown, significant in the uniformitarian paradigm, would be much more so given the reality of the Flood. Even uniformitarians see the problems.

Surprisingly, perhaps, GSSPs located in sections that have an abundant

fauna may also introduce unknown correlation errors, particularly if they are in shallow-water shelf environments likely to give rise to an hiatus... (Gradstein et al., 2004, p. 27).

And this is not the only barrier to driving spikes.

However, some GSSPs...are tightly folded and may no longer retain magnetostratigraphic, geochemical, or other secondary markers for global correlation (Gradstein et al., 2004, p. 27).

No wonder it is taking so long to establish a full suite of GSSPs!

Finding the right site for a spike is even harder when we add the requirement that the “perfect” type locale be easily correlated elsewhere.

The ideal GSSP is at a horizon amenable to radiometric and/or astronomical cycle calibration or is bracketed by dateable horizons. This coincidence has been achieved for only a few GSSP placements.... If such a horizon is absent, it is essential to be able to correlate to dateable horizons elsewhere using precise global correlation markers (Gradstein et al., 2004, p. 27).

Once again, if these “precise global correlation markers” are so obvious, why bother with GSSPs?

When one begins to tally all of these difficulties, it becomes clear that there probably is no such thing as an “ideal” location. Those with many correlative criteria are restricted to a few specialized environments.

In short, GSSPs appear to be nothing more than another layer of confusion designed to obscure significant problems in uniformitarian historiography. If the time were self-evident in the rock record, none of this effort would be needed. If the time is not evident, then the central thesis of this series has been sustained: the timescale is not the empirical culmination of two centuries of hard science; it is instead a template sinking under

the weight of its faulty assumptions. Creationists should readily understand that the powerful, absolute timescale is nothing more than a house of cards, with its GSSPs often strongly influenced by the favorite field areas of influential members of the subcommittees. Thus the title of this paper; analysis of the new timescale spikes reveals they are iron sulfide (FeS_2)—fool's gold.

Conclusion

The geologic timescale is presented in schools, from elementary to university, as an empirical construct with all the veracity of the Julian calendar. Yet this rock-solid edifice is in the process of getting a radical face-lift, exposing in the process many weaknesses previously suspected, but seldom admitted. For years, creationists have noted that the stratigraphic assumptions hidden behind the façade of temporal elegance were biased, that its methods were flawed, and that its reasoning was invalid. Yet how many times did evolutionists tell Dr. Morris, Dr. Gish, or other creationist debaters that biostratigraphic correlation or radiometric dating had clearly established the timescale and that the resulting construct “proved” the superiority of evolutionary history and uniformitarian geology?

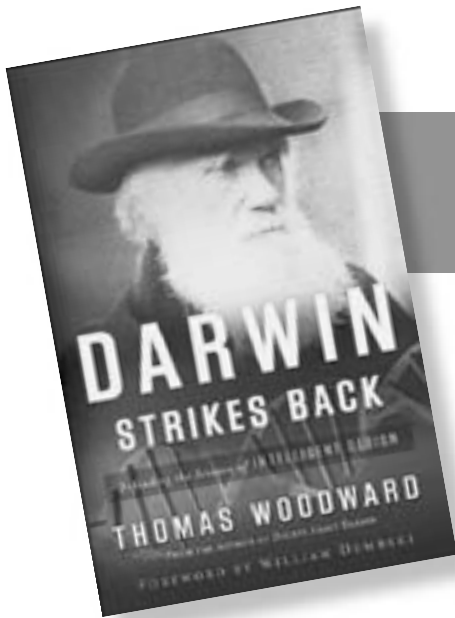
Now it seems that the creationists were right all along—validated by no less than the International Commission on Stratigraphy. GSSPs and GS-SAs further expose these weaknesses, further separate stratigraphy from science, and impose historical reality by bureaucratic fiat. Given the antipathy of their Enlightenment forefathers for authoritarianism, it is fascinating to see an exemplar of elevated European

civilization humbled by the wisdom of the Okefenokee Swamp: “We have met the enemy... and he is us!”

The times, they are a'changing!

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Book Review

Darwin Strikes Back: Defending the Science of Intelligent Design

by Thomas Woodward

Baker Books, Grand Rapids, 2006, 223 pages, \$15.00.

Many people are anxious to be better informed about the issue of intelligent design (ID). This book is written by a leading promoter of the concepts that the universe and life itself demonstrate order and useful purpose, both key features of ID. Many (including Woodward, but not all IDers) are opposed to the theory of Darwinian evolution, and so with this mind-set, author Woodward explains the history of ID and predicts the future.

The modern ID movement, including anti-Darwinism, became more popular in the 1980s. Michael Denton's book *Evolution: A Theory in Crisis* was published in 1985 and later caused "a turning point" (p. 22) in the lives of two future ID leaders, namely lawyer Phillip Johnson and biologist Michael Behe. The movement expanded into the 1990s, during which time its opponents, mostly Darwinists, were striking back with increasing intensity.

"The year 1999 can be marked as a turning point—the year that a major Darwinist counteroffensive began" (p. 43). Two major authors who considered ID to be a threat to the integrity of science were Kenneth R. Miller (*Finding Darwin's God*, 1999) and Robert T. Pennock (*Tower of Babel*, 1999). Meanwhile the ID community maintained its

offensive, which led to another turning point. This was a 2000 ID conference at Yale University. The gathering "was seen by many as another turning point for not only public exposure," but also "scholarly credibility of ID as a young but legitimate program in science ...all the major ID leaders spoke" (p. 48). During this time fifteen prominent speakers and writers participated. Evening meetings were attended by as many as 350 participants, some favoring ID and some opposing it.

The continued "seething controversy exploded in August 2004...it was a surreal window in time...stretching out over a year to the fall of 2005, the insidious threat [of ID] spread across the globe" (p. 19). Many in the mainline scientific community proclaimed that ID was all religion and not science, and if ID succeeded it would lead to the death of science. ID was stigmatized as a Trojan horse. Even now we remain in a serious period of change.

According to ID leading spokesman Michael J. Behe, author Thomas Woodward is "the premier historian of the Intelligent Design Movement" (back cover of the book). Woodward is insightful and accurate in his assessment of the past and current scenes. Based upon his knowledge of the past, Woodward makes

the daring prediction that there will be a steady decline of neo-Darwinism and its "catastrophic implosion within 10 years...by 2025 at the latest" (p. 177). Woodward is well qualified to make such predictions because of his background and current position.

Woodward has a Ph.D. from the University of South Florida and is a professor at Trinity College of Florida. In addition to speaking frequently, he has authored one previous book (*Doubts about Darwin*, 2003), and with James P. Gills has coauthored and edited *Darwinism Under the Microscope* (2002), which is an excellent compilation of design topics. His writing style is not only authoritative but also captivating.

The present book covers a host of important ID and creation/evolution topics, including cellular complexity, textbook misinformation, fossils, origin of life, and cosmology. The foreword is by ID leader William Dembski. There are 17 pages of notes and a 10-page index. *Darwin Strikes Back* should be read by all scientists and should be in all libraries dealing with origins issues.

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Statistical and Philosophical Notions of Randomness in Creation Biology

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Abstract

Mutations that occur in the absence of selection have often been cited as evidence that mutations are philosophically random—that is, that they do not follow a predetermined pattern but occur haphazardly. Mutation in absence of selection, however, may be a part of an adaptation process, specifically engineered for maintaining variability in organisms as a hedge against future environmental changes. A statistically random distribution of a constrained set of semi-specific (i.e. nonphilosophically random) mutations in populations would enable them to preserve a fairly constant percentage of mutants, which would foster survival in adverse conditions.

Introduction

Much is often made, both in creationary and evolutionary circles, of the notion that genetic mutations are, at least in general, “random.” There are multiple definitions, however, of the word “random,” and knowing which definition is being used can help analyze both the veracity of the claim and how the claim impacts our understanding of biology if the claim is true. Specifically, the Lederberg and Luria-Delbrück experiments are often considered evidence that mutations are random in the sense that they are haphazard. While these experiments do demonstrate the randomness of many

mutations for certain definitions of randomness, another possible model is that some of the mutations are deliberate in order to maximize the population’s genetic diversity (Anderson, 2003).

Other types of mutations exist that may fall outside of the “random” designation (Purdum and Anderson, 2008). These mutations, while extremely interesting, are not within the scope of this paper. Rather, in this paper I will consider only those mutations that occur in the absence of any selective pressure and use these mutations as a springboard for thinking about concepts of randomness as applied to Creation theory.

Definitions of Randomness

In evolutionary biology there are three definitions of chance or randomness that are offered—noncorrelation, statistical randomness, and philosophical randomness. Much confusion in both the scientific and popular literature arises from treating all varieties of randomness the same. At their core, most notions of randomness involve some sense of unpredictability from at least one vantage point (Eagle, 2005). This is somewhat of a minor point, however, compared to the variety of notions for which randomness is used. Clarifying the concept of randomness will aid not only in communicating the properties of systems clearly, but also in discovering new avenues of design in biology.

Noncorrelation is the simplest notion of randomness, as all that it implies is that two variables have no relationship to each other. This does not

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imply anything about the operation of the variables themselves – they may be perfectly nonrandom on their own. As long as they vary independently of each other, they can be considered noncorrelative. Also, noncorrelation can rarely be generalized – if a variable is noncorrelated with another variable, that does not prevent it from being correlated with another similar but different variable. In current mutation theory, mutations are said to not be correlated with the fitness needs of the organism that they occur in (e.g. Templeton, 2006, pg. 3).

Another notion of randomness is what I call “philosophical randomness.” This is the notion that a given event is happenstance. That is, a given event occurred outside the plan or guidance of any overarching control system. These events may be deterministic, but are fundamentally uncontrolled. When using this concept as applied to biology, Eble called this the “evolutionary notion of chance” and applied it to large-scale events in natural history as well as to the mutations on which natural selection acts (Eble, 1999, p. 75).

The last notion of randomness is what I call “statistical randomness.” This is the notion that a given set of events, whether deterministic or indeterministic, follows a specific set of statistical properties. Statistical randomness was originally specified by Von Mises, who stated that a process is random if all infinite subsets of the process’s outputs that can be specified using recursive algorithms are random (see Eagle, 2005, p. 756). Events that have a low likelihood of occurring and are statistically random are fairly easy to detect by counting those events in groups. If the mean and the variance of the counted groups are roughly equal, it provides good evidence that the process is statistically random (Luria and Delbrück, 1943).

Noncorrelation and statistical randomness, however, are quite distinct from philosophical randomness. Noncorrelation does not imply anything

about whether or not a given output was planned, and statistical randomness is actually harnessed in many applications to produce a planned result. In philosophical randomness, the output event is outside of a control. But in many cases programmers and engineers put statistical randomness under specific controls to produce specific outputs. Programmers use statistical randomness to minimize worst-case runtime performance in a variety of settings. As an example, some algorithms perform poorly on specific input orders, and therefore by randomizing the input order as the first step, the average computation time for the algorithm will be maintained even if the input ordering is always the worst case. Slot machine designers use statistical randomness to guarantee that (a) the result of any individual pull of the slot machine will not be determinable externally, and (b) the slot machine owner will give out less money than he received. Statistical randomness utilized within controlled systems is fundamentally different from philosophical randomness, in which the outcomes are not under any system’s control.

There are also other notions of randomness. For example, algorithmic randomness is determined by the compressibility of a string of results (e.g. Eagle, 2005, p. 769). It is safe to say that there are many varieties of randomness available, but here we will focus on noncorrelation, statistical randomness, and philosophical randomness. Specifically, we will look at the Luria-Delbrück and Lederberg experiments and see what sorts of randomness they imply.

The Luria-Delbrück Experiment

The Luria and Delbrück experiment (Luria and Delbrück, 1943) is often hailed as definitive proof that mutations are philosophically random—that they are haphazard events, not derived from the “need” of the organism. The test

is known as the “fluctuation test.” The test (illustrated in Figure 1) works as follows:

1. Start with a single colony of bacteria.
2. Cultivate the colony in several separate tubes and separate these into two sets.
3. After cultivation, the tubes are separated into two groups.
 - a. In the first group, the bacterial populations from each tube are randomly mixed and then spread onto several Petri dishes containing a selection agent, such as a bacteriophage.
 - b. In the second group, the population from each tube is spread onto separate Petri dishes (i.e. the populations are not mixed) containing the same selection agent.
4. The number of surviving/resistant colonies on each dish are counted, and the mean and variance for each group is totaled. If the mean and variance are roughly equal, the distribution is considered a Poisson distribution, indicating statistical randomness. The possible results are as follows:
 - a. If the first group is not a Poisson distribution, then the experiment was either not conducted correctly or the mutational pattern is not assessable by this experiment.
 - b. If the first group is a Poisson distribution and the second group is also a Poisson distribution, then the selection event is the cause of the mutation.
 - c. If the first group is a Poisson distribution and the second group is not a Poisson distribution, then the selection event is not the cause of the mutation.

The test of the first (mixed) group tells whether or not the mutation itself is statistically random and if the experiment was set up correctly. If the

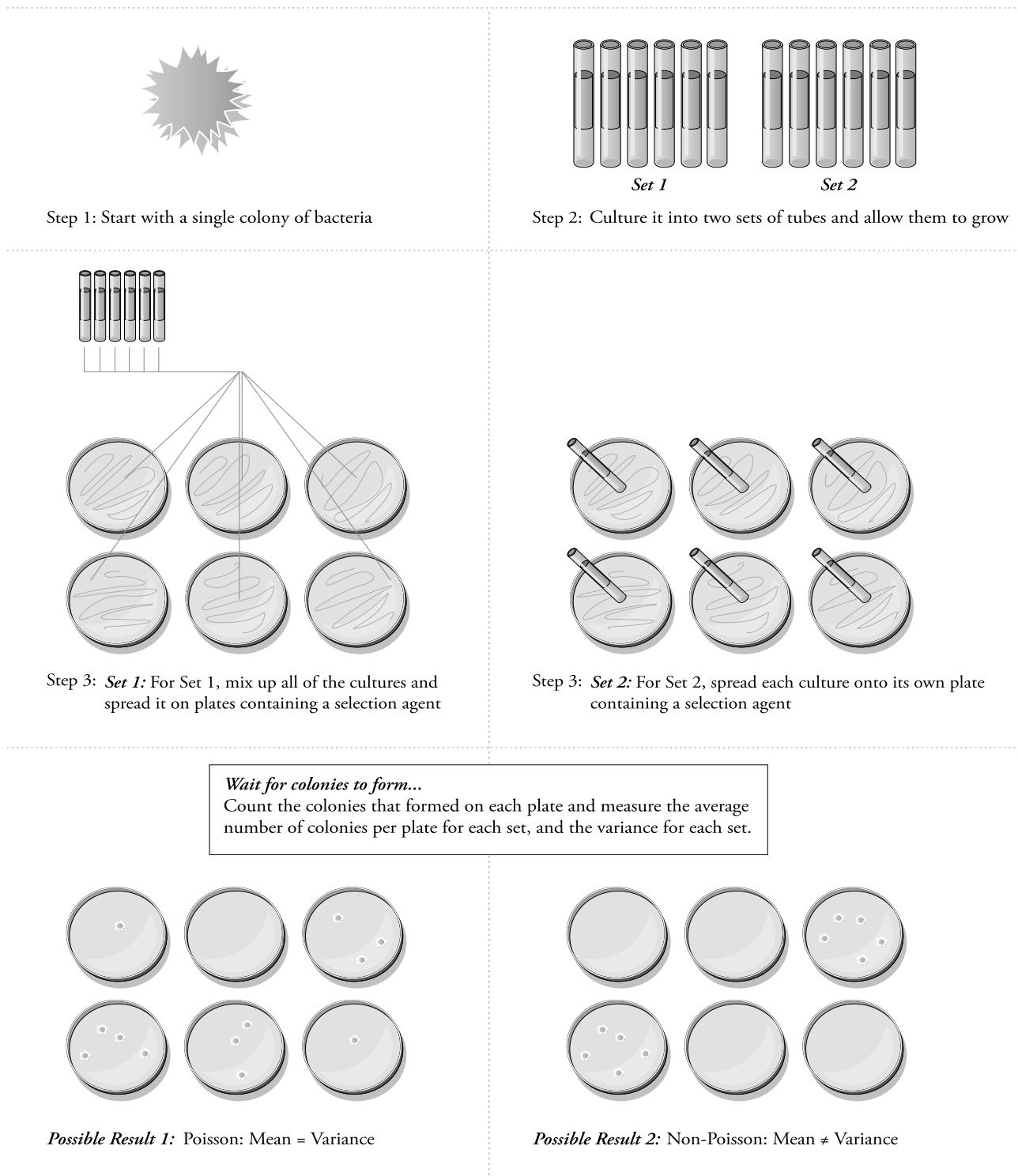
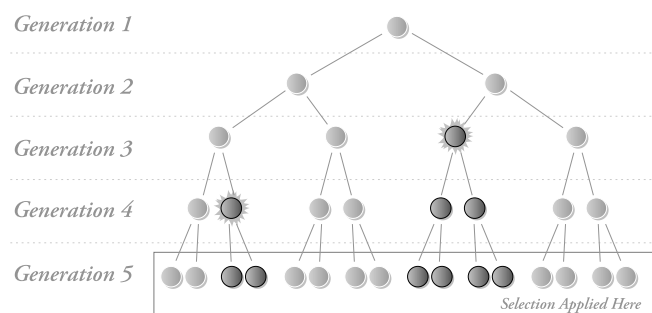


Figure 1. In the Luria-Delbrück experiment, a single colony is cultivated in two sets of test tubes (Step 1 and Step 2). In step 3 they are spread across Petri dishes containing a selection agent such as a virus that normally kills the bacteria. The test tubes in Set 1 are all mixed before spreading onto plates, while in Set 2 each plate is spread from exactly one test tube. After waiting for colonies to form, the colonies on each plate are counted. The time to allow for colony formation is dependent on both the selection agent and the bacteria—in the original experiment colonies were counted after 24 and 48 hours. If the mean colony count for a set is roughly equal to its variance, then it is likely that set follows an underlying Poisson distribution. The experiment will give a Poisson distribution for Set 1 and a non-Poisson distribution for Set 2 if the mutation is statistically random and not correlated with the selection agent.

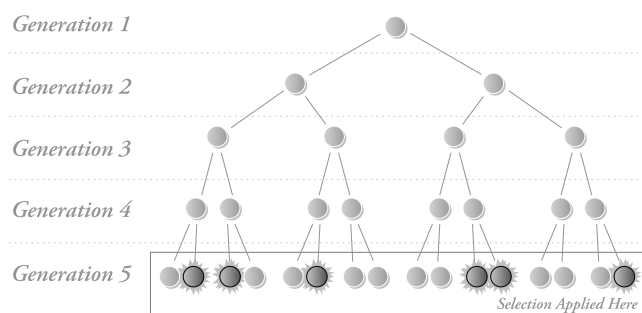
Luria-Delbrück Theoretical Model

Possibility 1: Selection-independent mutation
Mutation spread out evenly across all generations

Children inherit mutation, concentrating mutation according to lineage. Thus, certain lineages will have a lot of the mutation and others will have none, causing an high variance.



Possibility 2: Selection-induced mutation
Mutation spread out evenly at point of selection



Key: ● non-mutant
● newly-occurring mutation
● inherited mutation

Figure 2. This is a model showing why the distributions are different for selection-induced and non-selection-induced mutations. The light gray dots represent bacteria that do not have the mutation. Black dots represent bacteria that do have the mutation. In this graph, selection is applied at Generation 5. If the mutation was statistically random and noncorrelated with selection, then the mutation could have occurred at any point in the organism's history. The onset of the mutation is not only statistically random but also statistically random in every generation. Since the mutation is genetic, the descendants of the mutated cell will also have the mutation. This gives cells from that lineage a much larger representation in the final population, which will create a large variance. The other possibility is that the mutations are the result of selection. In that case, the lineage will not affect the outcome of the mutation—they will be statistically random at the point of selection, and nonexistent otherwise.

mutation is statistically random, then we can use the second group to tell if the selection event was the cause of the mutation.

In the second group, the bacteria were grown in separate tubes, giving each tube an independent lineage. If the mutation happened because of the selection event, then that would mean that the specific lineage of a cell would not matter in determining survival—it would be the selection event, not the lineage, that was causing the mutation. If separating them by lineage does dramatically affect the distribution (giving it a high variance), then lineage is the

primary factor determining survival, and thus the mutation must have occurred beforehand (i.e., independently of the selection event) and been passed on genetically. Figure 2 depicts these two possibilities graphically.

This experiment established that, for a large number of mutations, the produced mutations were both statistically random and noncorrelative with the selection event.

The Lederberg Experiment

A different experimental method known as “replica plating” was developed a

decade later. It also tests for the noncorrelation of mutation with the selection event but does not prove whether or not the mutation is statistically random (Lederberg and Lederberg, 1952). The Lederberg experiment is also much more intuitive and requires less mathematics to understand. In the Lederberg experiment, a bacterial culture is spread across a Petri dish. Following incubation, individual colonies form on the surface of the plate. Using a special technique called “replica plating,” the colonies on the first plate are sampled and copied to a new plate, where they are in the same position as the original.

