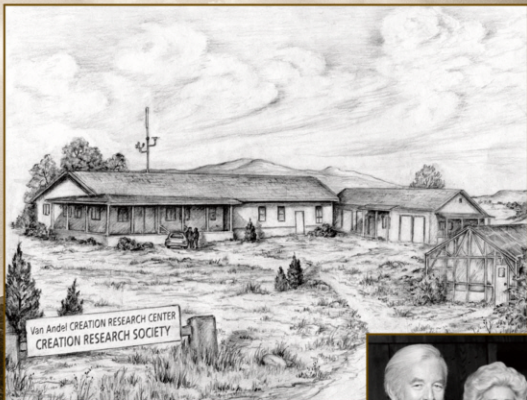


CRSQ

CREATION RESEARCH SOCIETY QUARTERLY



Volume 36

September 1999

Number 2

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Front Cover

The Van Andel Creation Research Center is pictured in a drawing done by Esther Frye. The photograph is of Jay and Betty Van Andel, whose contributions are described in the article on page 68.
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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

Editor's Comments

Lane Lester has assembled a well-balanced Quarterly in terms of the variety of subjects covered in this issue. The article by Henry Morris is a synopsis of a chapter from his new book *Defending the Faith*. He exposes the fuzzy thinking of astronomers, astrophysicists and cosmologists who wish to have a fully-functioning universe without a Creator. His analysis clears the fog, revealing a raw, unbridled atheistic viewpoint.

Wayne Frair discusses embryonic recapitulation which has been discredited for years, but still appears in textbooks as a proof for evolution. Dr. Frair shares some personal experiences concerning the "biogenetic law" as well as noting that Ernst Haeckel falsified his illustrations trying to "prove" recapitulation. The history of the concept is presented and scientific evidence against the bogus idea is given. I am reminded of a recent op-ed column that appeared in the *Wall Street Journal* and later in *Human Events* entitled "The Church of Darwin" by Phillip E. Johnson. In a section entitled Leading Scientists Resort to Distortion, the author claims that the National Academy of Sciences has replaced real science with flim-flam. Obviously distortion and deceit have often been employed in the promotion of molecules-to-man evolutionism.

It is a pleasure to have a well-written discussion about the Van Andel Creation Research Center in Chino Valley, Arizona in the magazine. Steady progress has been made at the Center in collecting equipment and initiating research studies. John Meyer outlines many possibilities for study and explains the ongoing projects. We are encouraged by the addition of many new structures on site thanks to the financial support of the Jay and Betty

Van Andel Foundation. A research team of Meyer, Howe, and I were able to use the Research Center as headquarters last summer while we did a geological reconnaissance of Verde Valley, "just over the mountains from Chino Valley." We introduce the geology of Verde Valley to our readers and encourage others to examine the region from a catastrophist perspective. There are definitely some intriguing geological problems "waiting to be interpreted."

Peter Klevberg writes on the philosophical background of sequence stratigraphy. We have had earlier treatises on sequence stratigraphy, one written by Carl Froede, Jr. and the other by Alan Bartlett, appear in *CRSQ*. This recently-developed tool for interpreting strata offers great promise for catastrophists if it is handled correctly. Carl Froede, Jr. and John Reed take serious issue with other creationists who have employed the global uniformitarian stratigraphic column as time boundaries within a Flood-based framework. Froede and Reed state that the times-based stratigraphy of the column is not compatible with the event-based stratigraphy implied by the Bible. They offer evidence from the Gulf of Mexico against either the Paleozoic/Mesozoic boundary, the Mesozoic/Cenozoic boundary, or the Pliocene/Pleistocene boundary as being a world-wide Flood-post-Flood boundary. I urge you to read and study this article.

Many of the shorter selections will be of interest to you as the topics range from biological to geological. I hope you enjoy and profit from this issue of the Quarterly. Let me hear from you.

Emmett L. Williams

Creation Research Society Sponsors Workshop on Debating

What: Workshop: How To Win Debates Against Evolutionists

When: Thursday, May 18, 2000; 9 a.m. to 12 p.m.; 1 p.m. to 4 p.m.

Where: Motel, Atlanta, Georgia

Speaker: Dr. Duane Gish, former CRS Board Member and Vice President of the Institute for Creation Research, San Diego, California, who has had over 100 debates with evolutionists.

Registration Fee: \$30 by April 30, 2000, \$40 after April 30, 2000.

Eligibility for Workshop: Attendees must be Voting or Sustaining members of the Creation Research Society. An explanation of these categories may be found in the Membership Application at the end of this issue. The Workshop Director may deny registration to any applicant for any reason.

To register, please send the following information along with your check or money order for the above amount to:

Dr. David A. Kaufmann, 3745 N.W. 7th Avenue, Gainesville FL 32607:

- Name
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For further information: contact David A. Kaufmann, 352-378-9112 or email kaufmannd@hotmail.com.

Invited Paper

Far-Out Evolution

Henry M. Morris*

Abstract

Dr. Henry M. Morris, now in his eighties, is still active in defending the Christian faith. This invited article is a synopsis of a chapter, "The Wild Blue Yonder", in his new book, *Defending the Faith*. The author discusses in his usual crystal clear manner, the abject foolishness of atheistic scientists trying to account for the physical universe without the benefit of a creator. He

touches on the so-called Big Bang theory, hydrogen as the father and mother of all things physical and the even more esoteric concepts of the universe generating itself. A sense of realism prevails as one reads the author's arguments contrasted against the mathematical "fog-bound" mazes that brilliant scientists construct to free themselves from God.

Introduction

Evolutionary scientists and philosophers in general cannot be content with organic evolution. They must have total evolution. The very purpose of evolutionism is to explain everything naturalistically, without any supernatural injections into the process by a transcendent agent of any kind. Speculative naturalistic evolutionary processes must explain not only the origin of species, but also the origin of life itself, and even of the entire cosmos.

So we have theories of cosmic evolution, stellar evolution, galactic evolution, planetary evolution, and finally abiogenesis, all as precursors to organic evolution.

It is painfully obvious that no one has ever *observed* this kind of evolution. Those who wish to have stars evolve or galaxies evolve or life evolve from non-life are, in the very nature of the case, limited to mathematical manipulations, computer simulations, or just plain metaphysical speculation, for they can never observe any such thing happening in the real world.

The biggest question of all is that of the origin of the universe. Various theories exist, none of which can be tested, of course, but the theory in current favor is that of the Big Bang, which had to precede everything else if it ever really happened. This widely accepted theory is contrary to the laws of thermodynamics, the law of cause-and-effect, and to other scientific laws, as well as being completely contrary to the revealed Word of God. The Big Bang and all other theories of the origin of the great

blue "yonder" are wild indeed. Yet a goodly number of evangelical churches and para-church organizations are accepting them as true, and then trying to "wrest the scriptures" (II Peter 3:16) to accommodate them in their theology.

Evolving from Nothing to Everything

The notorious Big Bang that supposedly started our evolving cosmos was neither "big" nor a "bang." It is said simply to have evolved suddenly out of the primordial "nothing" to become an infinitesimal particle of space/time. This remarkable particle somehow contained essentially infinite energy and unlimited information which enabled it to expand rapidly into our gigantic universe with all its stars and galaxies and animals and people.

Fred Hoyle, who was deriding the whole idea while promoting his own "Steady State" concept of the universe, originated the name "Big Bang" in 1950.

But how could one really find a suitable name for something as esoteric and intangible as this mathematical toy of the cosmo-physicist? What, exactly, is meant by "quantum fluctuations of empty space," as they are saying by way of explanation? In an article intriguingly titled, "Everything for Nothing," a theoretical physicist at the Institute for Advanced Studies in Austin, Texas, notes that Alexander Vilenkin of Tufts University "proposed that the universe is created by quantum tunneling from literally nothing into the something we call the universe.

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Although highly speculative, these models indicate the physicists find themselves turning again to the void and fluctuations therein for their answers" (Puthoff, 1990, p. 55).

Highly speculative indeed! Astronomer Robert Oldershaw, of Dartmouth College, has some pithy comments about all this. "First, the big bang is treated as an unexplainable event without a cause. Secondly, the big bang could not explain convincingly how matter got organized into lumps (galaxies and clusters of galaxies). And thirdly, it did not predict that for the universe to be held together in the way it is, more than 90 per cent of the universe would have been in the form of some strange unknown dark form of matter" (Oldershaw, 1990, p. 59).