Lederberg Experiment

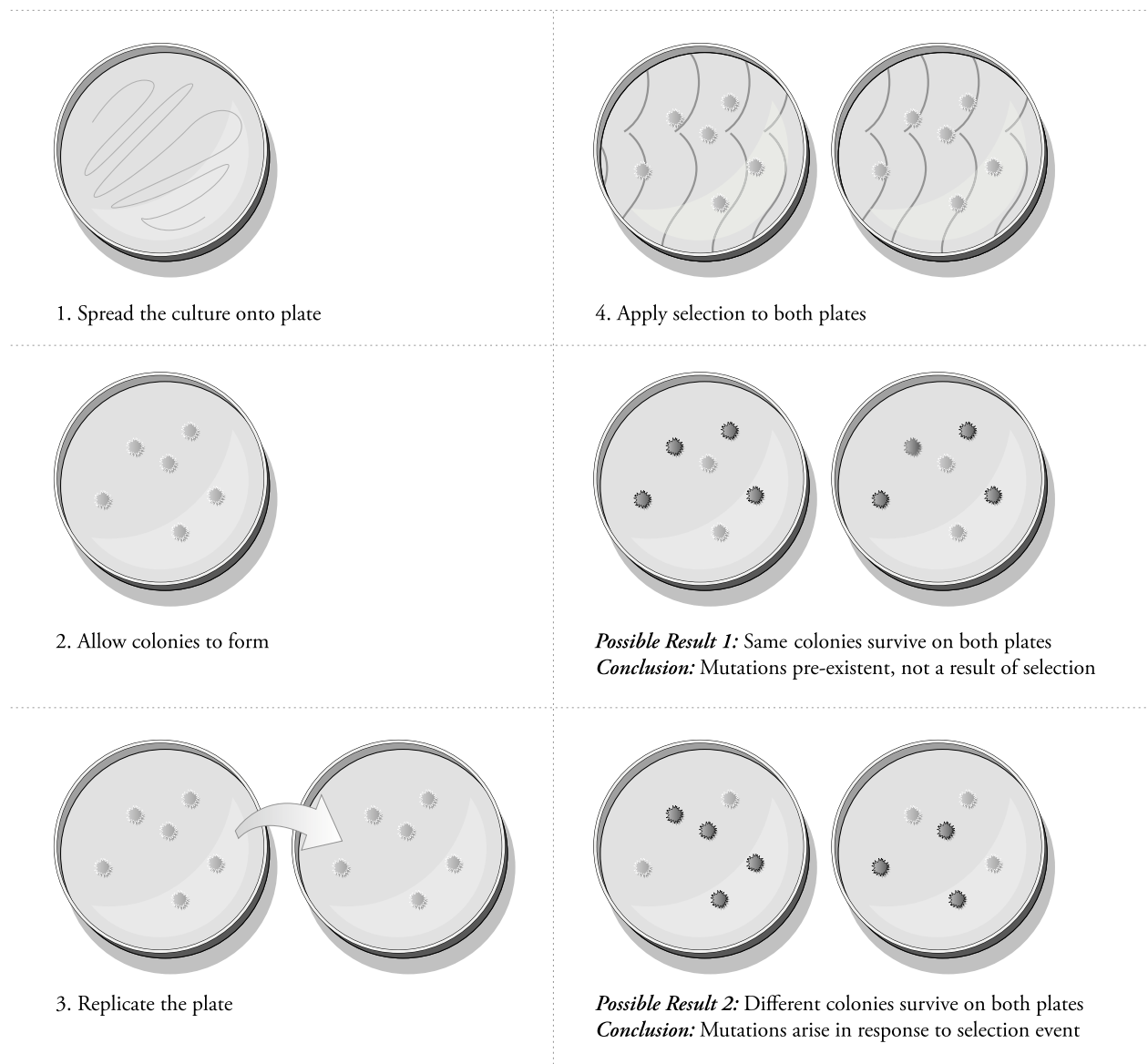


Figure 3. In the Lederberg experiment, a Petri dish is spread with bacteria (Step 1), and individual colonies are formed following incubation (Step 2). The Petri dish is then replicated-plated onto another Petri dish in such a way as to preserve the position of the colonies on both plates (Step 3). A selection agent is then applied (the original Lederberg experiment used bacteriophage T-1) to both plates (Step 4). If the selection itself is the cause of the mutation, then there should not be a positional correlation between surviving colonies on each plate. If the mutations were already in the population, however, then the same colonies should survive on both plates.

Then, a selection agent is applied to both plates. If the surviving colonies are in the same location on both plates, then that means that the mutation had occurred prior to the selection event.

If the surviving colonies are in different locations on each plate, then that means that the mutation occurred after (and because of) the selection event (see also Figure 3).

Lederberg, Luria-Delbrück, Philosophical Randomness, and Future Fitness

The result of these experiments is that a large class of mutations is both statisti-

cally random and noncorrelated with selection events. For many researchers, this has indicated that the mutation process is, in fact, philosophically random. As stated in the Berkeley evolution web site, “In this respect, mutations are random—whether a particular mutation happens or not is generally unrelated to how useful that mutation would be” (Caldwell et al., 2007). This is a clear articulation of the concept of philosophical randomness, which is directly attributed to such experiments. Another popular articulation of it appeared on Talk Origins’ Chance FAQ, where the author stated, “The changes that get encoded in genes occur with no forethought to the eventual needs of the organism (or the species) that carries those genes” (Wilkins, 1997). One more statement comes from the more technical literature: “Although many environmental agents can influence the rate and type of mutation, one of the central tenets of Darwinian evolution is that mutations are random with respect to the needs of the organism in coping with its environment” (Templeton, 2006, p. 3). Again, Lederberg is cited in support.

The common conclusion of philosophical randomness from the Luria-Delbrück and Lederberg experiments is based upon a false dichotomy. The reasoning that mutation in the absence of selection indicates philosophical randomness is unwarranted if design possibilities are included. Specifically, statistically random mutation in the absence of selection makes sense in a design paradigm as a process to maximize future fitness.

The two types of randomness discussed in connection with the Lederberg and Luria-Delbrück experiments are noncorrelation and statistical randomness. Statistical randomness is characterized by processes that lead to a constant percentage of given events no matter what the population size or the method of segregating the population. Therefore,

using statistically random mutations, a population of organisms could preserve a steady supply of alternative metabolic configurations in the population in order to prevent selection events from wiping out the entire population. If a statistically random process is used, it guarantees that a certain percentage of mutants will exist in the population. This is like stock market investors who maintain a given percentage of their financial holdings in alternative types of investments (gold and bonds for instance) just in case market conditions cause the primary investments to fail. In the same way, the reason many of these mutations are noncorrelated with the selection event, and thus the organism’s *current* fitness, may be because they are instead looking forward to the whole population’s *future* fitness.

Like alternative investments, each possible configuration has trade-offs. The alternative configurations for organisms are not as fit as the primary one under standard conditions, but maintaining a certain percentage of organisms in the population of mutant configurations enables them to survive novel or extreme circumstances in which their primary configuration fails them (Anderson, 2003; 2005; Anderson and Purdom, 2008). Thus, with design, we have the additional option of understanding mutation as being teleological, even when it is not related to any present need.

Production of Variability in the Genome

If a population lacks variability, then it is extremely susceptible to selection events. If an organism were engineered to produce variability, however, it would then be much less susceptible to adverse selection. Because of experiments like the fluctuation test and replica plating, it has often been assumed that specific variation-producing mechanisms do not exist, or if they do exist, they are a minor phenomenon in origins. Many

recent studies, however, point to existing mechanisms that produce biologically sensible mutations and do not merely select them. This may occur either as a response to selection or independent of selection (Ashcraft, 2004; Caporale, 1999; Caporale, 2000; Henderson et al., 1999; Moxon, 1997; and Rogozin et al., 2005 are just a few examples). If the set of mutations is restricted to those that are biologically meaningful, or at least those likely to be biologically meaningful, then statistical randomization within this set will produce mutants that are biased toward current or future usefulness.

This does not mean that all mutations conform to this pattern—some or many mutations may indeed be philosophically random—but that creation biologists should at least consider the possibility of forward-looking mutations when analyzing mutational patterns.

Phenotypic Versus Genotypic Randomness

When determining whether or not a mutation is philosophically random, one factor that often is not fully considered is the difference between analyzing genotypes and analyzing phenotypes. Many evolutionary experiments are evaluated only on the basis of phenotypes, the genotype being determined only indirectly by the behavior of the phenotype across generations. But when looking at phenotypes, the only possibilities that can be considered are those that can be observed. When examining the genetic makeup of an organism, however, we have access not only to the results of the organism’s coding but also to the code itself.

Think of a sentence such as “Eat an orange.” If we were to make a statistically random change with uniform probability at the level of the lettering (i.e., the coding), the result would not likely make much sense at all. Performing a random replacement via a simple

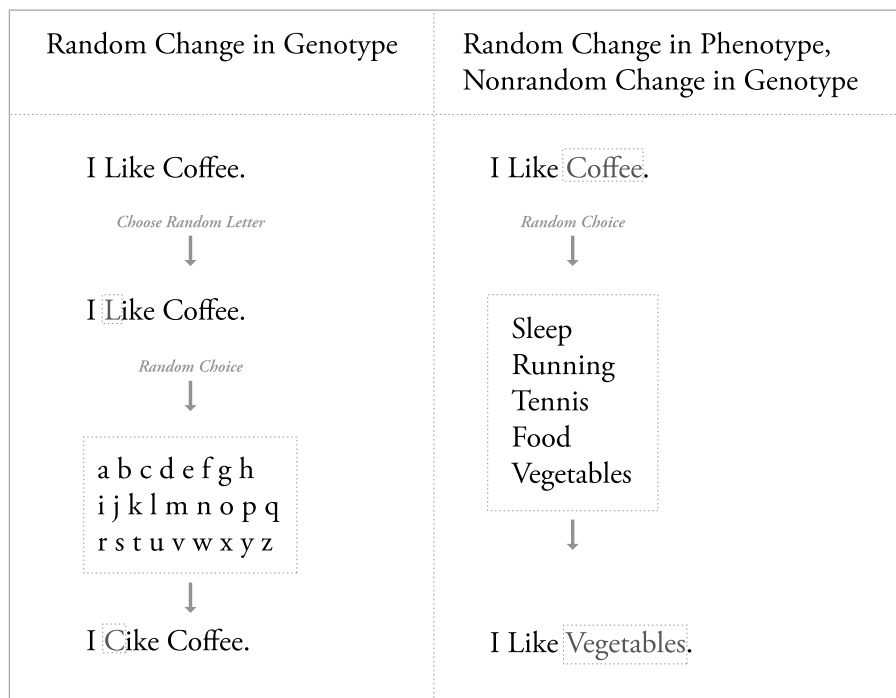


Figure 4. This figure demonstrates what is meant by random phenotype changes being different than random genotype changes. If the random change is on the level of the genotype (as would be expected with “copying errors”), the change itself has no relation to the final meaning of the sentence. In this example we changed one letter at random without any respect to the final meaning of the sentence. The end result made the sentence nonsensical. The second example is a random change in phenotype. In this case, all of the possible choices are at least sensible, whether or not they are true. It is still a genotypic change and is still statistically random, but the randomness has been restricted to possibilities that are at least potentially sensible. In this example we used whole words as the unit of changes, but it could also be done using a unit as small as morphemes (the smallest semantically-meaningful unit) or as large as can be imagined. The main point is that it is still a random choice, but the possible alternatives have been restricted much farther than an arbitrary genotypic change would allow.

computer program produced “Eat an ortnge,” which is nonsensical (i.e., it does not produce a valid phenotype). However, if instead we constrained the lettering (genotypic) changes to those that make sense within the context, or those that at least have a chance of making sense within the context, we have much better results. For example, if I chose to replace “orange” with a statistically random member of the set (“apple,” “pear,” “tomato,” “radish”), then all of the resulting phrases (genotypes) would at

least make grammatical sense—i.e., we would get a viable phenotype at the end (see Figure 4 for a side-by-side comparison of these ideas).

Therefore, if an evolutionary study were looking at phenotypes alone, such a study would not be able to see the amount of constraints on the underlying genotype that were involved. What might appear to be an unrestrained change may in fact be severely constrained in its production (not just selection) by the cell itself. Merely looking at

the phenotypes cannot tell us whether or not the underlying code is changing in a way that is constrained toward biological sense or if the underlying code is changing in an unconstrained way. Philosophical randomness, also called the “evolutionary notion of chance,” would require that the mutations occur outside of biological controls. If we instead find that the biology of cells is restricting the mutations in large part to sensible areas, then even if the changes are statistically randomized within these areas, it is a constrained randomness.

What is observed is that genomes do not exhibit statistical randomness across all configuration possibilities, but instead the set of possibilities is restricted by mechanisms within the genome that focus mutations in “hot spots.” Two possibilities then occur. Either these regions are hot spots simply because of arbitrary structural occurrences, or they are hot spots for the purpose of constraining mutation to functionally useful areas. One can differentiate between these two possibilities by whether or not the hot spots are more likely to contain beneficial mutations than the rest of the genome (Dembski, 2001; Dembski, 2005).

For instance, in criticizing Behe, Coyne has pointed out that

what we do not mean by “random” is that all genes are equally likely to mutate (some are more mutable than others) or that all mutations are equally likely (some types of DNA change are more common than others). It is more accurate, then, to call mutations “indifferent” rather than “random”: the chance of a mutation happening is indifferent to whether it would be helpful or harmful (Coyne, 2007).

What Coyne has said is that the existence of hot spots in a genome does not invalidate the hypothesis that mutations are philosophically random. In order to maintain that they are “indifferent,” however, these hotspots should not be highly correlated with the usefulness of

a change compared to a random one. In this instance, by random I mean a statistically random one with a uniform probability distribution across the genome. If changes in these hot spots are, in fact, more biased toward beneficial or at least biologically sensible changes than arbitrary changes in the rest of the genome, then the idea that they are “indifferent” and merely the result of “errors in DNA replication” falls short.

Rogozin et al. (2005) give a helpful overview of some properties of genomic hot spots, but fall short of categorizing the hot spots according to their occurrence in functionally useful areas. Caporale (1999) is much more concerned with the beneficial nature of what she calls “molecular strategies” and says that genomes

have evolved mechanisms that generate multiple sequence changes in a single step, allowing them to bypass unselected neutral, and negatively selected, sequences that may lie on point mutation pathways between the current sequence and a more optimal sequence (p. 2).

Thus, according to Caporale, there are many genomic potentials that will never even be attempted because of the molecular strategies in place. It is not that they are selected against, rather the genome focuses its own mutations in potentially beneficial directions while skipping the likely dead ends.

This sort of phenomenon already has been shown in certain cases of somatic hypermutation, which is a related but different type of mutation in which mutations are accelerated in response to specific environmental stresses. For instance, in mutating the immunoglobulin genes for refining binding affinity, the mutations are constrained almost entirely to the V region of the immunoglobulin gene, which is the most likely place for a beneficial mutation to occur (Wagner et al., 1995, Papavasiliou and Schatz 2002). The challenge for future creationist research will be to show quan-

titatively that hot spots for spontaneous mutations are also more likely than random to produce biologically sensible changes that may be useful in alternate environments.

Conclusion

Randomness is not a singular concept but instead a multiplicity of concepts. Only certain varieties of randomness are at odds with teleology, and it is important for creation biologists to be familiar with how the different types of randomness can be utilized in evaluating biological phenomena. Statistically random mutation, even when noncorrelated with a selection event, is not sufficient evidence for philosophical randomness. Instead, such mutational processes may also suggest that population microevolution “plans ahead” to prepare for future contingencies. The evidence in the current biochemical literature gives support for the idea that the genome is biased toward generating biologically “sensible” mutations. This in turn indicates that such processes are loaded with information about the search space that could not have been obtained solely through stochastic events, and that their ultimate origin “transcends chance and necessity” (Dembski 2005).

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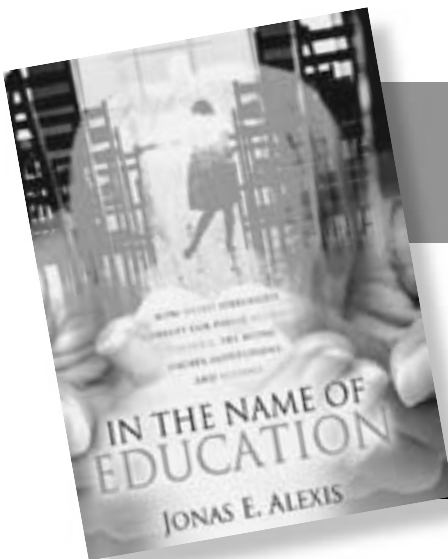
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Book Review

In the Name of Education

by Jonas E. Alexis

Xulon Press, Longwood, FL,
www.xulonpress.com, 438
 pages, \$22.00.

Author Jonas Alexis is a high-school math teacher in Avon Park, FL (p. 29). As an “insider,” he has much to say about current public education, and it is not positive. Alexis describes declines in the political, social, moral, educational, and spiritual fabric of the U.S. In particular, he identifies educational failure with the “weird – and detrimental ideologies [and spokesmen that] infiltrate our schools” (back cover). The popular, misguided trends include political correctness, “no child left behind” policies (p. 243), affirmative action (p. 265), evolution, secular humanism, entitlements, slavery reparation (p. 281), multiculturalism

(p.305), and many others. Regarding multicultural excesses in the classroom, author Alexis is a native Haitian and knows the issues personally. The only solution that Jonas finds is to bring God back into education (p. 321). That is, we need to return to the Biblical, Christian heritage of American public schools.

The book shows familiarity with thousands of named writers and leaders. These include poets, philosophers, and scientists of the past and present. Useful quotes appear on every page. In preparation for this book, the author describes checking out 50 library books at a time, and the scholarly effort is obvi-

ous (p. 407). There are 1770 endnotes and a “select” bibliography list with 360 references.

A second edition of this book (which is underway) may correct some shortcomings. Along with numerous typos, the words “macro-” and “microevolution” are somehow reversed in meaning (p. 234). Also, the ten-page index has little value since the page numbers listed do not match the text. Beyond this, author Alexis has written an important book, and further polishing will add to its value.

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Tides and the Creation Worldview

Don B. DeYoung*

Abstract

Lunar tides play a significant role in creation studies. Tides help our understanding of the fundamental law of gravity and also contribute to the biological health of the world's oceans. Canada's Bay of Fundy is one location where tides are especially evident, and an on-site description is included. The earth-moon tidal interaction results in a gradually receding moon and a slowing of the earth's rotation. These dynamical changes are highly dependent on earth-moon separation and are in conflict with the evolutionary timescale.

Introduction

The moon is our nearest neighbor in space. This natural satellite plays a key role in creation studies, including the topics of lunar origin, dust accumulation, orbital recession, transient phenomena, and the origin of life. The lunar tides interface with several of these topics. Ever since the fourth day of Creation, tides have washed the earth's coastlines. The history of tidal studies goes back many centuries with efforts to understand their cause. These efforts were largely unsuccessful until the gravity insights provided by Isaac Newton in 1687. Still today, questions remain concerning details of the tidal interactions between the earth and the moon, especially historical changes and frictional effects.

Tide History

There are excellent summaries of the development of tide clocks, maps, mechanical predicting machines, tide tables, and explanatory theories (Cartwright, 1999; Wylie, 1979). Galileo (1564–1642) proposed a unique cause for the earth's tides in his 1632 work, *Dialogue Concerning the Two Chief World Systems*. Figure 1 illustrates Galileo's approach, which does not involve the moon. The earth both rotates and revolves, and the large partial circle shows the earth's orbital path. The portion of earth at point F moves fastest through space since the rotation and revolving speeds add together in the forward direction. In contrast, the S position moves slowest since the forward revolving speed is somewhat counteracted by

the back rotation. Galileo suggested that the ocean waters "piled up" at F as they were pushed ahead, and they likewise accumulated at S because of sluggish motion. The result was two high tides, roughly twelve hours apart, just as we observe. Galileo's explanation is interesting, but it is entirely wrong. One must remember that Galileo was searching for evidence of earth movement in his effort to challenge the geocentricism of his day, four centuries ago.

Fifty-five years after Galileo's publication, Isaac Newton showed in his classic *Principia* (1687), that the pull of the moon's invisible gravity is the key to understanding the tides. As Galileo had realized, the difference in relative earth motion at points F and S is not negligible. Orbital speed averages 66,000 miles per hour, and rotation speed is about 1,000 mph at the equator. However, the daily change of $66,000 \pm 1,000$ mph does not cause the seawater to "pile up" since the seas are a fixed component of Earth's rotation. Furthermore, the high tides do not line up with

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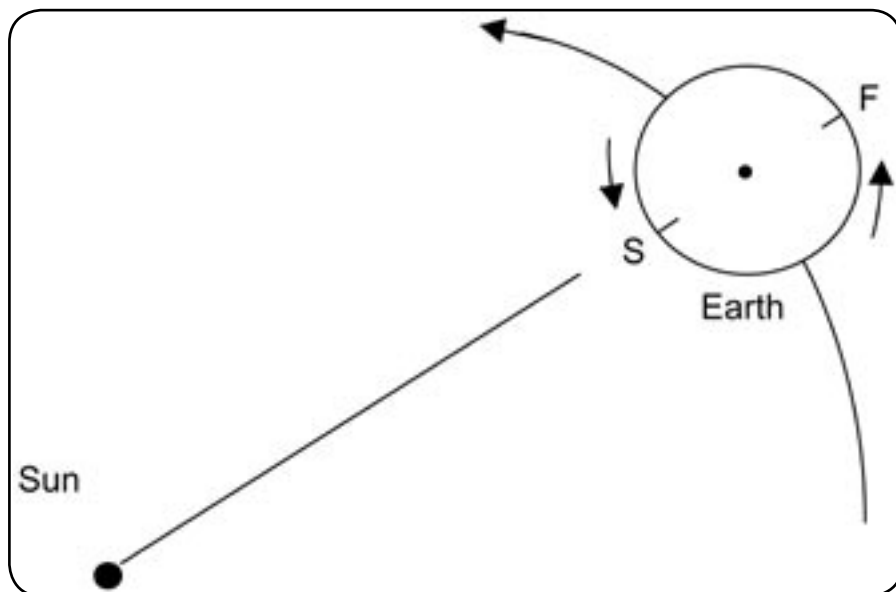


Figure 1. Galileo's model attributed high tides F (fast) and S (slow) to the earth's rotation (small circle) and revolution about the sun (large partial circle). Not drawn to scale.