It does seem that science is becoming quite squishy if it has to salvage its theory of cosmic evolution by assuming that 90 per cent of all matter in the universe is invisible and unknown and strange. Oldershaw (1990, p. 59) goes on to say: "Theorists also invented the concepts of inflation and cold dark matter to augment the big bang paradigm and keep it viable, but they too have come into increasing conflict with observations. In the light of all these problems, it is astounding that the big bang hypothesis is the only cosmological model that physicists have taken seriously."

There are other cosmological models (the steady state theory, the plasma theory, etc.), but these have even more problems, which is why most cosmologists cling to the Big Bang. Nevertheless, as one of America's most eminent astronomers has said: "Big bang cosmology has become a bandwagon of thought that reflects faith as much as objective truth.... This situation is particularly worrisome because there are good reasons to think the big bang model is seriously flawed" (Burbridge, 1992, p. 120).

The fact is that astronomers simply do not know *how* the universe evolved, nor do they know how stars evolved, how galaxies evolved, how clusters of galaxies evolved, how anything evolved! They do have mathematical equations that purportedly describe in part how some of these *might* have evolved, but that's a far cry from any experimental proof. It should be remembered that no one has ever actually *observed* the formation of a star or a galaxy or a universe.

In the very nature of things, this type of exercise must always be nothing but sheer speculation. Astronomer Roger Windhorst, of Arizona State University, has said concerning stellar evolution: "Nobody really understands how star formation proceeds; it's really remarkable" (Powell, 1992, p. 30).

With respect to galactic evolution, a recent article is even entitled, "Seven Mysteries of Galaxies," indicating how little is really known about such things. Its authors say: "Now, in the 1990s we can still say that we are only on

the verge of understanding how galaxies are born, how they work, and what roles they play in the universe at large" (Gallagher and Keppel, 1992, p. 39). Furthermore, "the process by which galaxies clump together poses a significant mystery for astronomers" (p. 41).

Lest anyone misunderstand, none of these authorities whom I have quoted are creationists in any sense of the word; they are all devout evolutionists. Nevertheless, they are honest enough to admit they do not yet have any proof.

And the sad thing about all this is that there are a number of evangelical scientists and theologians who are willing to give up the straightforward, factual, sensible Genesis record of the creation of the universe in order to accommodate this badly flawed Big Bang model of evolutionary origins. Some are even trying to convince Christians that the Big Bang is God's work of creation, as announced in Genesis 1:1.

The leading astronomers, cosmologists, and astrophysicists harbor no such notions, of course. A few may be flirting with New Age pantheism, but not Biblical creationism. Note the words of Paul Davies of England, one of the world's most influential astronomers: "When the Big Bang theory became popular in the 1950s, many people used it to support the belief that the universe was created by God at some specific moment in the past.... However, this sort of armchair theology is wide of the mark. The popular idea of a God who sets the universe going like a clockwork toy and then sits back to watch, was ditched by the church in the last century" (Davies, 1993, p. 4).

Sometimes, Christians refer to Davies, or Fred Hoyle, or Robert Jastrow, or some other eminent astronomer as believing in God, but their "god" is not the God of the Bible, and it is dangerous to follow them. As Davies says, it is "possible to imagine the universe coming into being from nothing entirely spontaneously. . . ." He sees "no need for an external creator" (p. 4).

Oh, but there *is* a need! Without a Creator, there is no Savior and no hope for eternity. May God help us to do all we can to tell the world there is a great God who made us for Himself and has even, through Christ, given us eternal life in Him!

There is not a fact of science anywhere to keep us from believing that: "By the word of the LORD were the heavens made, . . . and all the host of them by the breath of His mouth.... For He spake, and it was done; He commanded, and it stood fast" (Psalm 33:6,9).

In the Beginning, Hydrogen

But evolutionists have a more amazing faith. They believe that people have evolved up from the ape (or some-

thing like an ape), that apes and other mammals have evolved from reptiles, that reptiles have evolved from amphibians, amphibians from fish, fish from some unknown phylum of multicelled invertebrates, that invertebrates in all their phyla evolved from some unknown protozoan, that some other unknown protozoan evolved from complex chemicals, and that the complex chemical elements evolved from the simplest chemical element of all, namely, hydrogen.