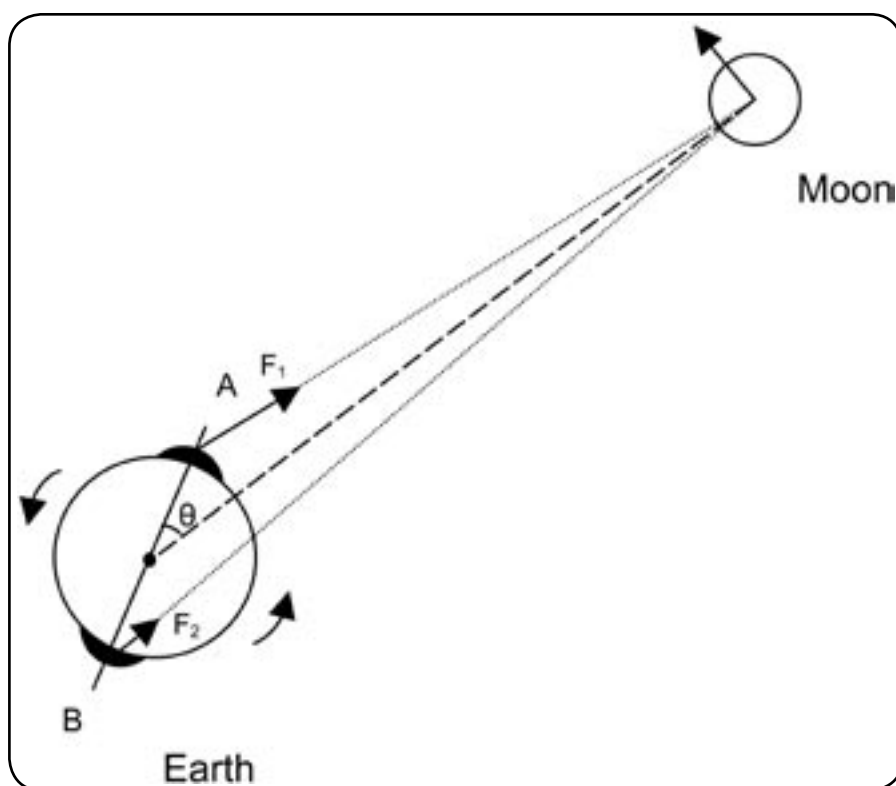


Figure 2. The earth and moon from above earth's North Pole, not drawn to scale. Friction causes the earth's tidal bulges to advance slightly ahead of the moon. The lag angle θ is two degrees or less. The forces F_1 and F_2 show the moon's gravity pull on the high tide bulges.

the sun as Figure 1 assumes. As Newton realized, it is the distant moon's gravity that controls the tides.

Tides and Gravity

It is readily noticed that the earth's high tides are separated by about 12 hours and 25 minutes. That is, if high tide occurs at a given location at twelve noon one day, then the next two high tides will occur at about 12:25 a.m. and 12:50 p.m. the next day. Since the moon rises about 50 minutes later each night, a lunar-tidal connection is apparent. We now know that the 50-minute increment is due to the combination of the rotating earth and revolving moon. In days gone by, however, this explanation was not obvious.

Figure 2 shows the earth with its two high-tide bulges, exaggerated in size. The bulges do not line up exactly with the moon's position, as explained in following sections. The bulge nearest the moon occurs since that portion of the earth experiences the greatest lunar gravitational acceleration. The bulge on earth's far side can be thought of as feeling the least acceleration, and therefore bulge B "lags behind" that of the center of mass of the earth. As the earth rotates, the two high tides act like permanent ripples on the moving crustal surface. Two low tides also occur every 24 hours 50 minutes, each about six hours after a high tide. Mathematical details of the tides are given in Appendix 1. Between the earth's near and far sides from the moon, the tidal force difference totals an astounding 1.32×10^{19} Newtons, or about 1500 trillion tons.

On earth, gravity is easily out-pulled by simply lifting a paperclip with a hand magnet. On the scale of moons and planets, however, the gravity force dominates space with impressive strength. The sun also causes earth tides. The solar tides are about one-half the magnitude of lunar tides, mostly due to the sun's greater distance from earth, 400 times further away from us than the moon.

Crustal and Atmospheric Tides

Tides are not limited to earth's seas, but also extend to the earth's solid crust and atmosphere. Solid or body tides of the earth are detected by small periodic gravity variations at fixed points on the earth. Such measurements were first made around 1900 with the construction of precise gravity meters. The earth's crust is somewhat flexible on the large scale, and its surface at high tide rises about 30 cm, or 12 inches (Peale, 2001). If a large stethoscope could somehow be placed upon the earth, one might hear the creaks of the stretching and contracting earth. One might also suggest this flexing of the earth's crust is an occasional trigger for earthquakes, but no such correlation has been found between tides and seismic events.

High tides in the atmosphere are due to a very slight outward lunar pull and expansion of the air. This leads to a measurable decrease in barometric pressure. A small, twelve-hour oscillation in pressure was detected with a mercury barometer in 1785 (Cartwright, 1999). It amounts to a pressure change of about 3 millibar, that is, 0.002 in or 0.005 cm of mercury. This is a 0.0066% change from normal air pressure. Solar heating of the atmosphere causes a far larger barometric effect. The thin upper atmosphere may expand and contract by several kilometers.

Bay of Fundy Tides

Around the world, high tide averages about 3 feet, or 1 meter above low tide. In places, however, tides reach impressive levels. One such location is the Bay of Fundy, located between the Canadian provinces of New Brunswick and Nova Scotia (Figure 3). The bay trends north-east with an Atlantic entrance width of about 60 miles (100 km) and a length of 180 mi (290 km). Toward the closed end, or head, of Fundy, the high tides reach 50–56 feet (15–17 meters) above

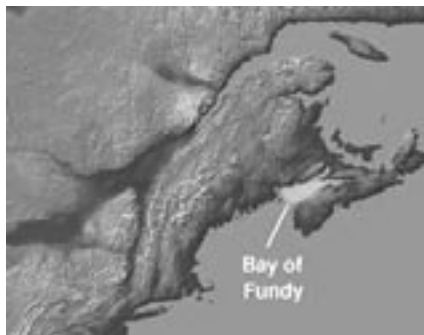


Figure 3. The Bay of Fundy lies between Canada's eastern provinces of New Brunswick and Nova Scotia. The bay covers an area of about 12,000 mi² or 31,000 km² of water.

low tide levels. This dramatic change is as high as a four-story building.

There are two contributing reasons for the record tides in the Bay of Fundy. First, the length of the bay results in resonant water movement with the tides. The time for a wave to move from the mouth of the Bay to its head, and back again, is 12–13 hours. This is approximately the time between two high tides. As a result, the rocking motion of the water builds up and is amplified, an effect called *seiche*. The phenomenon is somewhat like a child sloshing water back and forth in a bathtub or small pool. A second reason for the impressive Fundy tides is the gradual narrowing of the bay along its length, funneling incoming water together. Two smaller horn-shaped bays at the head of Fundy further act like funnels within a larger funnel, concentrating the incoming water. It is in these inner bays where the highest tides are recorded.

A Personal Tour of Fundy

During Fall, 2007, my wife Sally and I traveled along the New Brunswick coast of Fundy Bay. The large-scale tides result in many wide tidal flats, streams

and rivers that periodically reverse their flow, and coastal rock formations that are alternately submerged and exposed. The intertidal zone and inland waterways are a paradise for wildlife as the tides come and go. Of special note are Hopewell Rocks near the head of Fundy Bay (Figure 4). These are several sandstone/conglomerate sea stacks, 60–80 feet tall (18–24 m), which have been sculpted by the relentless tidal motion. At low tide, one can walk on the seafloor at the base of the mushroom-shaped rock formations. The ground is thick with gardens of seaweed and barnacles. Six hours later, at high tide, the tops of the stacks become small islands covered with spruce trees. Brochures at the Hopewell site claim that the rock formations formed during the ice age, 12,000 years ago. However, the Hopewell Rocks are actively eroding due to advancing and receding water. One team of geologists suggests, on the basis of old photographs, that the Hopewell Rock formations are only 100–250 years old (Trenhaile et al., 1998). This estimate fits the young-earth view of history, where earth changes are not on the scale of multiple thousands or millions of years. Readers may recall the 2003 loss of New Hampshire's "Old Man of the Mountain" and also the 2005 collapse of the "Apostle" sea stack on Australia's coast. The earth's surface is changing before our eyes.

At the entrance to Canada's Fundy National Park, the coastal village of Alma provides a dramatic view of the changing tides. As high tide diminishes, one can watch the shoreline widen at the rate of several feet per minute. Mudflat islands appear offshore and soon connect to the mainland. Docked fishing boats are left stranded and tilted on the wet ground until the tide returns to refloat them six hours later.

Moncton, New Brunswick, is famous for a tidal bore occurring periodically on the Petitcodiac River. Incoming water at high tide is funneled into the shallow, narrowing river. Friction on



Figure 4. Hopewell Rocks are scenic coastal formations near the head of the Bay of Fundy. These sea stacks are flooded and dried out twice every 24 hours.

the river bottom causes the rising water to slow and build up to a single wave that moves upstream against the normal river current. Similar tidal bores occur worldwide on coastal rivers where the local geography permits. River surfing is possible on the impressive Amazon tidal bore, but there are also dangers with the phenomenon. In 1843, the daughter and son-in-law of French writer Victor Hugo (1802–1885) were drowned on the Seine River when their sailboat was overtaken by a tidal bore. Also, in 1922, 130 lives were lost when a large bore wave capsized a steamer

on the lower Colorado River in Mexico (Wylie, 1979).

Our visit to the Moncton tidal bore was on a November morning. There is a city park with bleachers placed along the riverside for viewing. However, building and bridge construction along the river have diminished the bore in recent years. When we asked residents about the tidal event for which their city is famous, some were not familiar with the heritage. There is a time clock in the park to indicate the arrival of the bore for observers, but it was not accurate. In past years, the Moncton bore wave

reached five feet high. The wave we observed on a fall morning was less than one foot. Still, it was impressive to watch this leading-edge wave moving upstream at about walking pace, 3 miles/hour (4.4 feet/sec). The wave was accompanied by a line of white foam extending from shore to shore. The tidal bore made little sound, and unwary ducks were surprised and tossed into the air by its passing. The Moncton, New Brunswick, tidal bore continues twice every 24 hours, year around, little noticed except for tourist season, and greatly diminished from earlier years.

Tidal Energy

Energy extraction from the tides for electricity is an attractive option. Consider the Bay of Fundy, where 100 billion tons of water sweep in and out, twice each day. This is about twice the total discharge of all the world's rivers combined. Tidal energy produces no smoke or thermal pollution, and no radioactive waste. There is an estimated worldwide tidal power production potential of about 200 billion watts, equivalent to 200 fossil fuel or nuclear plants. This is a small component of the current total since there are more than 50,000 power plants worldwide, large and small. Still, at full potential, harnessed tidal energy could replace the consumption of 3–4 billion barrels of oil annually. Reality, however, complicates the picture. Tidal electric generating plants are limited to coastline areas where the tides are high, and where the water can be channeled through turbines. Also, the building of major dams to channel seawater is not economical, and a host of environmental concerns arise with coastal construction.

The best-known tidal power plant is located on the English Channel estuary of the Rance River in France. Since 1966, this facility has been generating 240 million watts of power, about one-quarter that of a large power plant. U.S. states considering similar tidal plants include Alaska and Maine. Countries with plans to tap tidal energy include Australia, Brazil, Canada, China, India, Korea, and Russia. Rising oil prices may yet make tidal generating plants a growth industry worldwide.

Tidal energy currently is lost to water turbulence, friction between water and the sea bottom, land erosion, etc. The tidal energy dissipation across the entire earth is enormous. The tidal power loss is estimated at $1.5\text{--}2 \times 10^{12}$ watts (Stacey, 1969, p. 34). This is the approximate electric power production of the entire world. The large-scale frictional energy loss resulting from the moving seas is the subject of the next two sections.

Lunar Recession

George Howard Darwin (1845–1912) was the fifth of Charles and Emma Darwin's ten children. George is called the “father of geophysics” for his dynamical studies of the earth and solar system. In 1878, he proposed that our moon originated by fission from the earth. He believed that the earth once rotated about ten times faster than at present. The moon was flung outward from the Pacific Ocean basin, much like mud from a spinning bicycle wheel. Lunar fission is a failed theory and has been followed by a parade of alternate lunar origin theories, none of them scientifically adequate or convincing (DeYoung and Whitcomb, 2003). Nevertheless, George Darwin's fission theory led him to consider the gradual outward movement of the moon from the earth. He wrote five major technical papers during 1879–1880 that included both lunar recession and earth retardation.

Figure 2 shows that the earth's two tidal bulges do not line up exactly with the moon. The lag angle is not well known, and it varies. One estimate of the high tides offset is 2.2° (MacDonald, 1965, p. 285). High tide occurs eastward or ahead of the moon because of friction and inertia of the earth's tidal waters. The near-moon bulge continually pulls the moon forward, resulting in a slow outward-spiraling lunar orbit. The increasing distance to the moon is precisely measured by earth-based lasers. Beams are reflected back from retro-reflector devices placed on the moon during the 1969–1972 Apollo missions. The current lunar recession rate, after orbital motions and oscillations are subtracted, is 3.82 ± 0.07 cm/yr, or 1.5 in/yr (Cartwright, 1999, p. 250).

George Darwin realized that lunar recession was nonlinear, and was considerably greater in the past when the moon was closer and the tides were stronger. Based on theory, Darwin's estimate for the time when the moon fissioned from the earth was on the order of 54 million

years ago (Cartwright, 1999, p. 150). Appendix 2 gives a calculation for the extreme nonlinearity of lunar recession. This analysis gives a maximum lunar age of less than 1.55 billion years. By no means is the moon necessarily this old. Instead, this number is an upper limit on lunar age, and it also is a major challenge to the evolutionary view of lunar history. If one “regresses” the lunar distance into the distant past, the moon comes uncomfortably close to the earth in less than two billion years. If such an event actually occurred, the resulting tides would be hundreds of feet high and would sweep far inland. Furthermore, tides from a nearby moon could heat the oceans to the boiling point and extinguish life on earth. Worldwide earthquakes and volcanoes would result from distortion of the earth's crust. If the moon were ever closer to the earth than the Roche (rōsh) limit, it would be destroyed. This limit extends outward from earth's center about 2.9 radii, or 18,500 km. If the moon were ever at this near-earth position, the earth's gravity would overcome the self-gravity of the moon. As a result the moon would shatter into fragments and spread out into a Saturn-like ring around the earth.

The preceding limit on lunar age, less than two billion years, cannot be tolerated by the natural science community. The moon is firmly assumed to be 4.6 billion years, the same age as the earth and the rest of the solar system. What is the response to the serious conflict between the 4.6 billion year age assumption and the moon's recessional age limit? Some creation critics simply reject a nonlinear, increasing recession rate in the past. If the recession has always been just 3.82 cm/yr or less, then an ancient lunar age is compatible. However, the lack of understanding of such critics needs no further rebuttal.

Another suggestion is that the current value of lunar recession, 3.82 cm/yr, must be anomalously high. That is, in contrast to the physics model of Appen-

dix 2, the recession rate is said to be getting larger over time rather than smaller. In this view, for a long period of history, lunar recession was very small. Then, at some point, the moon underwent a sudden speedup in its outward motion. This unexplained increase in lunar recession rate (and earth rotational slowdown) is described as an inflection or phase-change of the earth-moon dynamics (Lathe, 2006; Thompson, 2000). There is no mechanism for such a change, which appears to be a desperate attempt to preserve the assumed 4.6 billion year age for the moon.

Some fossil corals and banded iron formations appear to show tidal growth lines from the distant past. This data has been searched for evidence of a dramatic, historic, inflationary change in tide magnitude, but without success. Whether or not fossil coral bands actually show evidence of paleotides is a separate, doubtful issue (DeYoung, 1979). On a timescale of just 6000 years, with little change in the 3.82 cm/yr recession rate, the moon has moved outward since Creation a negligible distance of about 230 meters.

Earth Retardation

As the moon's orbit slowly spirals outward, the earth's rotation slows. Eclipse records give supporting evidence: Around 1695, Edmund Halley noticed that Arab solar eclipse records from A.D. 900 were in conflict with the calculations of his day by 1–2 hours. Research continues on eclipse records found on Babylonian clay tablets. In 1754, Immanuel Kant first suggested that the length of day was increasing due to tidal braking. George Darwin's 1879–80 technical papers clarified the idea of "earth retardation," or rotational slowing.

It is currently estimated that earth's daily rotation is decreasing by about 0.002 sec/century. This value is highly nonlinear, just as Appendix 2 shows for

the lunar recession rate. The historic rate of earth's rotational slowdown is somewhat uncertain due to unknown frictional effects, continental drift, fluid core motion of the earth, ice distribution, and solar activity. Considering evolutionary time, and linearity for simplicity, one billion years ago the length of each day would be 5.6 hrs shorter than today, or 18.4 hours long. In contrast, on a creation timescale, the length of a day 6,000 years ago was just 0.12 seconds longer than at present.

Tides and Life

Tidal cycling has been suggested as a driving force for the spontaneous origin of life on earth (Lathe, 2004). The periodic coastal flooding and drying is thought to be helpful for the spontaneous formation of replicating prebiotic polymers, or precursors to life. Multiple uncertainties in this origin-of-life scenario include the presumed faster tidal cycling in the ancient past, sea salinity, available chemicals, and continental drift. Varga et al. (2006) point out further problems with this desperate attempt to begin life on the earth using the moon's tides as a catalyst.

Apart from life's origin, the moon is indeed essential to present-day life. The moon is responsible for the regularity of earth's seasons by its stabilization of the earth's rotation axis (Ward and Brownlee, 2000, p. 222). Without the moon, on a long timescale, the earth's axis would wobble randomly. As a result, much of the earth might become locked into a permanent deep freeze, or else heated to dangerous levels.

Aside from the seasons, the moon also is indirectly responsible for about half of the oxygen in our atmosphere. The seas are filled with microorganisms—algae, bacteria, and phytoplankton—that perform the near magic of photosynthesis. These organisms have been called the grasses of the seas, with total biomass that exceeds all the land

plants and trees. Likewise, coastal areas support vast amounts of aquatic vegetation, including submerged kelp forests. The total oxygen production of the sea closely matches that provided by all the land vegetation (Travis, 2003). It is tidal movements that help keep the seas healthy by neutralizing chemicals entering from the land. The rivers of the world pour an unhealthy mix of chemicals into the oceans, both natural and man-made, especially agricultural runoff. Continual dilution, dispersion, and disintegration of pollutants take place, and as a result, the seas remain suitable for the essential oxygen-producing plant life.

A further vital connection between life and the tides are the biorhythms that govern sea and shoreline creatures. The spawning of grunion, the hatching of sea turtles, and the feeding of seabirds all depend on the regularity of the tides.

Some have suggested that the moon and its tides influence people. After all, tides act on water, and the human body is composed of about 65% water. Attempts have been made to connect the birth rate, crime rate, and stock market performance with the moon and its tides and phases. However, studies fail to show a convincing statistical correlation. Appendix 1 shows that lunar tides do not apply to people. Tides act on the earth because of the 7,910-mile (12,730 km) diameter distance between its near and far sides from the moon. However, the distance difference between a person's head and feet gives a negligible tidal acceleration. There may be unknown lunar connections between the earth and moon, especially in agriculture, but "human tides" do not occur.

Evolutionary Future of the Moon

Secular science does not have an optimistic view of the distant future (Stacey,

1969, p. 39). Some of the predictions include: If lunar recession continues unchecked, then in about four billion more years the moon will reach a maximum distance from earth of 350,000 miles, about 50% farther than its present location. By then, earth rotation will have slowed to 55 of our present days. There will then be only 6–7 days in an entire earth year. The moon orbit time will also be slowed to 55 days, so it will appear to be suspended motionless in the sky on one side of the earth. Lunar tides will no longer be significant or change because of the greater earth-moon distance and the earth-moon synchronism. Any existing life on earth will be endangered by the reduced tides and lack of ocean mixing. Lunar recession will now reverse its outward motion and begin to approach the earth,

due to the sun's extended atmosphere (Powell, 2007).

An earlier section of this paper describes the breakup and loss of the moon as it approaches earth's Roche limit. With the moon now reduced to a ring of debris, solar tides will dominate and gradually slow the earth's rotation further. Eventually, the length of the day will equal or surpass the length of the year. One side of the earth will become a permanent scorching desert while the dark side is covered with miles of ice. Before this happens, however, the sun will reach its red giant stage. That is, the sun will expand greatly and burn the earth's surface, if not vaporize it completely.

There are a variety of eschatological views among creationists. However, each view has a more optimistic and

positive view of the distant future. We are assured that the times are in the Creator's hand (Ps. 31:15).

Conclusion

We have discussed several aspects of the earth's tides, yet mysteries remain. One unknown is the actual mechanism of tidal friction, on both the sea and land. Also, we know that tides are caused by the moon's gravity, but what is this invisible force that gives stability to the universe? General Relativity shows that curvature of space is responsible, yet the source of the curvature is itself a mystery. Meanwhile the tides continue to wash the world's shorelines daily, as they have done since the week of Creation.

Appendix 1: Earth Tides

Figure 2 shows the earth-moon system, including earth's two high-tide bulges. The high-tide offset from alignment with the moon is discussed in Appendix 2. The earth's near side feels the greatest lunar gravity attraction, resulting in bulge A. The earth's far side feels a minimum lunar gravity force, leading to bulge B. Consider the total gravity force F between the earth and moon,

$$F = Gm_e m_m / r^2$$

where G = the universal gravity constant, m_e = earth mass, m_m = moon mass, and r = the earth-moon separation. Let us find the difference dF in lunar gravity attraction between bulges A and B, where dr is earth's diameter, by taking the differential of F .

$$\begin{aligned} dF &= F_1 - F_2 \\ &= -2Gm_e m_m dr / r^3 \\ &= -F 2dr / r \end{aligned}$$

Substituting $F = 1.98 \times 10^{20}$ N, $dr = 1.28 \times 10^7$ m, and $r = 3.84 \times 10^8$ m,

$$|dF| = 1.32 \times 10^{19} \text{ N}$$

This difference between the lunar forces at bulges A and B is nearly 1.5×10^{15} tons. That is, lunar gravity pull is about 7% stronger at bulge A than at bulge B,

$$dF/F = 0.0667$$

Appendix 2: Lunar Recession

Figure 2 shows the earth-moon system, including earth's tidal bulges, not to scale. These high points result from the unequal lunar gravity forces F_1 and F_2 , where $F_1 > F_2$. Notice that F_1 and F_2 result in a twisting effect, or torque (T) about the earth's rotation axis, tending to slow the earth's rotation. Note that this tidal torque is distinct from the more familiar torque responsible for the earth's precessional motion. This latter torque is also due to the moon but results from earth's equatorial bulge, not the tides.

From Appendix 1, the height or size of the tidal bulges is proportional to $1/r^3$, where r is the earth-moon separation. That is, the height of the tides increases strongly as the earth-moon separation decreases. Furthermore, the forces F_1 and F_2 themselves increase proportional to $1/r^3$. Said another way, one can think of this as positive feedback: As r decreases, earth's tidal bulges will grow as $1/r^3$ and F_1 , F_2 will also increase as $1/r^3$. As a result, the braking torque on the earth's rotation varies sharply as $1/r^6$. See (Peale, 2001) for a full discussion of this torque.

Conservation of angular momentum requires that the amount lost by the earth's decreasing rotation is taken up by the moon's orbital angular momentum (l_m). From Newton's second law, the earth braking torque is

$$T = dl_m/dt \quad (1)$$

and

$$l_m = m_m r^2 \omega \\ = m_m r v$$

where m_m , ω , and v are the moon's mass, orbital angular velocity, and orbital velocity.

Applying this discussion to (1) and absorbing m_m and the torque proportion into a constant k^l ,

$$1/r^6 = k^l d(rv)/dt$$

we can substitute v from Kepler's third law, where G is the gravitational constant and M is earth mass,

$$v = (GM/r)^{1/2}$$

then, with a new constant k^l ,

$$1/r^6 = k^l d(r^{1/2})/dt$$

the differential becomes

$$d(r^{1/2}) = 1/2r^{-1/2}dr$$

Therefore, with a modified constant k ,

$$dr/dt = k/r^{11/2} \quad (2)$$

Now integrate, with the lower limit $t=0$ when $r=0$. That is, with the moon's origin by either fission or collision, it begins at the earth's location at time zero.

The result is

$$t = 2/13(r^{13/2}/k) \quad (3)$$

This is the same result achieved by MacDonald (1966, p. 181), and Brown (2008), with alternate derivations. For a graph of equation (3), see DeYoung (1990).

Looked at another way, one can solve equation (3) for k , and substitute k into (2). The result is

$$dr/dt = 2r/13t$$

Applying this equation to the present, $r = 384$ thousand km, $dr/dt = 3.82$ cm/year, t gives the historical time at which the moon would be positioned at the earth's location. The result is $t = 1.55$ billion years. This number should be looked at as an approximate, extreme limit on the moon's age. The range of alternate derivations is 1.4–2 billion years, one-third to one-half of the moon's assumed age.

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Book Review

Darwin Day in America

by John G. West

Intercollegiate Studies Institute,
Wilmington, DL, 2007, 370
pages, \$20.00.

It has often been said that ideas have consequences. This truth comes forth in this work by John G. West. West is Senior Fellow at the Discovery Institute in Seattle. He earned his Ph.D. from the Claremont Graduate University in government and has published a number of works dealing with Darwin and related issues.

Darwin Day shows how the ideas put on the table by Charles Darwin in the nineteenth century have affected how we view life, not only in America but also across the globe. It may be fair to say that the man on the street, if asked, would say that Darwin and his ideas are only of biologic interest. Not so, says West. He brings attention to the ways in which Darwinian thought is not only about biology but also about economics, poverty, wealth, education,

sex, life, and death. Darwin has provided an all-encompassing view of reality and has infected us on how we deal with each other. Calling Darwinian thought “scientific materialism,” West contrasts this view with the more traditional view that life is more than the sum total of things material.

West takes a journey into modern thoughts about crime and punishment. Under Darwinian thought, crime is a mental illness and punishment is turned into treatment (chapters 3-5). Especially eye opening is the discussion on eugenics, a movement that is making advances in our day. Life becomes cheaper under Darwin. West shows how poor science has led to poor decisions in American life.

Much of the book might be viewed as “nothing new” in the sense that those

who have followed the impact of Darwin for years know the disturbing implications. Nevertheless, there will be others for whom the book can be a wakeup call, inviting them to investigate more fully the things they thought to be true, as presented in countless books, films, TV programs, magazines, and college courses. It can safely be said that many in the creation science movement are not on the same page as our friends at the Discovery Institute, the leading “think tank” for intelligent design. There are differences between us, but we are in the same fight, one directed to bring integrity and honesty back to the table. To that extent, we can join forces with West.

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Evolution and the Origin of Human Language

Jerry Bergman*

Abstract

A critical difference between humans and all other life-forms is language. Neo-Darwinism teaches that language evolved from gestures into grunts, then into primitive and, eventually, highly evolved languages. A comparison of ancient and modern languages reveals that the so-called primitive languages are as complex—or in some ways more complex—in grammar and syntax, the ability to accurately express ideas, and other central aspects of language as most modern languages. One advantage in studying ancient languages compared to other ancient artifacts is that many ancient languages are known today in a fair amount of detail. All languages change, as can be easily determined by a study of a single language such as English, but no evidence exists that language began as animal grunts and evolved into fully developed human language.

Introduction

Language is viewed by Darwinists as a critical breakthrough that has forever separated humans from all other life-forms (Müller, 1996; Svoboda, 2007). In Darwin's words, language has justly been considered "one of the chief distinctions between man or the lower animals" (Darwin 1871, p. 53). The problem of the origin of language "has traditionally been seen as the central question about the nature of man" (Aarsleff, 1976, p. 4). Darwinists also have concluded that language is the "most significant and colossal" innovation that has yet evolved and is "essential to human life" (Gaeng,

1971, p. i). Darwin's theory is "now the keystone for every discussion about language evolution that has followed it" (Kenneally, 2007, p. 20).

Darwin (1871) concluded that language evolved from grunts by a Lamarckian process: "As the voice was used more and more, the vocal organs would have been strengthened and perfected through the principle of the inherited effects of use" (p. 57). Before Darwin, the "orthodox view" by language scholars was "that language could not have been invented by man, but was a direct gift from God" (Jespersen, 1964, p. 27). Stokoe (2001) concluded that after Dar-

win, "supernatural" explanations were "not acceptable as scientific postulates" to explain the origin of language (p. 40). Stokoe argued that if God created language in humans, who taught God language? My present article documents that no evidence exists for Darwin's grunts-to-complex-language theory; rather, language has always been highly complex, having grammar, syntax, vocabulary, and other aspects that fit the needs of the speakers.

The Evolution of Language

Languages are probably the best-documented aspect of culture, partially because they are among the most carefully studied of all cultural artifacts. Written languages in many cases have been well preserved back to ancient times (Friedrich, 1957). Written language is "only six

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thousand years old,” and one of the earliest known written languages appeared in Sumeria around 4000 BC., but several script languages also date back that far (Bodmer, 1944; Gaur, 1984; Kenneally, 2007; Linton, 1969). Extensive literature written in Sanskrit dates back farther than any European language; and from a study of the earliest known examples, linguists have determined that Sanskrit contains a complete system of declinations and conjugations that has helped us to trace the Indo-European family of languages back to a common original language (e.g. see Baugh, 1957, pp. 19–20).

The origin of language is, for all of the above reasons, an important research topic. It is also a very controversial topic and widely recognized as unsolved (Svoboda, 2007). Nonetheless, Darwinists have concluded that human language evolved from nonverbal gestures, growls, pointing, and grunts—as are common in many modern mammals—and eventually into the complex languages that we know today (Ludovici, 1965).

It is well documented that a chasm exists between human communication and that of all other life-forms, including the higher primates. Linguist John Oller has gone further by arguing that in the evolution from unicellular organisms to humans “the most difficult transition in the series was the one leading up to the human language capacity” (Oller, 2001, p. 28). The chasm is so great that Nowak and Krakauer (1999) noted the “lack of obvious formal similarities between human language and animal communication has led some to propose that human language is not a product of evolution but a side effect of a large and complex brain that evolved for nonlinguistic purposes” (p. 8028). They concluded that the emergence of language radically changed not only the “character of human society” but also the course of evolution (p. 8028). The solution required to “scale mount improbable, that huge feature of the evolutionary

landscape that would seem impossible to conquer” was, as Darwinists propose, a gradual evolution of language ability (Oller, 2000, p. 337).

Critics of the evolutionary theory of language origins point to the fact that little need existed to evolve complex human languages because many modern primates are excellent at communicating “by means of facial expressions, calls, gestures and other behaviours, and our language does not seem to have been designed to do that job especially well” (Blackmore, 1999, p. 96). One would assume that the reason language evolved is obvious, but “why and how language arose, and what its early forms were like are still shrouded in mystery” (Deacon, 1992, p. 133). This includes written language, which evolved so rapidly that no evidence of its evolution exists today (Gaur, 1984).

The Glorious Accident Hypothesis

One theory, called the glorious accident hypothesis, was advocated by Harvard paleontologist Gould and MIT professor Chomsky, as summarized by Kenneally:

Throughout his career, Gould stressed the ways in which the human species was a glorious accident. The wonder of evolution, he emphasized over and over, was that it was “an unpredictable process with no drive to complexity”... At some point in the past, Gould believed, our brains evolved to a level of complexity that would enable us to reason our way through certain situations, and at that level we had the structures for language already in place. In a sense, language simply “happens” when you have a machine complex enough to accommodate it. So rather than language being selected, we lucked into it, and it wasn’t part of what initially made us successful as a species—even though now it’s es-

sential to our existence (Kenneally, 2007, p. 55).

Professors Steven Pinker and Paul Bloom in a paper presented at MIT wrote,

Noam Chomsky, the world’s best known linguist, and Stephen Jay Gould, the world’s best known evolutionary theorist, have repeatedly suggested language may not be the product of natural selection but a side-effect of other evolutionary forces such as an increase in overall brain size and constraints of as yet unknown laws of structure and growth (Quoted in Kenneally, 2007, p. 57).

The glorious accident hypothesis explains little, however, and is based not on evidence but on lack of evidence. For these reasons it is no longer accepted by many evolutionists.

Alarm Calls Theory

Hayakawa concluded that before humans developed languages as we now know them today, our ancestors

probably made, like the lower animals, all sorts of cries, expressive of such internal conditions as hunger, fear, loneliness, sexual desire, and triumph. We can recognize a variety of such noises and the conditions of which they are symptoms in our domestic animals. Gradually such noises seem to have become more and more differentiated; consciousness expanded. Grunts and gibberings became language (1972, p. 76).

Although this gesture theory has been “widely embraced” (Blake, 2000, p. 213), it is still very controversial. Gaeng (1971) stressed, as is true of “all other theories that have been advanced to account for the mystery of how (and when) man first learned to speak,” that the gesture theory has both its adherents and critics:

Whatever its shortcomings may be (and how are we to pass judgment

on the scientific validity of any such theory that must remain, at best, intelligent guesswork?), its most plausible feature would seem to be the fact that it sees language as derived from words signifying human actions (Gaeng, 1971, p. 4).

The main problem with this theory is that alarm calls are not comparable to human words because they are genetically programmed, and for this reason animals will produce them even when reared in isolation from other animals (Kenneally, 2007). They are automatic responses to such stimuli as hunger and pain or to internal conditions such as fear.

Nowak and Krakauer (1999) posulated that protolanguages evolved in a nonlinguistic human society by the natural selection of superior communicators because the better communicators were more able to survive and thus more likely to pass on their improved language genes to offspring. Actually, there are at least eight different theories to explain the origin of language, all of which have their supporters and detractors (Gaeng, 1971). A major debate among evolutionists centers on this question: "Was it the power of speech that caused the mind to develop, or was the evolution of the mind a critical influence in developing the power of speech?" Contemporary theorists differ enormously on the importance of each. Although Darwin (1871) seemed to have favored the view that the ability to use speech had a major effect on the evolution of the mind, Haeckel (1900) argued for the view that the

higher grade of development of ideas, of intellect and reason, which raises man so much above the brute, is intimately connected with the rise of language. Still here also, we have to recognize a long chain of evolution which stretches unbroken from the lowest to the highest stages (p.18).

The problem is that we humans required a complex set of biological ca-

pabilities, including not only the mind, but also the nervous system, the entire oral-nasal-pharynx design, and many accessory structures such as the teeth, tongue, lips, nasal cavities, larynx, lungs, uvula and nose, before we could have used the complex human expressive language existing in humans today (Gaeng, 1971). Hauser et al. (2002) reviewed three major biological language evolutionary theories, each of which they conclude is "plausible to some degree," but acknowledged that to determine which one is correct requires "empirical data, much of which is currently unavailable" (p. 1573). Among the many major differences that exist between human and animal language is the fact that the human brain is not merely a scaled-up ape brain, but is qualitatively different in several critical ways (Pilbeam and Gould, 1974).

This problem was well expressed by Scaruffi, who wrote that, while "language may date back to the beginning of mankind," the real problem is

not the evolution of modern languages from primordial languages: it is how non-linguistic animals evolved into a linguistic animal such as the human being. It's the "evolution of language" from non-language, not the "evolution of languages" from pre-existing languages. Several biologists and anthropologists believe that language was "enabled" by accidental evolution of parts of the brain and possibly other organs (Scaruffi, 2003, p. 378).

The "accidental evolution" view of language evolution is not supported by any direct evidence, and is widely discounted by linguists because it is not an explanation for language evolution but actually evades the problem. It assumes evolution from grunts to fully developed language in contrast to the findings of long-term empirical research on language evolution that the historical trend is a tendency to shorten words as a result of the common trend to reduce

the muscular effort needed to enunciate words, making pronunciation easier (Diamond, 1965).

Another difference is that children usually require several years to acquire their specific language, whereas animal species possess an innate set of oral responses that have very limited malleability (Tomasello, 2003). The human communication system is far richer and more varied and employs numerous communication techniques not used by any other primate (Oller, 2000). Furthermore, animals must rely on a single system of communication; humans use one or more of the almost 7,000 different extant language systems, from English to Swahili (Harrison, 2007). Although both humans and many animals can use body gestures to communicate, humans can effectively use both oral and written language, while animals have only a very limited vocal system. Furthermore,

no other species has been shown to have a full-blown syntactic systems of the sort found in human language, whether spoken or signed.... It has been argued convincingly that the primary infrastructural features of human syntax (grammatical categories and hierarchical syntactic phrase structures as specified in x-bar theory, recursive application of rules, various characteristics of government and binding, etc.) are entirely absent, as far as can be told, from the communication systems of any other species (Oller, 2000, p. 212).

Human linguistic communication also involves interpretation of symbols by social convention. In addition, human language is grammatical—meaning that factors such as word order are all critical in determining meaning (Tomasello, 2003). A few examples where word order is critical:

- Nietzsche said God is dead. God said Nietzsche is dead.
- The girl likes to drive fast. The fast girl likes to drive.
- Word games like this will drive

me to drinking. Drinking will drive me to word games.

- Only I can do this job. I can do only this job. I can only do this job.

Human language is also highly contextual. For example, “wise man” and “wise guy” mean opposite things, as do “overlook” and “oversee,” but “slow down” and “slow up” have the same meaning. A critical factor often ignored in language evolution theory is the need for a corresponding brain and nervous system able to produce and understand language. Oller noted that the

richness of human syntax represents a remarkable feature of differentiation from other species. Yet before a creature can be expected to form advanced linguistic structures (e.g., hierarchical phrasing, center embedding, anaphoric reference, and complex agreement patterns), the creature needs a whole series of more basic capabilities that can be expressed in terms of design features that are essentially ignored in the widely noted literature on syntactic superiority or uniqueness of humans. These largely ignored basic capabilities can form a more substantial basis for illustrating the relations in power and in evolutionary distance between human and nonhuman communication (Oller, 2000, p. 212).

Study of Putative Primitive Languages

Extensive study of putative “primitive” languages does not support the theory that humans once communicated by grunts and slowly evolved a language. The “incredible complexity” of both primitive and extinct languages is well documented (Rice, 2007; Friedrich, 1957). Professor Dixon, chair of the Department of Linguistics at the Australian National University, wrote that he learned in school that the

Australian Aborigines were the lowest type of man, scarcely better than animals, with no idea of property or work; they were explicitly contrasted with Maoris who were said to be at the top of the blackman league, only a jump away from Europeans in their capacity to be civilised. I’d long since worked out my own views on such matters, but it was still a surprise to be told that Australian languages had complex grammars that could provide as strong an intellectual challenge as any linguistic system known (Dixon, 1989, pp. 5–6).

He added that the Australian anthropological journal *Oceania* reported that their language, even of “the lowest type of man,” has many “gender classes and extensive grammatical concord, perhaps even more than the Bantu languages of East Africa.” Dixon also learned from his field work that the

language of the Worora people had just the kind of grammatical detail that fascinated me. They had lived for thousands of years in the mountainous ranges of north Western Australia...Capell’s paper led me to a sketch grammar...in the *Journal of the Royal Society of Western Australia* for 1930–32. He reported, amongst much else, that there were no less than four hundred and forty-four forms of the verb “to be,” each carrying information about the subject and object of the sentence (Dixon, 1989, p. 6).

A careful study of ancient languages has revealed that many of the earliest written languages “were as complete in their grammar and as adequate for the conveyance of ideas as any modern ones” (Linton, 1969, p. 9). Those who study ancient languages such as Latin, Hebrew, or Biblical Greek soon realize that their grammar is as complex as that of modern languages. It has been possible to piece together many so-called dead languages (i.e., those that are no

longer spoken today), often by utilizing documents that contain the same text repeated in several languages. The best-known example of this, the Rosetta Stone, was discovered during Napoleon’s campaign in Egypt (Bodmer, 1944). The stone contains early Egyptian, later Egyptian (called demotic), and the Greek translation.

Yale linguist Edward Sapir, after a lifetime of language study, concluded that simple primitive languages do not exist (Kalmár, 1985). Eminent linguist Stuart Chase bluntly stated that “stories about tribes with only grunts and squeals are biological fakes” (Chase, 1954, p. 91). Kalmár (1985) wrote that from “earliest times ... it seems to be universally agreed, language has ... [remained] essentially the same, except for changes in the lexicon” (p. 151). Gaeng (1971) concluded that we cannot learn anything about the evolution of language from

observing the speech of primitive societies that are still functioning. Anthropological research has conclusively shown that even the most primitive tribal societies of our time possess highly structured and complex languages with rich vocabularies. Any difference that may exist between the languages of primitive communities and our highly sophisticated cultures lies in the number of ideas and concepts that require expression rather than in the way in which they are expressed. Any hope, therefore, of discovering the specific origin of language from the languages of primitive groups must also be abandoned. (p. 8)

One reason why we cannot observe the evolution of language by studying primitive languages is that

there are really no ‘primitive’ languages. All languages have much the same degree of complexity. All fit the demands of the people who use them.” (Ludovici, 1965, p. 21)

Vocabulary Evolution

Although “at some ‘deep’ level all languages are the same,” language vocabulary especially changes in response to cultural, technological, and other societal changes (Kalmár, 1985, p. 151). Gaeng (1971) wrote,

Constant change both in time and space is a universal characteristic of any living language. Meanings, vocabulary, grammar, and, of course, sounds change. Nothing in language stands still until a particular language is no longer spoken. At that point it has become a “dead” language like classical Sanskrit, Greek, and Latin, which now exist only in written records (p. 201).

The study of changes in language vocabulary over time has documented that although names of persons, places, and things increase, the general trend for language is to simplify with time (Diamond, 1965). Linguist Albert Baugh concluded that “the evolution of language, at least within the historical period, is a story of progressive simplification” (Baugh, 1957, p. 10). By comparing twelfth-century English with fifteenth-century English and with twenty-first-century English, the many changes that have occurred during this time can easily be evaluated. It is well documented that the spelling and pronunciation of modern English words are in some ways “much simpler than ... immediate precursors such as Old English and Anglo-Saxon, and all the Romance languages” (Rice, 2007, p. 233). Furthermore, many ancient languages in some ways seem to be more complex than the languages of the putative “primitive” tribes living today. Even societies with the

least complex cultures have highly sophisticated languages, with complex grammar and large vocabularies, capable of naming and discussing anything that occurs in the sphere occupied by their speakers. The oldest language that can reasonably be reconstructed is already modern,

sophisticated, [and] complete from an evolutionary point of view (Simpson, 1966, p. 477).

Since language is intelligently modified, it must respond to the needs of the population (Lehmann, 1992). The best example is vocabulary growth, but other aspects of language are intelligently changed as well, leading to the conclusion that language becomes simpler in some aspects, yet more complex in others. Language is a lens through which one sees the world (Winawer et al., 2007). In one ancient language called Sawi, fully 38 verb endings existed (Richardson, 1976, p. 171). In English we have one word, namely “open,” for all of the following phrases: “open your eyes,” “open your heart,” “open your door,” “open a tin can,” or “open someone’s understanding.” The Sawi language uses a different verb in *each* of these cases.

In some Eskimo languages, a single noun can have more than a thousand different forms, each with its own precise meaning. In one Guatemalan language, any verb can have thousands of different forms by adding various endings. Eskimos have long been known to have many different words for “snow,” whereas English has one. These examples illustrate the conclusion that having specific words for objects and ideas produces a heightened sensitivity to them and is another reason why language is important.

Many ancient languages such as the Myan, the Olmec, the Isthmian, and the Oaxacan languages have left adequate written records to allow us to study their changes for much of their history (Pohl et al., 2002). A study of these “so-called primitive languages can throw no light on language origins, since most of them are actually more complicated in grammar than the tongue spoken by civilized peoples” (Linton, 1969, p. 9). He further admits that we “know absolutely nothing about the early stages in the development of language, although this has not

prevented philologists from putting forward a number of more or less ingenious theories about their evolution” (Linton, 1969, p. 9).

Researchers “have no actual knowledge of language earlier than about 4000 B.C.” which is the date of the oldest written records by the Sumerians (Gaeng, 1971, p. 3). Aronoff and Rees-Miller (2001) estimated the earliest language dates back to only 3,000 BC. Of note is the fact that the Sumerian language is a complex, well-developed language. The oldest known written language, Accadian, was spoken by the people who inhabited the plains of Arabia. They used cuneiform writing, and a wealth of their records still exists today on clay tablets, bricks, and cylinders (Bodmer, 1944). Study of these records shows they used an advanced, complex language.

It is often assumed that Western nation tongues are more advanced because they have more words. For example, English and certain other major Western languages each contain about a half million words, and the Zulus and Australian Aborigines far less. This fact should not mislead us into making oversimplified generalizations about the vocabulary range of so-called “primitive” languages. They lack the scientific, technological, and occupational words of the languages used in the Western lands, but they often use an amazingly large vocabulary for objects, concepts, and terms to describe their world that we have no equivalent for in English. The best evidence is that we often borrow their terms instead of translating them into our language. Examples include the word “taboo” from the South Sea islands, “boomerang” from Australian natives, and “totem” and “wampum” from the American Indians. We also use a conventional translation of a term to use the idea, such as when we copied the Chinese and speak of “saving face.”

Although, the basic language families are, in many ways, drastically different (indicating a separate origin

for each major language family) some linguists have found four elements useful in determining the development of a language in a national group (Bodmer, 1944). These elements are: (1) similarity of vocabulary, (2) accident (word inflection), (3) syntax, and (4) phonetics (the sounds or pronunciation of words). Vocabulary is commonly spread from different languages, and phonetics but can be studied only in living or voice recorded languages. Of note is the fact that these four factors are poor predictors of complexity in child language development, contradicting the common Darwinist claim that language development in infants imitates language development in human evolution.

Darwin's Theory of Language Evolution

Darwin concluded from his research that language evolved from animalistic emotional communication, such as grunts, into modern languages such as Chinese and English (Bever and Montalbetti, 2002). The evidence he used to back his theory of language evolution includes fieldwork with the Fuegians, a people who lived in South America whom he called "savages," "primitive beasts," and "cannibals" (Bergman, 2007). Darwin concluded that these "savages" had an extremely primitive animal-like language.

In contrast to Darwin, Thomas Bridges (1886), a missionary who lived and worked intimately with the Fuegians for many years, concluded that the Fuegians, although "one of the poorest tribes of men, without any literature, without poetry, song, history or science...have a list of words and a style of structure surpassing that of other tribes far above them in the arts and comforts of life" (quoted in Barclay and Jenkins, 1950, p. 148). Darwin concluded that the Fuegians had only around 100 words in their language, called Yahgan. Contrarily, Thomas Bridges researched the Yahgan language for his Yahgan-

English dictionary and identified over 32,000 words and inflections (Barclay and Jenkins, 1950). To put this number in perspective, a speaker who knows the basic grammar and 5,000 words in a language is considered to have basic competence in the language.

The language of the Australian Aborigines (once incorrectly considered the most "primitive" of all known languages) is not only complex but also very different from ours. An examination of other tongues, such as those spoken by American Indians and the Australian Aborigines, reveals that languages once thought to have inferior modes of expression in fact display a wealth of novel and significant concepts and forms that rival those of the best-known classical tongues of Europe.

The first person to pen a pamphlet on the Darwinist theory of linguistic evolution was August Schleicher in an 1869 work that arranged languages in an evolutionary line in what seemed to Schleicher to "be a progression from simple to more advanced" (Kalmár, 1985, pp. 148–149). The problem is that Darwin taught "evolution was not goal-diverted, not progressive," but rather a product of natural selection favoring random factors (Kalmár, 1985, p. 149). According to Kalmár, language changes actually are often progressive, not due to random factors, but because they are goal-directed by scribes, priests, language teachers, the media, and cultural trends. Another problem is that the Schleicher scheme was racist (Kalmár, 1985).

Influenced by Darwin, Sir Richard Paget argued that humans first communicated by body movements, and "human speech originated in verbal imitations" of these body movements (Gaeng, 1971, p. 3). In spite of a century of work on Darwin's idea, Hauser et al. (2002) stressed that the means by which humans made the jump from animal grunts to their rich expressive human communication is an "evolutionary puzzle" not bridged by quantity changes but quality leaps (p.

1570). In fact, Darwin's gradual theory is now largely viewed as dead by many evolutionists, and in its place is the saltational view—language evolved by jumps.

These examples support Ruhlen's conclusion that there is "no shortage of speculation about how and when language developed" (Ruhlen, 1994, p. 1). Kenneally (2007) reported that "hundreds" of scholars are working on solving the problem of language evolution. Language evolution is even now a separate discipline, yet the question of "how did the language of our parents get here" remains unanswered and "remains the hardest problem in science today" (pp. 6, 11, 12).

In contrast to Darwin's conclusions, historically it was widely believed that humans used a very complex language from the beginning of human existence. This was based on the belief that Adam and Eve could use language from their initial creation as recorded in Genesis 2:16–17. One illustration of this belief is an ancient emperor named Akbar, who was informed that Hebrew was the original language of humans and that children who were not taught a language would naturally speak Hebrew. To test this conclusion, a group of infants was isolated and raised by deaf mutes. They found that the 18 subjects could not speak Hebrew, but rather communicated by gestures just like their caretakers (Linton, 1969, p. 9). The problem with Darwin's theory of language evolution from grunts, called the "gestural origins" theory, is the fact that

chimpanzees, monkeys, and other primates address each other with gestures and calls lends plausibility to this hypothesis, and gestures are part of everyone's face-to-face language today, but the gap between these rudimentary communication systems and human language is enormous, and how that gap was bridged, and when and where it was bridged, are questions that are not really resolved by the theory of

gestural origins, even if it should be correct (Ruhlen, 1994, p. 2).

Nonetheless, some linguists still hold to Darwin's view:

Charles Darwin observed that languages seem to evolve the same way that species evolve, but, just like with species, he failed to propose what the origin of language was. Today, we have growing evidence that ... languages evolved just like species, through little "mistakes" that were introduced by each generation (Scaruffi, 2003, p. 378).

But little evidence exists to support the "language evolves by mistakes" idea, as revealed from the study of various language families such as the Romance languages. We "simply do not know how language originated" (Yule, 1996, p. 1). These problems with Darwin's theory of language evolution have motivated some linguists to conclude that linguists should "exercise more caution in their dependence upon Neo-Darwinian theory," which Stebbins calls a "still unstable and fallible scientific theory" (Stebbins, 2007, pp. 1, 16). Oller (1997) has shown how Darwin's ideas about language have even influenced the development of IQ tests, which, in turn, were used to support the social Darwinism eugenics movement.

Language Families

There are almost 7,000 known languages, and it has yet to be explained why so many exist that have a basic core, yet are radically different (Nettle and Romaine, 2000). Human DNA uses a universal code, yet humans lack a universal code of communication, as is apparent from the wide variety of human languages (Hauser et al., 2002, p. 1569). Yet, in spite of the enormous differences in language, communication between individuals who speak the same language is highly effective. Even slight nuances of vocabulary usage or contextual distinction are generally well recognized and

understood by those fluent in the same language (in contrast to the difficulty such nuances present to someone not fluent in the language).

Nonetheless, some scholars believe that all languages can be traced back to about a hundred language groups or less (Bodmer, 1944; Hagman, 1990). Linguists have been endeavoring to extrapolate from modern speech back to the ancient languages for decades, and research completed so far indicates that all human language families had their roots in small populations (Allman, 1990, p. 69). This supports the conclusion of Morris (1976) that

there is a deep commonality between the basic thought patterns of all men, regardless of how diverse their individual languages may be. That is, there is a fundamental connection between all human languages, but no connection at all between human language and animal "language" (p. 1).

Conversely, there were far more languages spoken in the past than there are at present. Many languages with a recorded history have been lost as living languages, the most famous of which is Latin. Cornish and Euskara, although still spoken by a handful of Basque people, are examples of languages that likewise are expected to die soon. Instead of new languages evolving, Nettle and Romaine (2000) estimated that in the past 500 years close to half of all languages have disappeared, and of the 6,000 remaining, about one language becomes extinct each week. Harrison (2007) added that many linguists predict that by the end of the century only about half of the 7,000 languages existing today will still be spoken. Others dispute their estimates, but if even only partly valid, this trend shows not only simplification of certain aspects of each language, but fewer distinct languages—the opposite of what evolution predicts.

Work on preserving dying languages has been a focus of several research

groups, and, with much effort, some have been resurrected (Harrison, 2007). The best example is Hebrew, which was resurrected in order to utilize it as the official language of the modern state of Israel when that country was formed in 1948. Prior to this, Hebrew was learned primarily in academia, often by theologians, Old Testament scholars, priests, or others (usually Christians and Jews).

The most intensively studied language group is the Indo-European language family. Although its development has been well documented, its origin has so far eluded researchers (Gray and Atkinson, 2003). Scientists have attempted to determine how it spread into Europe. One view, called the Kurgan theory, postulates that it spread into Europe by Near East Kurgan horseman about 6000 years ago (Gray and Atkinson, 2003). A recent analysis of a matrix of 87 languages with 2449 lexical items by Gray and Atkinson has supported this hypothesis. Other theories also have been proposed, all of them very speculative and based on limited historical evidence.

The Origin of the 7,000 Languages

The origin of the human ability to use language is compounded by the problem of the origin of the almost 7,000 different languages. This is especially problematic when all of the enormous diversity existing in human language must be explained primarily by geographic separation. Consequently, linguists have debated whether the variety of languages existing today arose due to either monogenesis (a large tree with one trunk) or polygenesis (many trees and many trunks). That is, did all of the languages originate by the "evolution" of one language from non-language, which then diverged into the many known languages, or did the ability to use language evolve separately in several different geographic locations?

The proponents of the monogenesis view focus on the overall pattern of linguistic similarity, while the proponents of polygenesis focus on the major distinctions that divide language families today. It is very difficult to explain, solely on naturalistic grounds, why such overall unity of human language exists, yet also explain the sharp dichotomies in grammar, symbols, and vocabulary existing between the language families. Within these sharp distinctions, many unexplainable similarities also exist (e.g. one study of 1,000 languages found close to 700 uses of the word “papa” for father) (Morton, 2006, p. 33).

Evidence for an Innate Language System

The fact that all languages share so many similarities argues that at the foundational level language “is innate and thus universal” (Kalmár, 1985, p. 151). MIT professor Noam Chomsky spent his career studying languages, and is often called the father of modern linguistics (Aronoff and Rees-Miller, 2001, p. 2).

In the first half of the twentieth century, *structural linguistics* was a popular construct. This view suggested that language was a purely social phenomenon like learning table manners. Chomsky was troubled by this theory and began raising questions that the structuralism theory was unable to answer. For example, if language is simply learned behavior, why do very young children have the ability to produce and understand an infinite number of sentences, including those that they never heard uttered before? Chomsky recognized that children normally acquired language spontaneously without being overtly taught; and he came to the conclusion that language is rooted, not in behavior, but rather in biology. Each child subconsciously deduces a set of rules that is unconsciously drawn upon when they produce or understand a sentence.

Chomsky introduced his inherited program theory in 1957.

Some linguists have noted that two competing demands exist in learning a language. First, a language must contain a large set of rules to effectively communicate. Conversely, the more devices available to convey information, the more difficult it is to learn a language, and the harder it is to sort through the maze of possibilities in order to express oneself properly. To resolve these conflicts, Chomsky worked out a theory that he called the minimalist program, which, using Occam’s razor, postulates that all healthy people are born with a complex brain system that allows them to effectively acquire the native language to which they are exposed while growing up (Fox, 1999).

Fox concludes that Chomsky’s inherited program theory involves a system that “has been optimally designed—that the connection of sound to meaning was forged as simply as possible, as by the divine super engineer” (Fox, 1999). This biological mechanism allows children to generate a rich array of sentences with a minimal amount of information. Of note is the fact that Chomsky’s work has “explicitly discouraged interest in language evolution, and has even suggested that language is so different from most other animal characteristics that it may be a product of physical or chemical processes rather than biological ones” (Aronoff and Rees-Miller, 2001, p. 2).

Another problem is that animals can imitate sounds and understand commands (often by simple repetition, plus reinforcement and punishment), but there is an enormous gap between the noises that animals produce and human speech. Chomsky concluded from his lifelong research on this subject that no evolutionary transition exists between the noises that animals make and human speech (Chomsky, 1972). Of note is the fact that humans are the *only* life-forms on earth that possess the complex biological equipment, such as the brain,

required for speech (Finn, 1985, p. 53). Our putative closest relatives, the chimpanzees, are physically unable to produce speech.

Evidence for an inherent propensity for language is found in many sources, including the fact that children generally begin learning a language about the same age regardless of the individual child’s specific environment (McNeill, 1970). Even hearing children born to deaf parents begin to speak at about the same time as children growing up in a normal hearing family. Furthermore, the position of a child in the family does not appear to affect the time that language development begins. On average a first child begins speaking about the same time as the last child, even in large families. Of course, exceptions exist due to factors such as brain damage, birth defects, or extreme environmental deprivation. Nonetheless, these patterns hold across a wide variety of environments.

Even though Chomsky recognized that language is genetically inherent in the human brain, he assumed that this could have resulted from a few mutations. This macro-mutation theory of language evolution “maintains that modern language exploded onto the planet with a big genetic bang, the result of a fortuitous mutation that blessed the Cro-Magnon with the gift of tongues” (Kenneally, 2007, p. 9). The mutational theory is central to Chomsky’s view of the origin of the human brain’s language center. However, there is no genetic data supporting the mutational origin of human language. Instead, mutations are generally degenerative (Bergman, 2005; 2008), and the entire genome is steadily degrading (Sanford, 2008). What is more, the mutational origin is refuted by research on communication defects caused by disease that destroy parts of the brain. This research proves that many different parts of the brain are involved in language, disproving the idea that a few critical macro-mutations could have created language ability. Scientists

now realize that thousands of mutations would be required (Kenneally, 2007).

Therefore, what is more plausible is to conclude; that the human brain's language center resulted from thousands of independent, yet essential and interlinked mutations, or that it was initially designed to use language and effectively acquire a language as young children? Such an acquisition was not a process of mindlessly repeating sounds heard from their elders as once thought, but by subconsciously ascertaining language rules that they then fit into a preexisting brain language program. For example, every child has the concept of singular and plural. A child only needs to put the plural rule into his or her mental construct. The English rule often requires adding the letter "s" or the letters "es" to the singular form. In Latin, the rule often requires dropping "us" and adding the letter "i" (octopus is singular, octopi is plural).

Conclusions

No evidence exists to support Nowak and Krakauer's (1999) Darwinian challenge: "If language has evolved, it must have done so from a relatively simple precursor" (p. 8028). Although languages can be ranked from those lacking a written language to those with a highly developed written language, or those with a few symbols or letters (such as English's 26 letters) to those such as Chinese that use a large number of symbols, the hierarchy depends on the factors used to do the ranking. The number of words, the size of its written literature, and the number of "cases" all have been used to rank languages from so-called "primitive" to "advanced." University of Virginia professor Paul Gaeng wrote that the answer to the

question of where language started ... must be just as uncertain as it is to the question regarding the precise location of the Garden of Eden. No language spoken today, no language

of which we have any sort of record, can suggest what prehistoric language was like (Gaeng, 1971, p. 8).

Bodmer (1944) wrote that, aside from having no idea of what prehistoric language was like, we can only speculate about the origin of human language:

In a modern classification of the animal kingdom taxonomists unite many small groups, such as fishes, birds and mammals, or crustacea, insects and arachnida (spiders and scorpions) in larger ones such as vertebrates and arthropods. *Beyond that point we can only speculate with little plausibility about their evolutionary past ... So it is with languages* (p. 186, emphasis added).

MIT professor Noam Chomsky (1972) concluded that we have "no more of a basis for assuming an evolutionary development of 'higher' from 'lower' stages, in this case, than there is for assuming an evolutionary development from breathing to walking" (p. 67). Many attempts have been made to "determine an evolutionary origin of language, and all have failed" as supported by the finding that people

with least complex cultures have sophisticated languages, with complex grammar and large vocabularies, can name and discuss anything that occurs in the sphere occupied by their speaker...the oldest language that can reasonably be reconstructed is already modern, sophisticated, and complete from an evolutionary point of view (Simpson, 1966, p. 477).

The claim that primitive languages are simple has been shown by numerous studies to be wrong, falsifying Darwin's conclusion that language "slowly and unconsciously developed by many steps" from primitive language consisting of grunts (Darwin, 1871, p. 55). The biggest problem has been bridging the chasm that separates humans from nonhumans.

The question of when our ancestors were first able to produce articulate

speech has long puzzled scientists. Anthropologists who trace the development of complex behavior in the archeological record, as well as linguists concerned with the definition of language, have offered many reasoned accounts about how prehistoric humans crossed some "vocal threshold," abandoning apelike grunts for the mellifluous tones of an Olivier (Laitman, 1984, p. 20).

Although we know about when the first written language appeared, scientists have no way of knowing how language began or even when (Kenneally, 2007). Since no one can prove any of the theories about language origins, a "free-for-all" exists. Although the "origin of human language has been an evanescent topic in the history of ideas for many centuries" and will no doubt continue to be so in the future, we are no closer to uncovering its origin today (Bever and Montalbetti, 2002, p. 1565). An article in *Science* titled "What Don't We Know," in answer to the question, "What are the evolutionary roots of language and music?" stated, "Neuroscientists exploring how we speak and make music are just beginning to find clues as to how these prized abilities arose" (Kennedy and Norman, 2005, p. 99). The evidence is that fully developed language existed from the beginning of human existence (Muresan and Wieland, 1998; Harbin, 1982; and Morris, 1976).

Acknowledgments

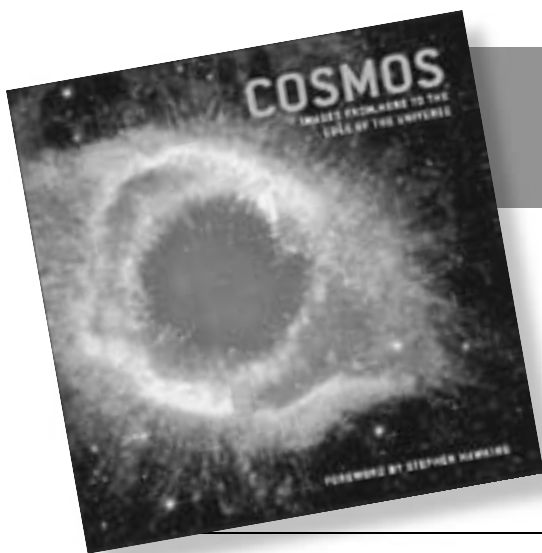
I thank Jody Allen, RN, John Oller, Ph.D., John UpChurch, George Howe, Ph.D., and several anonymous reviewers for their helpful comments on an earlier draft of this paper.

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Book Review

Cosmos: Images from Here to the Edge of the Universe

by Mary K. Baumann,
Will Hopkins, Lorelee
Nolletti, and Michael
Soluri

Duncan Baird Publishers,
London, 320 pages, \$20.00.

This “coffee table” book displays a gallery of 150 outstanding astronomy photos taken through 2006. Sources include Hubble and ground-based telescopes. The book itself is small, just 7 ½ inches square.

The author team includes three writers and a photographer. None is a scientist, but the text shows careful consultation with astronomers. The book reads much like a university astronomy course or a media nature program. I kept track of the frequency of mention of several topics: star formation, 27 times;

life in space, 5 times; Greek gods and goddesses, 13 times; the Biblical Creator of all the objects shown, 0 times.

Some specifics will catch the reader’s eye. The Orion Nebula Complex is said to have produced more than 100,000 new stars during the past 10^7 years (p. 16). The alleged big bang is said to have occurred 13 billion years ago, while some stars are 12 billion years old. Some of the writing is a bit crude: When a coronal mass ejection occurs on the sun’s surface, “all hell breaks loose” (p. 113). One intriguing galaxy, NGC

4622, is rotating backward, against the curvature of its spiral arms (p. 267).

Space photos are accumulating rapidly. The growing reservoir of data awaits detailed technical analysis by creationists. The book begins with a foreword by Stephen Hawking and concludes with a survey of telescopes, glossary, and index. The price for this color-filled book, \$20, is a bargain.

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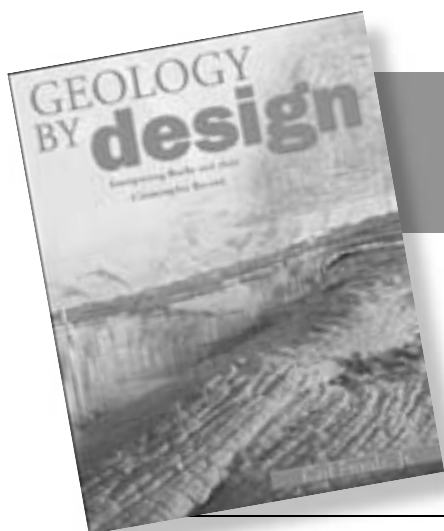
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Book Review

Geology by Design: Interpreting Rocks and Their Catastrophic Record

by Carl R. Froede, Jr.

Master Books, Green Forest, AR, 2007, 160 pages, \$15.00.

The first edition of this book was entitled *Field Studies in Catastrophic Geology*. This new edition is greatly enlarged and contains an introduction by John K. Reed and an afterword, written for the first edition, by the late Henry M. Morris. The illustrations for the ten chapters of *Geology by Design* are generally larger and of better quality than those of the original monograph. A glossary of terms, an index, and an extensive reference section are included. In most cases the terminology employed is defined within the context of the specific discussion. Questions at the end of each chapter will encourage readers to determine what concepts they have retained in their study.

The uniformitarian geological timescale is introduced along with its deficiencies. So-called natural history

and actual science are differentiated. The attempts of creation geologists to develop a Flood/young-earth timescale are discussed. One of the major differences between a uniformitarian model with an inflated age of the earth and a Flood/young-earth model is the way geologic energy is thought to be expended. The uniformitarian view is one of local low energy expenditure over long, long periods of time under conditions such as sedimentation in riverbeds and shallow seas. The Flood/young-earth approach entails massive energy expenditure during the Deluge (erosion, sedimentation, and volcanism) in a brief period of time. Basically, it is uniformitarianism versus catastrophism.

The above thesis sets the tone for the remainder of the book. Froede presents various geological features in the rock

record, along with ample photographs to demonstrate what is being described. The two origins models and their comparative validity in postulating how a particular structure was formed are discussed. These features include (a) imagined paleoenvironments that were buried under sediments, (b) storm deposits, (c) buried "ancient" soil horizons, (d) laterites and ferricretes, (e) sedimentary structures formed by violent earth movement (seismites), (f) rounded sedimentary material, (g) ripple marks, (h) clays derived from volcanic ash emitted from subaqueous and aerial eruptions, as well as their importance in the geologic record, such as the formation of petrified wood, etc., and (i) turbidites.

The text, combined with abundant illustrations, makes for easy reading and visual comprehension. If you enjoy

rock or fossil hunting, learning a different interpretation of how geologic materials were formed, or gaining some understanding of what you are viewing as you gaze over a rocky landscape, this book is recommended for you. It is intended primarily for laymen, and I suggest that individuals have a dictionary

of geological terms available as an aid in their study.

There are a few minor omissions and grammatical mistakes that do not affect the understanding of the text or the intent of the author. Froede provided captions on all illustrations he supplied. Other illustrations placed within the

text by the publisher need captions so that readers can understand the significance of the photographs. This book is an excellent addition to the growing creationist scientific literature.

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Book Review



Explore Evolution: The Arguments For and Against Neo-Darwinism

by Stephen C. Meyer,
Scott Minnich, Jonathan
Moneymaker, Paul A.
Nelson, and Ralph Seelke

Hill House Publishers, TM
(Melbourne & London), 2007,
160 pages, \$40 softbound and
\$50 hardbound.

We have been awaiting a book that accomplishes what *Explore Evolution* does. All the authors are well qualified, and they deal frontally with the evolutionary issues faced by students at high school and basic college levels. Also, any readers who are concerned about probing current pro-evolution and anti-evolution teachings can become better informed. Full color is employed throughout the book, and there is strong bibliographic support for the material presented.

The authors contrast Darwin's evolutionary single monophyletic tree of life with a polyphyletic "orchard" of trees representing separate, unrelated types of plants and animals. A "forest" of trees would be a preferable term because an orchard characteristically has trees of a single type.

An inquiry-based approach is used in the book to examine the current evidence and arguments for and against the key ideas of modern Darwinian theory,

the monophyletic position. The authors start most chapters with "The Case For..." followed by the "Reply" from those favoring a polyphyletic position ("our point-counterpoint style," p. 113). Afterwards is a discussion in a section called "Further Debate." Most pages of all the chapters have colored photographs and illustrative diagrams.

There are some corrections that need to be considered in future printings: The footnote on page 66 defines embryological development as the time between fertilization of the egg and the adult organism. However, commonly embryology refers to the period of time between fertilization and hatching or birth—or in humans at the end of the second month when the embryo is referred to as a *fetus*.

On page 133 under "How Do Animals with Diaphragms Breathe?" it would be better to say "air sacs" rather than "balloons." The wishbone of birds

is formed by the fusion of the two clavicles and is not "the bird's sternum" (p. 133). On p. 140, "inner ear" should be replaced with "middle ear."

I am pleased to see that *Explore Evolution* stresses the fact that "large-scale macroevolutionary change [Darwinism] requires the addition of new genetic information [i.e., new genes]" (p. 77), and we do not have good mechanisms for how this could happen. Also, on page 95 it is wisely pointed out that "natural selection works well as an editor, but not an author."

Hopefully, *Explore Evolution* will be kept up to date because it deserves a broad readership. It can serve as a valuable resource for high school and college students, pastors, and educators, including scientists.

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Notes from the Panorama of Science

Death on the Plains of Nebraska

Introduction

Akridge and Froede (2005) described the Ashfall Fossil Beds State Park (AFB) in northeastern Nebraska (Figure 1) and presented evidence for the young-earth Flood model from the geology and paleontology of the area. The mysterious deaths and fossilization of a variety of large animals at the site are better resolved by a creationist framework. The uniformitarian interpretation leaves much to be desired, especially in its inability to explain the cause of the animals' deaths. This article will suggest the means of the demise of the creatures and demonstrate how that explanation fits well within Biblical history.

Background

Hundreds of partly- and fully-articulated, three-dimensional macrofossils of various kinds of animals have been discovered at the Ashfall Fossil Beds State Park in northeastern Nebraska. The interpretation of this site given by uniformitarian scientists is insufficient to properly explain the paleoenvironment and the reason(s) for mass death of the fossilized animals. Through supplementary research and our trips to this important excavation site, we discovered facts that provide credible solutions to previously troubling questions brought up in regard to the strange deaths of so many animals found at AFB.

Various media have widely spread the uniformitarian interpretation of the mass-kill event in television programs (BBC Horizon, 1999), newspaper accounts (Seravalli, 2003), peer-reviewed articles (Voorhies, 1978), magazines (Voorhies, 1981), books (Maher et al., 2003), and



Figure 1. Location of Ashfall Fossil Beds State Historical Park in Nebraska.

literature distributed and sold at AFB (*Ashfall Fossil Beds—A State Historical Park*, n.d.; Voorhies, n.d.). The discoverer, supporter, and main developer of the fossil site is Dr. Michael R. Voorhies, who claims to have found a soft, biological, cellular growth on the bones of the animals. Dr. Karl Reinhard, a paleopathologist at the University of Nebraska, diagnosed that growth as symptomatic of Marie's disease, known from the world of veterinary medicine. He concluded that there was a common cause of the illness because *all* the animals at AFB showed signs of this malady (BBC Horizon, 1999).

Uniformitarian scientists have attributed the disease to the inhalation of volcanic ash following a large volcanic eruption 1,000 miles to the west, which covered hundreds of square miles of Nebraska with ash as deep as 13 feet in the vicinity of AFB (Voorhies, 1978) (Figure 2). The ash would have abraded sensitive lung tissue, resulting in Marie's disease.

But in spite of the certainty with which this interpretation is presented, we cannot find any documented information explaining the pathophysiology of the disease as diagnosed in these animals or any laboratory tests on the bones to ascertain the cause of the growth.

In fact, it appears unlikely that Marie's disease or the similar "hypertrophic osteopathy" (HO) caused the deaths of the animals. Although the disease in animals has similarities to that found in humans ("Marie's disease" or the currently accepted term, "Marie-Bamberger syndrome"), it is different from HO, the veterinary equivalent, especially in its symptoms (Lenehan and Fetter, 1985; Pool, 2003).

Was Hypertrophic Osteopathy the Killer at Ashfall Fossil Beds?

Did HO play a part in the deaths of the animals at AFB? HO is a secondary



Figure 2. A wall chart showing the presumed location (Left Arrow) of the source (Bruneau-Jarvis Eruptive Center) of the volcanic ash that swept eastward from Idaho and covered much of Nebraska. Ashfall Fossil Beds is located at Right Arrow.

disease occurring in mammals, such as horses, cows, dogs, sheep, and deer. Most studied cases begin as a pulmonary disease, such as space-occupying lesions in the lungs or esophagus of the affected animal. Those lesions cause secondary lesions affecting the skeletal system. Initially, soft tissue swellings of the distal portions of all four limbs will be noted. Subsequently, a diffuse periosteal formation of new bony material can affect all the limb bones (Lenahan and Fetter, 1985; Pool, 2003).

Lesions known to trigger HO include diffuse granulomatous pneumonia, primary lung tumors, large pulmonary abscesses, and a parasitic esophageal granulomatous lesion (Pool, 2003). This latter form can be initiated by a parasite found in the United States (Arizona Veterinary Diagnostic Laboratory, 1998; Lenahan and Fetter, 1985). There are other causes of the initial thoracic insult, and any of these could have led to the bony growths noted by the uniformitarian scientists at AFB. The onset of the

primary lesions even in extant animals is difficult to discover because they are rarely recognized until late stages of the disease. The exact origin of the bone growths on the fossil bones cannot be known because the original soft tissue no longer exists.

Some of the AFB specimens are possibly the only fossil animals to have been diagnosed with HO or a similar bone disease. The resulting bony growth has only been reported in particular fossils from this locale. However, the fossils can be compared to modern pastoral and grazing animals diagnosed with HO (Lavoie et al., 1992; Leach and Pool, 1992; Wayne and Nicholson, 1999). From these studies, we would expect that the causes, symptomatology, and pathophysiology of HO would closely parallel the grazing animals found at AFB, such as horses, deer, camels, and rhinoceroses.

In horses and sheep, HO is usually secondary to pulmonary abscesses and pneumonia. Bone lesions are manifested

a few months after the pulmonary infection (Pool, 2003). One pattern of HO in horses possibly resembles the type of bony growth found on the AFB bones:

...a progressive, bilaterally symmetrical diffuse periosteal new bony response initially involving the diaphyses of long bones with mandibular, rib and vertebral involvement in very chronic longstanding cases.... Therefore, lesion development most likely requires several months rather than a few weeks to be manifest as a recognizable bilaterally symmetrical diffuse periosteal new bony response with even a longer course for involvement of the mandible and other bones (Pool, 2003).

Materials available at AFB state that all the animals developed the disease and died within days to weeks of the ashfall event (Ashfall Fossil Beds State Historical Park, n.d.; Voorhies, 1978, 1992). Some of the references state that "Marie's disease" killed *all* the animals (Figure 3). But this presents a significant problem. Modern studies show that this time period is much too short for the disease to progress from the initial insult of volcanic ash to the thoracic system to the growth on the bones. Unfortunately, this significant piece of evidence has had little impact on the popular account of the animals' deaths.

Observations have shown that HO can be chronic and long-standing, requiring a much longer time to progress to a fatal stage. In spite of this scientific knowledge, the museum claims that the bony growth on the mandible of a fossil skull was caused by the disease over a period of weeks (Figure 4). However, mandibular and rib responses require even more time than the several months needed for the symptoms to first attack major limb bones. Although the effects of some disease can be observed on fossil bones at AFB (Figures 4 and 5), the proposed time frame (days to weeks) from ashfall to death is inconsistent with modern veterinary studies of HO.



Figure 3. Pelvis of a female rhino found at AFB and containing bones of her unborn calf. The descriptive information for this exhibit states: “Bones of the unborn do not show symptoms of Marie’s disease, the respiratory condition that caused the death of the mother and all other mammals found in the ash bed.” (Emphasis added.)



Figure 4. A rhino skull excavated at AFB. The descriptive information for this exhibit states: “It [the skull] shows clear evidence of the *excess bone growth caused by suffocation over a period of weeks.*” (Brackets and emphasis added.)

Did a Catastrophic Ashfall Kill the Animals?

Modern veterinary studies demonstrate that livestock are unlikely to die immediately from exposure to an ashfall unless rates of deposition are exceptionally high and the ash accumulates in great thickness. The majority of livestock outside the blast zone survived the 1980 eruption of Mt. St. Helens despite ashfalls up to a foot thick. However, for stock to survive in such conditions, they must have a ready source of uncontaminated water and adequate food, because ashfalls as thin as 0.4 inches will affect pasture growth (Neild et al., 1998a). Since AFB experienced 4–8 inches of ash deposited over the immediate



Figure 5. A fossil bone removed from the volcanic ash at AFB. Descriptive information states: “Rough, light-colored bone is symptomatic of *lung disease that killed the animals.*” (Emphasis added.)

area (Voorhies, 1978), food for grazers would have been scarce or nonexistent. Furthermore, the available water supply would have been highly contaminated by ash that was kept in suspension by current flow and wading animals. Ingestion of volcanic ash can cause clinical diseases such as hypocalcemia, forestomach and intestinal damage, and secondary metabolic disorders (Neild et al., 1998a). After being covered by 1–6 inches of tephra, which is considered “thick burial,” most plant cover would be eliminated for at least a year (Neild et al., 1998b). The burial of food supplies and contamination of drinking water would probably have decimated the animals within a few weeks, whether they were diseased or not.

Given the modern data on HO, another explanation must be found that explains both the diseased bones and burial by ashfall. One possibility is the presence of minor eruptions prior to the

major eruption that produced the ashfall that killed and buried the animals at AFB (Ashfall Fossil Beds State Historical Park, n.d.; CVO Menu, n.d.). These minor eruptions, whether from the same source or not, could have deposited thin layers of ash over a period of time well before the major eruption. HO might have developed from earlier, lighter ashfalls. Occasional thin coverings of ash would have allowed the animals to survive because their food and water supplies would not have been fully compromised. If breathing ash was the actual cause of the disease, abscesses in the lungs caused by inhalation of sharp, glassy particles of silica, could have led to HO in *some* of the animals. But because HO takes several months to develop and affects only a small percentage of animals in the same environment that have similar lung lesions (Pool, 2003; 2007), it is unlikely that it would have affected *all* the animals found at AFB.

An Alternate Explanation

If HO is an unlikely explanation for the deaths of all the animals at AFB, then another cause should be considered. A likely one is fluoride poisoning, which can cause HO-like symptoms and death.

Fluorosis, i.e. fluoride intoxication, in herbivores can also produce a diffuse periosteal new bony response involving the surfaces of long bones and the jaws as well as is associated with the formation of enthesophytes, i.e. ossification of tendon and ligament insertion lines on bone surfaces (Pool, 2003).

What could have caused fluorosis in the hundreds of AFB animals? Certain rocks, soil, and water supplies can contain toxic levels of fluorine compounds (Cronin et al., 2000; Merck & Company, n.d.). The most likely source at AFB would have been the water. Several states, including Nebraska, southeastern

Virginia, Texas, and several of the Pacific Northwest states, have documented cases in which unique geological conditions have created high concentrations of fluoride in groundwater. Water derived from those aquifers can contain toxic amounts of fluoride (Harper, 2001).

However, the water is unlikely because high fluoride levels most commonly come from deep aquifers (Cronin et al., 2000; Harper, 2001), and no fossils of large carnivores have been discovered among the hundreds of fossil herbivores at AFB—only traces such as carnivore coprolites and bite marks on some herbivore bones (*Ashfall Fossil Beds—A State Historical Park*, n.d.; Voorhies, 1992). If the water supply had been toxic, carnivores should also have been poisoned and later buried by the ashfall with the herbivores. Thus, it is reasonable to conclude that the source of fluoride selectively affected herbivores, particularly grazing animals.

Some volcanic ash contains fluorine compounds in the individual tephra particles. Smaller tephra particles have a greater surface area and can carry a greater amount of adsorbed fluoride than larger particles. These smaller particles can be transported great distances. In fact, the greatest danger to grazing animals from fluorosis is usually from a distant eruption where less than a millimeter of ash is deposited. A thin covering of fluoride-rich tephra particles can adhere to grasses, poisoning any herbivore that ingests toxic amounts (Cronin et al., 2002; Gregory, 1996; Rubin et al., 1994).

In the aftermath of volcanic eruptions, one of the greatest hazards to grazing animals is fluorosis. Acute fluoride sickness occurred after the 1970 Hekla (Iceland) eruption in areas covered by as little as 0.5 mm of tephra. In areas covered by 1.0 mm, 3.0% of adult sheep and 8–9% of the lambs expired, totaling 7,500 deaths. Similarly, following the 1783 Lakagigar eruption in Iceland, it is probable that fluorosis killed a

high percentage of the 28,000 horses, 11,500 cattle, and 190,000 sheep that died. In the first days after the ashfall, acute fluoride poisoning was discovered in grazers. In Chile, cattle and sheep have experienced serious outbreaks of volcanic fluorosis, with cattle showing clinical signs of osteofluorosis after only four months of exposure (Cronin et al., 2002; Georgsson and Petursson, 1972; Gregory, 1996).

In 1995–1996, three eruptions of Ruapehu volcano in New Zealand spread three thin deposits of tephra over about 10,000 mi² of pastoral land with a medium-to-fine grade ash covering of less than 2 mm. Animals started dying within *nine days* of the ashfall from the 11–12 October 1995 eruptions, and continued dying for another 7–10 days. At least 2,000 grazing animals died from fluorosis, and animals that survived appeared weak and ataxic (Cronin et al., 2002). Furthermore, animals of all ages except nursing calves can be affected by fluoride toxicity, and signs of the disease are normally seen in several animals within a group (Greenough et al., 1972).

Although fluorosis may have killed the herbivores at AFB, it might not have been the only factor. Clearly, modern observations demonstrate that all the animals could not have died from “Marie’s disease” because the days and weeks between the ashfall and their deaths are insufficient for the disease to have caused fatal bone lesions. Also, only a small percentage of animals progress to the bone disease after exposure by all animals to the same conditions associated with HO. Even though all the animals inhaled ash, only a few would have developed bone lesions. However, if earlier minor ashfalls had occurred, it is possible that some of the animals did develop HO.

If the area at AFB was lightly covered by volcanic ash from earlier, smaller eruptions that contained toxic levels of fluoride, then herbivores would have

experienced fluorosis. A later eruption, possibly from the same volcano, covered the areas with 4–8 inches of tephra (Voorhies, 1978). Since that source is thought to have been 1,000 miles from AFB, only the finer ash would have been carried to the AFB site. As already noted, finer particles can carry much higher concentrations of fluoride, which would have poisoned the grazers (US Department of the Interior/US Geological Survey, 2006).

Between ingestion of fluoride from earlier ashfalls to the final ashfall event, the animals could have been weakened by fluoride toxicity. The period of time between these ashfalls could have been sufficient for osteofluorosis to manifest itself in the animals, with its accompanying diffuse periosteal new bony response that could be mistaken for HO. The final ashfall would have quickly killed the sick and weakened animals with the loss of food and uncontaminated drinking water. Their burial would have been accomplished by winds blowing the ash from the surrounding area and depositing it into the lower elevation of the water source.

The multiple ashfall theory also explains why no fish fossils have been found in the ashfall deposit at AFB. Although the uniformitarian interpretation explains the lack of fish fossils by postulating frequent drying of the water supply (Voorhies, n.d.), the fossils of aquatic animals and plants found there indicate a fluvial/lacustrine setting (Akridge and Froede, 2005). Fish living there could have died after the first ashfall(s), succumbing to contamination of the water by the ash and quickly decaying or being scavenged before the later and massive ashfall(s) covered AFB.

The multiple ashfall theory also explains why no large fossil carnivores have been found at AFB. Evidence from coprolites and bite marks indicate that carnivores were present but were not fossilized. Prior ashfalls that thinned the herds would have initially provided

a short-term feast for the carnivores, but eliminated their long-term food supply. The predators would not have contracted fluorosis, but would have moved to better hunting areas away from the AFB site. In outlying areas affected by toxic ash of less than 5.0 mm, the ash would have been mechanically incorporated into the soil within one year, vegetation canopies would have recovered within weeks, and there would have been no plant burial or breakage (US Department of the Interior/ US Geological Survey, 2006), so life could shortly return to pre-ashfall conditions.

Comparing the Theories

Often, competing speculative theories about unique past events cannot be empirically tested. However, in this case, such testing is possible, but has not yet been done. No documentation of necropsies on the mammalian fossils at AFB has been reported. Examination of the bones might indicate whether the animals died from HO, fluorosis, or some other unknown cause. One important clue would be whether or not the periosteal new bony growth on the bones exhibits bilateral symmetry. Because mandibles are displayed in the AFB Museum with the bony growth showing on one side of the exposed mandible, perhaps the affected mandibles of whole individuals could be inspected to determine if the diseased portions of a complete mandible exhibit bilateral symmetry. If so, it might reveal the presence of chronic, long-standing HO that was not necessarily the cause of death. Similar examinations could be made on ribs and long bones of the legs. If the specimens do not exhibit bilateral symmetry typical of the disease, this might point to fluoride toxicity.

It would also be helpful to quantitatively compare the fluoride content of bone and tooth samples of the AFB fossils with that found in bone and tooth samples of mammalian (grazer) fossils in similar settings not contaminated by

volcanic ash. Because fluoride has an affinity for both bones and teeth of living organisms, this test could indicate whether fluoride toxicity contributed to the deaths of the hundreds of animals at AFB. Fluorosis also causes abnormal wear and hypoplasia of teeth (Greenough et al., 1972). Hypoplasia is a condition of arrested development in the teeth (or other body parts) resulting in their being smaller than normal size or remaining in an immature state. Additionally, the teeth of grazers could be inspected for “spiking,” an outgrowth on molars caused by fluorosis that makes chewing difficult (US Department of the Interior/US Geological Survey, 2006).

Because fluoride does not easily pass the mammary barrier (Cronin et al., 2000), no fluorosis should be present in nursing calves, even if the mother developed fluorosis after giving birth. However, being able to positively identify nursing, nongrazing calves in the fossil assemblage may prove difficult. But, if the disease shared by the rhinos was actually HO, caused only by inhaling volcanic ash as the uniformitarian scientists believe, even some nursing calves would also be expected to have HO because they would have breathed the same ash-laden air as their mothers.

Fluorine will transfer through the placenta and may accumulate in the bones of the fetus (Jones et al., 1996). The bones of the unborn rhinos discovered at AFB could be analyzed to determine if fluoride is present or not (Figure 3). If present, this could indicate that the mother rhino was affected by fluorosis before the birth of her calf. If fossils of young, nursing rhinos exhibit the bone anomaly, this could be a sign that their mother was affected by fluorosis before giving birth, rather than the young rhinos developing HO from inhalation of volcanic ash.

Summary

Uniformitarian scientists explain the mass death of the herbivores at AFB

by Marie’s disease. However, modern knowledge suggests the need for another theory, and fluorosis may provide the needed explanation. The timing and mortality rates of HO make it a weak explanation, despite its present popularity among uniformitarian scientists.

The young-earth Flood model also offers a superior framework for understanding the fossils at AFB. Following the Flood, volcanic and seismic activities would have remained higher than at present, which would explain the large volumes of volcanic ash that are found covering a large part of Nebraska, as well as other locations. Post-Flood volcanic eruptions from one or more locations could have covered AFB many times with varying thicknesses of fluoride-toxic ash, killing the emerging populations of grazers in a short time. The post-Flood fluorosis theory might explain the absence of large fossil carnivores—particularly “pursuit predators,” such as saber-toothed cats, bone-crushing dogs, and wolves—at AFB and at other fossil beds containing mostly herbivores.

After the Flood, drainage from the Rocky Mountains would have provided abundant water and silt, encouraging fertile conditions for plants and animals. Carlson (1993) describes a fecund Nebraska, populated with large herds of grazing animals and prolific grasslands during the supposed millions of years in the later Tertiary and Cenozoic. Although his time frame significantly contrasts with the Flood model, which extends over a few thousand years, he pictures a Nebraska much like creationists would envision this same area after the Flood.

Post-Flood catastrophes created by volcanoes, earthquakes, landslides, breached natural dams, and other high-energy events would have killed many animals and preserved some, given the right conditions. Given those conditions, we should expect fossil beds such as those found at Ashfall Fossil Beds.

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Perhaps not everyone listed above would agree with every point made in this paper, but all of them were willing to assist by gladly sharing their time, interest, and expertise, for which we are most appreciative and deeply grateful. Any mistakes that may remain are our own.

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Book Review

All the Voices of the Wind

by Donald James Parker

Outskirts Press, Denver, 2007,
365 pages, \$12.95.

This book is about two bright high-school students. Jeremy is a premiere school athlete (football, basketball, and baseball); Maria is a cheerleader and athlete. From the beginning Jeremy is clearly and irrevocably smitten with Maria. However, Maria is a young woman with a mission, and she will not be derailed by teenage romance. She is commissioned by her dying father to do an in-depth study of evolution, and Jeremy assists. This study encompasses the evidences for and against evolution, as well as its consequences on society.

Jeremy's father is a college professor who is deeply devoted to the concept of molecules-to-man evolution. Maria lives within an evangelical context. Jeremy's father has a very loving and close relationship with his son, actually an ideal father/son relationship. We eventually find out that Jeremy's mother, who died at his birth, was a devout Christian. This

caused the father/husband to blame God and consequently to turn his back on the Christian faith. However, he remains faithful to his promise to his wife to raise Jeremy in a loving Christian manner.

As the research proceeds, Jeremy and Maria read many books from the intelligent design (ID) and creation science communities, as well as anticreationist literature. One of the most interesting incidents is a visit that Jeremy, Maria, and several other students make to the Discovery Institute in Seattle, where they meet and talk with ID notables. Eventually this research project brings sufficient alienation between Jeremy and his father that the son moves out of his home. It also causes the research group to request an audience with the school board on the subject of how evolution is being taught in their high school.

Novels succeed or fail on three major criteria: theme, plot, and character. Author Parker does a good job of paying attention to these necessary factors. The

theme is the quest for truth concerning the reality of macroevolution. The plot has to do with the various incidents as the characters pursue truth and how it impacts their lives for both good and ill. The characters grow in maturity and knowledge throughout the story, and they generate reader empathy. Jeremy comes to realize that his emerging faith can't be solely tied to the young woman that he has fallen in love with. This faith needs to be his own. It needs to be grounded in a personal relationship with God that can stand the winds of adversity. Even Jeremy's father has a major reevaluation of the beliefs he has held on to since the death of his wife.

This book should have a wide audience among high-school age Christians who take their faith seriously and want not only to resist faith-damaging ideologies but also to make a positive impact on their culture for Biblical truth.

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Hurricane Ivan's Impact (September 16, 2004) on the Alabama Gulf Coast Illustrates Matthew 7:24–27

Introduction

While the Bible was not written with the intention of being an Earth science textbook, it often conveys geological concepts that are relevant today. One example is from Matthew 7:24–27.

Therefore whosoever heareth these sayings of mine, and doeth them, I will liken him unto a wise man, which built his house upon a rock: And the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell not: for it was founded upon a rock.

And every one that heareth these sayings of mine, and doeth them not, shall be likened unto a foolish man, which built his house upon the sand:

And the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell: and great was the fall of it. (KJV)

While the geomorphic setting of this story is not clearly conveyed, it could be applied to a beach environment. Large storms can cause considerable property damage and create dramatic changes to beach geomorphology. For example, Hurricane Ivan impacted the Alabama shore creating widespread property destruction in a manner consistent with this scriptural passage.

Hurricane Ivan

Ivan developed from a large tropical wave off the West African coast on August 31, 2004. Meteorologists classify this storm as a classic, long-lived Cape Verde hurricane (Stewart, 2005). Ivan reached hurricane status on September 5 and quickly grew to a Category 5 hurricane (Saffir-Simpson scale). However, the storm weakened as it passed between the Yucatan Peninsula and Cuba and entered the Gulf of Mexico on September 13, 2004, as a Category

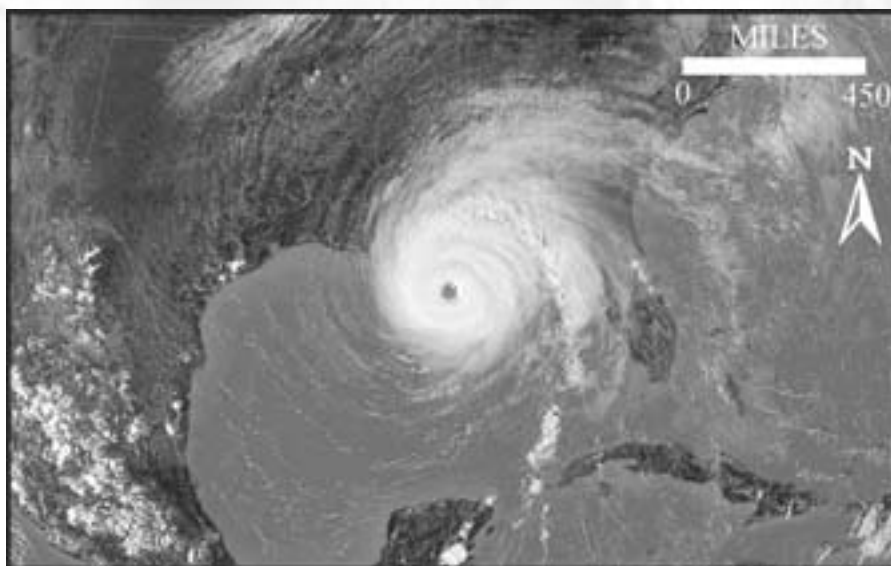


Figure 1. Hurricane Ivan was a massive and powerful upper Category 3 hurricane as it moved toward the Alabama coastline. This image was taken at 3:15 p.m. (local time) on September 15, 2004, just hours before making landfall between the Alabama towns of Gulf Shores and Orange Beach. Image courtesy of the National Oceanic and Atmospheric Administration (NOAA).

4 hurricane (National Weather Service-Raleigh, 2004). Its strength and intensity were further reduced as it moved northward toward the Alabama coastline.

Ivan made landfall at 12:51 a.m. (local time) on September 16, 2004 as an upper Category 3 hurricane (Figure 1), impacting the coast between the towns of Gulf Shores and Orange Beach, AL

Table 1. Hurricane Ivan was a powerful upper Category 3 hurricane when it made landfall along the Alabama coast. Data from various NOAA/National Weather Services sources (National Weather Service-Mobile/Pensacola, 2004a, 2004b; Stewart, 2005).

Hurricane Ivan Characteristics at Landfall

Wind Speed (Peak gusts)	130 mi/hr
Wind Speed (Sustained)	Estimated at 85 mi/hr
Storm Surge (Above mean sea level)	8.81 ft
Barometric Pressure	28.48 in (964 millibars)
Rainfall (9/15–9/16 total range estimates)	8.0 to 10.0 in

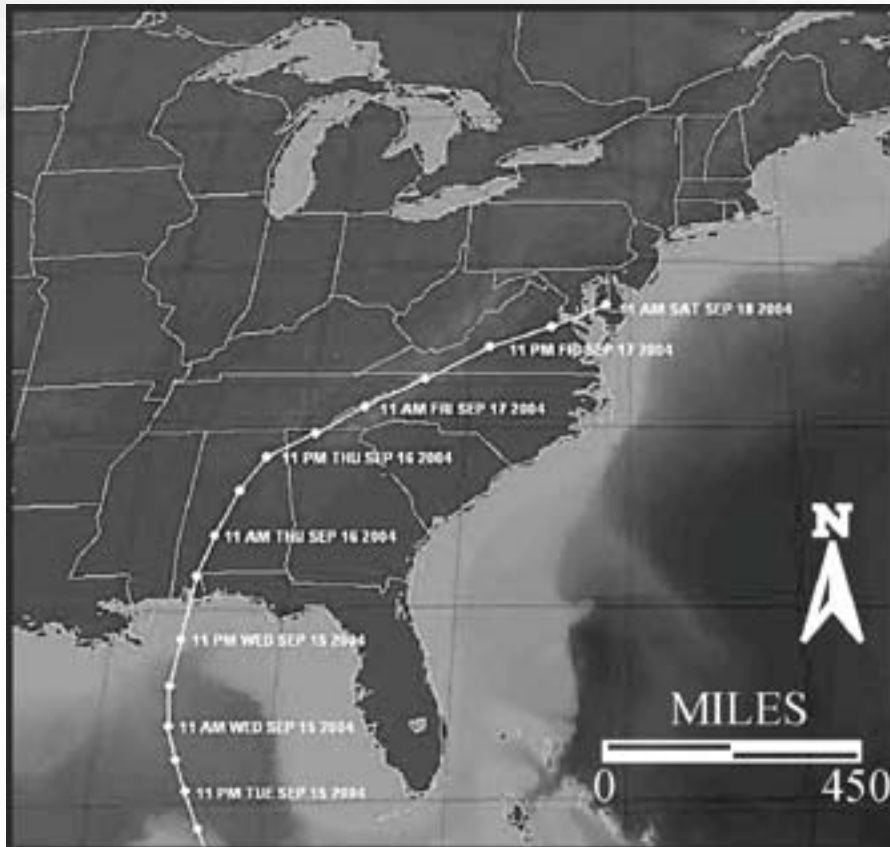


Figure 2 (*left*). This map shows the track of the hurricane as it moved from the Gulf of Mexico inland across the eastern United States. Hurricane Ivan was unique in that it exited to the Atlantic Ocean and circled back to the Gulf of Mexico as a tropical wave and made landfall along the Louisiana/Texas state line as a tropical depression. The impact along the Alabama shoreline is the subject of this article. Image courtesy of the National Weather Service, Raleigh, NC.

Figure 3 (*below*). Hurricane Ivan storm waves significantly flattened much of the beach along the Alabama shoreline between the towns of Gulf Shores and Orange Beach. During the course of the storm, much sand was eroded from the beach and transported out to sea. This allowed the storm waves to wash well inland and damage structures a considerable distance from the original shoreline. Image taken November 13, 2004.





Figure 4. The footings of this large condominium are exposed due to the tremendous volume of sand removed from the beach by Hurricane Ivan. Approximately 10 to 15 feet of sand has been removed from beneath this building. Image taken on November 13, 2004.

(Figure 2). The technical details related to the strength and intensity of the storm at landfall are presented in Table 1. It was the worst storm to hit this area in over 100 years, and adjacent areas along the Gulf Coast also were severely damaged (e.g., Froede, 2006).

Erosion Along the Alabama Coastline

While hurricane-force winds are incredibly powerful, it is typically the storm waves that cause the most destruction. Hurricane Ivan's storm surge was almost nine feet above sea level, and storm waves would have further elevated the water to as high as 15 ft (Stewart, 2005). Sand dunes and man-made structures

close to the beach were severely damaged or destroyed by this landward-moving surge of water. The beach was eroded and flattened (Figure 3), and structures within this beach zone experienced a considerable loss of supporting sand (Figure 4).

For many years, the United States Geological Survey Center for Coastal and Watershed Studies has been photo-documenting changes to America's coastline as a result of sea level changes and passing storms. This work includes the coastline along the northern Gulf of Mexico. Figure 5a shows a segment of the Alabama shoreline before Ivan struck. Elevated sand dunes covered in vegetation extend from beneath the

buildings toward the shoreline. Sand fences are in place to prevent wind activity from moving the quartz sands. Figure 5b shows the same area following the passing of Hurricane Ivan. Note the loss of vegetation and supporting sand. The large condominium on the left has collapsed. However, at this distance, any details related to the exact conditions of the structures or the state of the beach cannot be known.

When storm waves measuring up to 15 ft higher than mean sea level roll ashore, they can carry a significant amount of energy, which erodes the beach. This is demonstrated in Figure 6, where beach sand has been eroded from beneath a house. Portions of the



Figure 5a (*left*). This aerial image is from July 17, 2001, and it shows the condition of two structures adjacent to the beach. Note the two black arrows, one pointing to a beach house and the other pointing to a large condominium. Image courtesy of the US Geological Survey, Center for Coastal and Watershed Studies.

Figure 5b (*below left*). This aerial image is from September 17, 2004, and it shows the damage experienced by the two structures as a result of Hurricane Ivan. From this distance it is unclear if the damage resulted from wind or waves. Image courtesy of the US Geological Survey, Center for Coastal and Watershed Studies.



structure (left side of image) were destabilized and collapsed, only to be washed away by storm waves. Sand that was originally beneath the building was washed out into the gulf. Pilings on which the building was constructed were deep enough to prevent the total destruction of this dwelling but not for the adjacent condominium (Figure 7). It was apparently constructed on a concrete slab with no underlying foundation. As sand was eroded from beneath the building, its structural stability was compromised, resulting in its partial collapse. Surprisingly, this is not the only building along the beach that was constructed in this manner (Figure 8).

Conclusion

Biblical stories are intended to have spiritual significance and meaning. Sometimes these stories also contain scientific truth. The story conveyed in Matthew 7:24–27 by our Lord Jesus Christ addresses both spiritual truth and



Figure 6. This image documents the loss of sand beneath this house constructed on piers. Note the white paint marking the former sand line. Approximately six to nine feet of sand has been removed from beneath this house. A portion of the beach-facing side (left) of the building has collapsed and was washed away during the storm. This is the small beach house on the right, shown in Figures 5a/5b, and indicated by a black arrow. Image taken on November 13, 2004.



Figure 7. This image shows the damage to the large condominium shown on the left (indicated by black arrow) in Figures 5a and 5b. Apparently this structure was built on a concrete slab that was undermined during the course of the storm. Unable to retain its structural stability, a portion of the building collapsed. Note the exposed interior doors. Image taken November 13, 2004.

geological science. The spiritual truth is obvious: we are to place our faith and trust in Jesus Christ and live our lives accordingly. Failure to do so places us on shifting sand, which offers no lasting value or hope, especially when the storms of life come our way.

Various buildings along the Alabama Gulf Coast are constructed on sand. How they survive a passing storm, such as Hurricane Ivan, depends on the foundation on which they are built. Those with massive and deep foundations fared very well, like the large concrete condominium shown in Figure 4. Sand can be added to fill the vacant gap left by the storm waves. The hurricane proved to be nothing more than an inconvenience. However, smaller structures built on pilings of insufficient depth (Figure 6) or, even worse, on concrete slabs (Figures 7 and 8) failed to weather the storm and were destroyed.

This Biblical story conveys not only truth that is spiritually important in today's post-Christian society but also geological information that is relevant as the United States population moves closer to the coastline. Build your house (both spiritual and physical) on a firm foundation.

Acknowledgments

I am grateful for the very capable constructive review and comments provided by A. Jerry Akridge. Gratitude is expressed to the anonymous peer reviewers for their helpful comments. Dr. John Reed (Geology Editor) inspired the writing of this article. I thank my wife Susan for allowing me the time and opportunity to research and write this article. Any mistakes that may remain are my own. Glory to God in the highest (Prov. 3:5–6)!

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Figure 8. Several condominiums likely constructed on concrete slabs have collapsed due to the severe beach erosion created by the large storm surge generated by Hurricane Ivan. This occurred where sand beneath the slabs was removed during the storm causing structural instability. Note the former sand line along beach house pilings on the right side of the image. Image taken November 13, 2004.

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Letters to the Editor

The policy of the editorial staff of CRSQ is to allow letters to the editor to express a variety of views. As such, the content of all letters is solely the opinion of the author, and does not necessarily reflect the opinion of the CRSQ editorial staff or the Creation Research Society.

God, Hilbert, Weyl, Einstein, and Unifications

When particular ideas are presented, it may not seem important to give credit to individuals who appear to have historical priority. However, there may be methodological differences in the prior proposals that are significant. Unfortunately, these individuals' contributions are dismissed or not generally known.

Such is the case with David Hilbert's and Hermann Weyl's contributions to the unification of the gravitational and electromagnetic fields. Throughout the literature, statements such as those of Pais (1982), as presented by Powell (2008, pp. 18–19) and others, generally imply that it was Einstein who first conceived of the notion of unifying the gravitational and electromagnetic fields with the material world. If all of the references and translations as found in Mehra (1974) are to be believed, this is not true.

Gustav Mie was the first individual in the twentieth century to attempt to construct a complete theory of matter using the J. J. Thomson model of the atom. Mie's idea was that "the electric field, the magnetic field, the electric charge, and the charge current are entirely sufficient to describe all phenomena in the material world" (Mie, 1912, p. 512). Mie did not propose an actual unification of the gravitational and electromagnetic fields, in the usual sense.

Hilbert is probably the most significant mathematician of the late nineteenth and early twentieth centuries. Starting in 1912, Hilbert pursued certain topics in physics. After the

death of Minkowski, Hilbert took over instructing all of Minkowski's physics courses at the University of Göttingen, as well as acquiring all of his doctoral students. Hilbert was the doctoral advisor for many physics Ph.D.s, including Hermann Weyl. In those days, there was not as strong a separation between mathematics and physics departments as there is today.

To apply Mie's ideas, Hilbert proposed to "derive" a unification for the two physical fields using three physically related axioms and the calculus of variations. On 20 November 1915, Hilbert presented a remarkable, in my view, derivation to the Göttingen Academy that yields two sets of equations. He considers a "world-function" $H = g^{\mu\nu}R_{\mu\nu} + L$, where L is written in terms of components involving $g^{\mu\nu}$ and the four electromagnetic potentials consider as a vector A_μ . The first set of equations is equivalent to the gravitational field equations presented by Einstein at the Prussian Academy five days later. The second set of equations unifies the gravitational and electromagnetic fields. If you drop the L , only the gravitational field equations are derived. If L is replaced with a constant, a Hilbert-style derivation yields the gravitational field equations with cosmological constant.

Hilbert knew that Einstein was working on a field theory for gravitation since Einstein visited Hilbert. After that visit Einstein wrote in July 1915, "With Hilbert, I am enraptured. An important man!" (Mehra, 1974, p. 25). Hilbert's motivation was "to propose a new system

of basic equations of physics. They are of ideal beauty and, I believe, they contain the solution of the problems of Einstein and Mie at the same time" (Hilbert, 1915, p. 395). Thus, using the Mie proposal, this unification would lead to a complete theory of matter.

Relative to his methods and his derivation of the gravitational field equations, Hilbert wrote, "I am also convinced that through the basic equations set forth here the hitherto concealed phenomena inside the atom would find the closest explanation" (Hilbert, 1915, p. 406).

Einstein's approach was to develop the equations by discerning conjecture, and he criticized Hilbert's derivation in a postcard to Ehrenfest. He wrote, "I do not like Hilbert's formulation. It is needlessly specialized and, as far as matter is concerned, unnecessarily complicated. It is not honest in design, [and reflects] the pretense of a superman by a camouflage of techniques" (Mehra, 1974, p. 35).

As we know today, physically related axioms are used as a foundation for important physical theories such as quantum mechanics. However, as Hilbert determined later, if his conclusions are forced to be consistent with Minkowskian geometry (i.e. the metric), then each of the equations in the second set of unifying equations is equal to zero. This forces the Hilbert universe to be empty of both matter and electricity if L is included as a term in H .

After Hilbert's attempt, Einstein continued to reject the unification notion.

From May 1917, we have the Rudolf Humm statement:

I suggested to him [Einstein] that he had taken recourse to the quantum theory in order to modify the theory of gravitation, while Hilbert on the other hand wanted to derive the quantum theory from the theory of gravitation. At this he made a roguish grin. This would not do, he [Einstein] said, even though the theory of gravitation was more general. But [Einstein said] the idea of relativity could not yield anything more than gravitation (Seelig, 1954, p. 188).

This 1917 statement contradicts the Pais statement (Powell, 2008, p. 18) that implies that Einstein was the founder of this unification idea. Thus, Hilbert gave us the notions that axioms lead to physical behavior and that from the unified field equations and the theory of gravity quantum theory might be derived.

In 1918, Weyl, who, while a graduate student, was Hilbert's assistant, took up the challenge and presented his own unified field theory (Weyl, 1918). At this time, Einstein wrote a forward to Weyl's paper and appeared enthusiastic about the possibility. Weyl conceived of the notion of a "gauge-invariant geometry." Although this highly complex approach may have been exciting, Einstein showed that Weyl's results did not apply to our

real universe. But, what Weyl did institute was gauge theory, a very significant aspect of modern physics. I do not speculate as to what drove Einstein to alter his views and accept the Hilbert unification philosophy, although Einstein also failed to achieve a unification.

I note that, during the 1926–1932 period, John von Neumann was also an assistant to Hilbert. Hilbert and his mathematical ideas played a key role in von Neumann's reformation of quantum mechanics. Indeed, the structure von Neumann proposed is named a Hilbert space.

Thus, Hilbert, Weyl, and Einstein, in that order, attempted but failed in their unification attempts, at least for the fundamental fields. However, rather than considering this type of reductionism, there is a "general" unification that is more significant (Herrmann, 2001, 2004, 2006). This "ultimate" type of scientific operator unifies all physical laws and verified physical theories. And, this operator identifies the Biblical God as the first unifier.

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Continentially Correlative Flood Strata Sequences Are Essentially Globally Correlative and Synchronous

Dr. John Reed (2008) questions the value in diluvial geology of the assumption, which he says is the “key to the geologic timescale (and modern stratigraphy)” and has been long held by both uniformitarian and diluvialist stratigraphers, “that rock units can be ordered by reference to concentric layers of synchronous time that are globally correlative” (Reed, 2008, p. 256). Dr. Reed claims that “local variations in tectonic, hydraulic, sedimentary, and diagenetic environments make it unlikely that globally correlative synchronous time periods can be readily and practically identified in the rocks” (p. 256).

Continental scale geological maps however, show thick sequences of upper Paleozoic-Mesozoic-Cenozoic lithological units, which are continentally correlative on lithological grounds, probably in the same sequential order, on several large continents. Dr. Reed concedes that continent-wide correlative sequences were deposited rapidly in the global Flood and “at a given scale” represent the passage of time (p. 259). Such sequences, especially if deposited in the first forty days of the Flood year (Hunter, 2000), in the same sequential order, are, at least at continental scale, essentially synchronous. Given that the vast majority of Flood deposited strata occur on the continents, strata sequences that can be correlated intra and inter continentally are, I would argue, essentially globally correlative.

Dr Reed cites the results of laboratory experiments and field investigations on sedimentation by Berthault (1994), claiming that they bring into question “the foundational assumptions of stratigraphy” (Reed and Froede, 2004, p. 218), primarily the law of superposition, first proposed by Nicholaus Steno, that “the layers are the chronology” or “strata parallel time” (p. 257). Consistent with his long held view Dr. Reed suggests,

“If this relationship between rocks and time is not absolute, then modern stratigraphy and its timescale must be reevaluated from the ground up” (p. 257). This confirms his view expressed in 2003 when he wrote, “We do not see how creationists can escape the necessity of razing (the uniformitarian) worldview until no stones are left standing, and then rebuilding natural history and its derivative stratigraphy from the ground up” (Reed and Froede, 2003, p. 96).

Other creationist geological theorists have, like Dr. Reed, advocated sweeping reevaluations of the geologic record as represented in the uniformitarian geologic column, and creationist opinion regarding the validity of the column is changeable.

In 1983, Dr Andrew Snelling for instance suggested that “creationist geologists need to completely abandon the evolutionists’ geological column and associated terminology” (Snelling, 1983, p. 42). Then, in 1996 Dr Snelling wrote, “We recognise the general validity...of the lithostratigraphic and biostratigraphic columns” (Snelling, et al., 1996, p. 334), and now writes, “We believe much valuable work has been done in the secular realm in mapping and describing rock sequences, and that interpretations of the relative order of events can be useful.... Correlation of the Precambrian record around the world, as with other strata, is based primarily on the superpositional order mapped in the field” (Dickens and Snelling, 2008, p. 65).

Carl Froede on the other hand, changed his view in the opposite direction, writing, sensibly in my view, in 1995: “This author is not totally against the use of the uniformitarian geologic timescale...creationists should seek out and use all uniformitarian information where applicable and appropriate (incorporating it into the Flood model)”

(Froede, 1995, p. 90). Now however, in line with Dr. Reed’s consistently held view, Mr. Froede suggests, “Creationists should adopt a more empirical approach to stratigraphy (even “Precambrian” stratigraphy) and ignore the dictates of geologists who advocate a system built on uniformitarianism” (Froede and Oard, 2008, p. 9).

For the diluvialist, notwithstanding the acknowledged debate over how much if any of the Precambrian was Flood deposited, the absolute timescale for the Flood deposited geologic totals 371 days (vs. 4.55 billion years in the uniformitarian worldview), with the possibility that the complete geologic record may have been deposited in the first forty days (Hunter, 2000). The absolute timescale is established quite simply from the Genesis Flood narrative in Genesis 6-8. It does not rely on global correlation of rock units, on either lithological or temporal grounds.

The relative timescale however, within the Flood paradigm, does rely on the correct ordering of successive strata throughout the Flood-deposited geologic record, the varying lithologies of which should record the varying geohydraulic conditions throughout the Flood process. The global uniformitarian geologic column is correct only insofar as it correctly represents this sequence.

In 2004 Dr. Reed noted regarding Berthault’s work: “It has not yet been determined to what extent that work applies to the rock record, we suspect that this, like so many other things, will end up as a matter of scale” (Reed and Froede, 2004, p. 218). Dr. Reed also concedes that “at given scales, rock units certainly can be identified and correlated” and that “the succession of particular rock units at a given scale most likely represents the passage of time” (p. 259). The implication here, and from

other of Dr. Reed's publications (Reed and Froede, 2003), is that at continental scales Berthault's conclusions may not be valid, and local variations may not be so dominant.

In 2002 for instance Dr. Reed wrote, "The 'Cambrian explosion' is first and foremost a testimony to widespread extinction and rapid marine deposition across continental interiors" (Reed, 2002, p. 228); and, "the existence of widespread (and arguably correlative) marine 'Paleozoic' strata over much of North America supports continent-wide deposition by the Flood" (Reed, 2002, p. 229). Here Dr. Reed acknowledges "widespread" (at least continent-wide), "rapid," and "correlative" sedimentation, conceding that although Berthault's conclusions from his laboratory experiments and field observations regarding the origin of laminations in strata sequences may be valid at small scales, they may not preclude stratification at continental scale by vertical deposition of successive strata sequences, as illustrated in Figure 1 of Dr. Reed's paper.

Dr Reed claims that Berthault's work shows that Steno "failed to recognize that hydraulic variables could create the appearance of superposition without its reality (Figure 3) by the simultaneous formation of multiple sedimentary horizons" (p. 260).

Widespread stratification, comprising relatively thick layers of diverse discrete lithologies, characterises extensive similar sequences of upper Paleozoic, Mesozoic and Cenozoic strata on large continents, for example North America (as seen most clearly for example in the Grand Canyon), throughout Eurasia, and in Australia. Can it be seriously contended that stratification, comprising discrete variable lithologies, in these continent-wide sequences constitutes "the appearance of superposition without its reality," or that it resulted from "segregation" (Berthault, 1994, p. 103), or that the sequences resulted from "the simultaneous formation of

multiple sedimentary horizons" (Reed, 2008, p. 260)?

Dr. Reed describes the hurdles faced by "early stratigraphers" (p. 256) in their attempts to decipher the relationship between rocks and time, noting that their problem was that they observed "local successions of rock units that were commonly named without consideration for their lateral continuity (or lack of it)" (p. 257), and claims that extrapolation of "the initial 'Primary-Secondary-Tertiary' framework" by early stratigraphers from "local observation to global scale 'were'...unwarranted" (p. 259).

The initial subdivision by the earliest workers into *Primary-Secondary-Tertiary* (G. Arduino ca. 1759) and the correlation of these subdivisions, on the grossest of scales, as globally correlative synchronous time units, has been essentially vindicated, though significantly refined, by later work. Contrary to Dr. Reed's assertion regarding "the ability of any given lithology to occur in strata of widely varying ages" (p. 258), the diverse characteristic lithologic and biostratigraphic makeup of these three original subdivisions are mutually exclusive, and always occur in the same sequential order, recording, on the grossest of scales, essentially synchronous deposition, in the global Flood.

The radical "razing" and "rebuilding" approach (Reed and Froede, 2003), and the "empirical approach" (Froede and Oard, 2007; 2008), present today's creationist stratigraphers with the same problems faced by the "early stratigraphers," i.e. the inability to know how the strata sequences they were observing locally related to the global picture. The uniformitarian geologic column, despite its acknowledged problems (Snelling et al., 1996; Oard, 2006), at least provides a broad global framework of the relative order of strata sequences, so necessary, I believe, to the formulation of a valid geologic model of a global Flood.

The problem of the "early stratigraphers" is replicated in Froede and Oard's

view of the Precambrian, both in the Grand Canyon, and globally (Froede and Oard, 2008). They prefer to use an "empirical approach," viewing the Precambrian in the Grand Canyon in isolation from its global context, denying any validity to the subdivision of the Precambrian by the International Commission on Stratigraphy (ICS), or by independent workers, claiming it is based solely on radiometric dating. They claim, regarding the Precambrian in general, "there are no lithological or biostratigraphic criteria that can be applied either locally or globally" (Froede and Oard, 2008, p. 8), and prefer to apply *ad-hoc* "diagnostic criteria" based on what theorists believe might have characterised a global flood (Austin and Wise, 1994) to define a pre-Flood/Flood boundary in the Grand Canyon.

The geological literature on the Precambrian shows that its subdivision, both by the ICS, and, more clearly, by independent workers such as Salop (Salop, 1982), is based primarily on lithostratigraphic and superpositional relationships, mapped in the field on all continents, by thousands of geologists, over many years (Hunter, 1992, Fig. 10, p. 160; Snelling et al., 1996; Dickens and Snelling, 2008). The same is probably true for the subdivision of the remainder of the geologic record.

Dr Reed's statement that "although the Flood account in Genesis includes a chronology that can be read into Earth's geology (i.e., onset, transgression, highstand, recession, end), there is no guarantee that this chronology will manifest itself globally in similar predictable physical features of rock units" (Reed, 2008, p. 261) is difficult to interpret and contradicts his statement in 2002: "If the uniformitarian geologic periods are paleoenvironments, then why is there a unidirectional order in the sequence? Why is there not a random distribution of say, Precambrian-Cenozoic-Paleozoic-Mesozoic at least in some locales?" (Reed, 2002, p. 229). How can

Dr. Reed claim that the chronology can be “read into Earth’s geology” if it doesn’t “manifest itself”?

In acknowledging that the uniformitarian geologic column contains a “unidirectional order” and that the correct (non random) order of the Eras is Precambrian-Paleozoic-Mesozoic-Cenozoic Dr. Reed is effectively acknowledging that the geological Eras occur globally in the same sequential order, and are, if not globally correlative synchronous time periods, at least globally correlative on lithostratigraphic grounds.

The concepts of “transgression” and “recession” (Reed, 2008, p. 261) (or “regression,” e.g. Wise’s “Day three regression” [Wise, 1992, p. 71]), as illustrated in Figure 4 of Dr. Reed’s paper, are uniformitarian concepts, implying gradual processes occurring over millions of years, and do not adequately describe the catastrophic nature of sedimentation during the Flood.

The Flood was global (“all the high hills, that were under the whole heaven, were covered,” Gen. 7:19 KJV), catastrophic, and rapid (“the same day,” Gen. 7:11 KJV). The geologic characteristics of the Flood-deposited global geologic record should reflect the varying geohydraulic conditions through the Flood deposition event, and should occur globally in the same sequential order. The greatly compressed time frame of the Flood means that the Flood-deposited strata (Hunter, 1992, Fig. 10, p. 160; Snelling et al., 1996; Dickens and Snelling, 2008) are essentially globally synchronous, and therefore globally correlative, on both lithostratigraphic and temporal grounds. If the constituents of the global geologic record were derived by differentiation from the Earth’s mantle (Hunter 1996), a unidirectional

lithological and chemical order reflecting progressive depletion of the mantle sources should be evident throughout the global geologic record.

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Reply to Hunter: “I’m From Missouri”

Mr. Hunter covers a lot of ground in his letter, but I assume his main point is found in his title. However, that point cannot be completely addressed without a precise definition of “continentally correlative Flood strata sequences,” including a definitive set of criteria that would distinguish them from other stratigraphic units.

My series of articles in a nutshell is this: uniformitarians correlate rocks by reference to time; creationists should not. If Mr. Hunter disagrees, the logical outcome of his position would be a time-stratigraphic “Flood” column, with “Day 1,” “Day 2,” etc shown as a vertical global sequence. Physical rock units and unconformities would then be arranged in their proper temporal relationships, just like the uniformitarian timescale. I am intensely curious to see what global criteria separate “Day 1” rocks from “Day 2” rocks, and so on up the column.

Do strata really contain empirical clues linking them to a particular day (hour? minute?) of the Flood? That is the *only* way diluvialists *could* create a global, time-synchronous column, but it does not seem practicable—another reason that I agree with Berthault and others about the superiority of a sedimentological/hydraulic approach over the traditional time-stratigraphic approach. Those that desire a diluvial time-stratigraphic approach should propose a set of stratigraphic rules that allow the unambiguous assignment of rock units to unique and very precise time periods during the Flood. Do we correlate by months? Weeks? Days? Hours? If Mr. Hunter (or anyone else) can produce a credible column of this sort, then I will gladly admit that the time-stratigraphic method is valid.

For example, the Huber Formation of the Oconee Group is found near my neck of the woods in central Georgia. What aspect of this rock unit can we

use to tell us which day of the Flood was responsible for its deposition? What criteria can we use to demonstrate its continental or global extent—especially in the face of clear field evidence that it occurs in a limited geographic area? Problems like this are why uniformitarians jump back and forth between rock units and time units; it is a convenient way to evade some of the more pressing problems of stratigraphy. But creationists should face them head on. Defaulting to “Paleozoic,” “Mesozoic,” etc simply avoids field problems since these names do not designate *rock* units, but instead refer to anti-Biblical periods of time—conceptual constructs imposed on the rock record. As a creationist, Mr. Hunter rejects the assumptions on which these constructs are based (Reed, 2008a). If he knows the foundation is unstable, why does he want to live in the house?

I also need some help with what appears to be a logical error in his title. He states that continental Flood sequences are “essentially synchronous.” Aside from the imprecision of “essentially,” if individual formations were deposited in a matter of hours and it took a minimum of 40 days for the Flood to cover the continents, it stands to reason that continent-wide synchronous units would not be *logically* possible until highstand—Day 40 (or Day 150, depending on how you interpret the narrative). Hunter pushes himself further into a corner by asserting that almost all the strata were deposited during that transgression. I believe instead that since geological *processes* can be independent of time, transgressive deposits might be *physically* similar across broad areas, without being synchronous. That was the point of my Figure 4, which Mr. Hunter obviously missed. For example, there is an erosional surface on top of the basement over North America. That does not mean it happened at the same time in Manitoba and Mississippi.

I am just as eager as Mr. Hunter to correlate rock units, but, unlike him, I prefer to do it without being forced to use time as some interpretive Holy Grail. Perhaps this explains Mr. Hunter’s inability to understand my statements about correlating gross sequences across large areas based on factors other than time; e.g., large-scale marine sequences. Furthermore, I want to do so at the level of detail of formations and members, not continental mega-sequences. Perhaps he is unaware that uniformitarians do not group strata based on empirical criteria that could be directly transposed to Flood geology. It is a common misconception and hence the point of my article. Modern stratigraphy operates with a set of rules largely based on assumptions of: (1) prehistory, (2) uniformitarianism, (3) evolutionary succession, (4) the validity of radiometric dating, and (5) deep time. As these rules have driven stratigraphy further away from an empirical foundation (Reed et al., 2006), they have predictably become more and more arbitrary, as will be explained in more depth in my fourth paper of this series.

Despite the bold front of stratigraphers, the fact remains that if there were clear empirical criteria—such as lithology—that directly tied the rock record to time or allowed global correlation, the ICS would not be resorting to arbitrary methods: their Global Stratotype Sections and Points (Phanerozoic) and Global Standard Stratigraphic Ages (Precambrian). These are described both on the ICS website and in their authoritative new tome, *A Geologic Time Scale 2004*, edited by Gradstein et al. (2004). Any creationist not current with the ICS position can find it in this book or in a condensed version on the ICS website. It would certainly update Mr. Hunter’s understanding of Precambrian stratigraphy. I am not original in my disagreement with his assertion that it

rests on lithostratigraphy and superposition—I merely cite the ICS.

According to them and contrary to Mr. Hunter's belief, the Precambrian time scale is not connected to empirical stratigraphy. Instead, the Precambrian rests on nothing more than the arbitrary decree of the ICS. They made up the eons, eras, and periods; pulled their boundaries out of thin air; and mandated correlation by radiometric dating.

By contrast, Precambrian stratigraphy is formally classified chronometrically...the base of each Precambrian eon, era, and period is *assigned* a numerical age (Gradstein, 2004, p. 3, emphasis added).

No rock units or fossil zones constrained them.

Due to the fact that most Proterozoic and Archean rocks lack adequate fossils for correlation, a different type of boundary definition was applied for subdividing these eons into eras and periods... For these two eons, the assigned boundary, called a Global Standard Stratigraphic Age (GSSA), is a chronometric boundary and *is not represented by a GSSP in rocks, nor can it ever be* (Gradstein, et al., 2004b, p. 26, emphasis added)

Elsewhere, Mr. Hunter quotes my concerns about scale-dependent processes during the Flood, but does not seem to get the point. He states:

The relative timescale however, within the Flood paradigm, does rely on the correct ordering of successive strata throughout the Flood-deposited geologic record, the varying lithologies of which should record the varying geohydraulic conditions throughout the Flood process. The global uniformitarian geologic column is correct only insofar as it correctly represents this sequence.

But a *global* Flood stratigraphic template like the uniformitarian column

would require a discrete sequence of physical processes during the Flood to be both firmly anchored to the succession of time and geographically identical everywhere. That is a caricature of the Flood that defies our knowledge of physical processes, variations due to geography and topography, and the vagaries of the actual rock record. Does Mr. Hunter really believe that geologic processes during Day 62 were identical in Tibet and Tijuana? I do not. Furthermore, his conclusion about the relationship between the Flood sequence and the uniformitarian column cannot possibly be true. Since the uniformitarian column does not acknowledge the Flood or its supposed depositional sequence, logic demands that its ties to diluvial stratigraphy are at best accidental. Their only point of contact is in having the same object of investigation—the rock record. In other words, since it does not “represent the sequence,” it cannot be “correct.”

As an aside, Mr. Hunter's apparent belief that all Flood strata were deposited in the first 40 days (again, assuming the 40-day interpretation) seems quite odd when one considers the potential energy of water in a global highstand expended during a retreat to today's arrangement of continents and oceans. Also, the depositional characteristics of many sedimentary units (e.g., the coastal plains and continental shelves) suggest a large-scale regression, and therefore deposition well after Day 40. The relative youth of most mountain ranges also presents a problem. Finally, while I appreciate Mr. Hunter's dense, though uneven citations of my previous work, I think a closer reading of all the articles in context would help him resolve the apparent inconsistencies that he perceives and I do not.

But let's cut to the chase. Like Mr. Hunter, I put my main point in my title (for the benefit of those not from America, Missouri's nickname is the “Show-Me” state). If Mr. Hunter can

demonstrate *one* empirical globally correlative rock unit, unconformity, or similar horizon that clearly demonstrates temporal synchronicity based on a clearly defined, logical set of criteria consistent with the Biblical narrative of the Flood and readily identified in the field, then I will gladly grant his point and reconsider my approach.

To date he has not done so, instead confusing these hypothetical Flood strata with uniformitarian time units; e.g., “Precambrian.” Since the ICS defines the Precambrian purely on the basis of chronology as determined by radiometric dates (Gradstein et al., 2004a), its relevance to the Flood is undefined. Even if Mr. Hunter could find one surface that met this logical test, he would still face an arduous task, because understanding the rock record will require the globally synchronous compilation of *all* the rock units. I only wish it were that easy. Unfortunately, a proper diluvial understanding of the rock record will require hard work at a local level, and a set of stratigraphic rules that eschew deep time, evolution, radiometric dating, uniformitarianism, prehistory, and all of their interpretive tentacles that permeate secular geological publications. Instead of clinging to an outworn uniformitarian stratigraphy based on time, we need to develop these rules, do the fieldwork, and move forward. It might mean postponing our grand theories for a generation, but it will at least ensure that such theories have a healthy empirical foundation.

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Book Review

Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder

by Richard Louv

Algonquin Books, Chapel Hill, NC, 2008, 390 pages, \$15.00.

This book is a well-written national best seller. Louv highlights research that suggests that direct exposure to nature is essential for a child's health. Testimonies abound from those who know nature and who can inspire a love for nature in others. The book also includes the author's own personal experiences in the outdoors as both a boy and a father. He defines nature as the natural biodiversity found anywhere from the backyard to a mountain forest.

Louv cites alarming health statistics that include the increasing problem of 50% fewer children spending time

outside. Physical activity is occurring in smaller spaces and for less time among these "containerized kids." Youth from ages 5–18 are spending from 30 to 45 hours per week "plugged in" to electronics. Several studies have found that these children are increasingly obese, experience high blood pressure, become more depressed, and take more antidepressants. The World Health Organization has declared this a global problem.

The resulting consequence of this sedentary lifestyle is what Louv calls "nature deficit disorder." Though not a formal medical condition, the symptoms

include decreased senses, increased attention difficulties, increased physical and emotional problems, and feelings of isolation, all due to alienation from nature. He feels that unlike television, natural settings do not steal time but amplify it, highlighting studies suggesting that human mental and physical health improve with increasing exposure to nature. Historically, many cultures have recognized the health benefits for the mentally and physically ill when they experience natural surroundings or create gardens. Today, pet therapy is an accepted health care treatment and

nature-oriented, non-organized, play often decreases symptoms of ADHD in children.

As an ecologist and environmental educator, I connect with the message that Louv has so ably communicated. There is something about walking in the mist of an autumn forest or observing a fawn during a spectacular sunset. Like Louv, I grew up building forts, camping, trapping, hunting, and exploring. He discusses many reasons why the average child does not play like this today, including parental fear, government policies, technology, and a disappearance of natural history courses offered in academia. I see many of these trends in my own students; and when I take them for three days, exchanging the four walls of the classroom for the forest ecosystem, they experience the creation in new, active, and healthy ways. When they share their reflections about being at peace, overcoming fear, and enjoying profound beauty, it makes it all worthwhile. These kinds of experiences have been great discussion starters about the meaning of life, and, as a product of creation evangelism, they have allowed me to share my experiences with the Creator. I believe this is where Louv and I part company, for as we arrive at the worldview trailhead, he seems to prefer taking the evolutionary road and I prefer the narrow path that Christ illuminates (Psalm 119:105).

The book's neo-Darwinian undertones manifest themselves every time the author cites sources that try to explain why nature is so special. For example, E. O. Wilson believes our "biophilia"

is an urge to affiliate with other life-forms because of our evolutionary past (p. 43). Theodore Roszak argues that ecopsychology is a way for people to understand their "repressed ecological unconsciousness that provides our connection to our evolution on earth" (p. 44). Gordon Orians feels that our visual environment is connected to our physical and mental well-being and that humans must understand the importance of "ghosts" because they are the evolutionary remnants of past experiences, hardwired into a species' nervous system (p. 47).

Though the underlying philosophy of the book is bathed in materialistic naturalism, the Biblical worldview is illuminated when Louv encourages families to spend more time with their children in focused, loving, and healthy outdoor activities. He also devotes a full chapter to the spiritual necessity of nature for the young and shares various ecumenical testimonies from those who recognize that a God exists. He even urges environmentalists to consider conservation of the land as having both spiritual and utilitarian components.

Though I believe Louv's message is critical in terms of children's health issues, connecting with nature, and dysfunctional relationships, and experiencing creation is a great starting point, it will not get to the root of the issues. These problems describe the consequences of our independence from the Creator (Genesis 3; Romans 1–8). For many in the environmental movement, nature is viewed as holy and sacred. Having been on both sides of the fence,

I understand the feelings, but they are misplaced. When I came to Christ, I realized that my awe of nature was, in reality, my awe for the Creator of nature. I was not aware of my disconnectedness from Him, without the lamp of His Word. I learned that people were created in His image and that earth was a gift. We were created to love and enjoy one another and to cultivate these relationships while enjoying and taking care of the land. It is my opinion that the church should be at the forefront of promoting activities that give glory to the Creator while experiencing His creation.

Unfortunately, we have let the materialist worldview monopolize environmental stewardship, and that has led to the urban myth that the Christian worldview is antagonistic toward environmental issues. For Christian families who would like to get involved in healthy creation activities with their children, I recommend this book for its insights and starting points toward that end. The back of the book has an extensive bibliography of suggested readings and a thorough index. Also included is a field guide that describes how to join the nature movement and 100 actions we can take to encourage nature activities with children. There are many wonderful ideas that families, homeschools, and churches can do to build memories using the outdoors; they'll just need to be supplemented with a solid Biblical foundation for doing so.

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Lipman, E.A., B. Schuler, O. Bakajin, and W.A. Eaton. 2003. Single-molecule measurement of protein folding kinetics. *Science* 301:1233–1235.

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Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as the outstanding publication in the field. In 1996 the CRSQ was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The Society is a research and publication society, and also engages in various meetings and promotional activities. There is no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund and research center are maintained to assist in such projects. Contributions to the research

fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

Statement of Belief—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. *All members of the Society subscribe to the following statement of belief:*

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.

2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.

3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.

4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.