The operative word in the above sentence is *believe*. There is no evidence for this remarkable chain of events. Apes and reptiles and vertebrates and invertebrates and chemical elements (including hydrogen) still are here in abundance, but none of them are changing into anything else. Neither are there any evolutionary transitions documented in the records of the past (despite olden tales of mermaids and centaurs), not even in the fossils which are purported to represent a billion years of earth history. This remarkable chain of events is in reality nothing but a remarkable statement of faith in the great god Hydrogen, the elemental substance that is supposed to be the father and mother of us all!

Thus, hydrogen, the simplest chemical element, is “a colorless, odorless, tasteless gas which, given ten billion years or so, produces people.” That quaint definition, originally suggested by the late creationist astronomer George Mulfinger, in a cogent summary of the faith one must exercise in order to be an evolutionist.

It was that prince of evolutionary astronomers, Harlow Shapley, longtime head of the Harvard University Observatory, who long ago pontificated that people today should rewrite the first verse of Genesis. According to him, it should be something like: “In the beginning, hydrogen created the heavens and the earth.” Modern evolutionary astronomers and cosmologists have thus ruled out the idea of a personal, omnipotent, omniscient God as Creator of the universe. A more recent scientist has put it this way:

Take some matter, heat while stirring and wait. That is the modern version of Genesis. The “fundamental” forces of gravity, electro-magnetism and the strong and weak nuclear forces are presumed to have done the rest (Scott, 1985, p. 30).

But this same writer, perhaps not suspecting that some creationist might happen to read his evaluation of this statement of faith, proceeds to make the following admission:

But how much of this neat tale is firmly established, and how much remains hopeful speculation? In truth, the mechanism of almost every major step, from chemical precursors up to the first recognizable cells, is the subject of either controversy or complete bewilderment (p. 30).

To a biased creationist such as myself, it seems that “every major step” from one degree of organization to the next higher degree is not only speculative, but also impossible—at least in any realistic sense.

The chief problem (among many) is the Second Law of Thermodynamics, which notes that everything at least *tends to go* toward disorganization—not greater organization.

Cosmologists, however, have devised various curious schemes in their attempts to circumvent the Second Law. That most prolific of all science writers, the late Isaac Asimov, assumes the initial universe was like a cosmic egg (the ancient pagan evolutionists used to think of it in some such way also). He once wrote (1981, p. 24):

The cosmic egg may be structureless (as far as we know), but it apparently represented a very orderly aggregation of matter. Its explosion represented a vast shift in the direction of disorder, and ever since, the amount of disorder in the Universe has been increasing.

Just how the cosmic egg could have no structure and yet have a high degree of order is not clear to me, but of course I am an ignorant and biased creationist. Neither is it clear how this vast shift toward disorder somehow produced all the highly ordered systems in the universe, including human beings.

One of the great successes of evolutionary cosmology is the supposed ability of the Big Bang to explain the origin of hydrogen gas, and this is always offered as one of the three “proofs” of the Big Bang (the others are the background radiation and the supposedly expanding universe—both of which, however, have also been explained by certain rival cosmologies).

But that is all. Thus we are left with hydrogen as the originator of everything else, even though we do not know how it did this. As an article of faith, we are asked simply to intone the evolutionary mantra: “In the beginning, hydrogen.”

Perhaps the saddest aspect of this whole scenario is that so many Christians are being taken in by it. For example, a currently popular evangelical scientist seems to be echoing the atheist Asimov when he defends the Big Bang and the whole system of cosmic and stellar evolution. He says:

What [Dr. Duane] Gish and others fail to recognize is that the hydrogen which forms (by God’s cause and design) one millisecond after the universe began is much more ordered and less entropic than the galaxies, stars, planets, and life-essential elements. The galaxies and stars are broken-up pieces of the primordial gas cloud. The planets and life-essential elements are the burned-up remains, i.e., ashes—of hydrogen gas. Thus, the big bang

manifests, rather than violates, the second law of thermodynamics (Ross, 1994, p. 131).

I am not making this up; that paragraph is really quoted verbatim from a recent book! He believes that the obvious conflict of this concept with the Second Law is resolved simply by the postulated heat energy in the Big Bang.

He would like for us to believe that stars are “broken-up pieces” of the primordial hydrogen and that our own living bodies with their “life-essential elements” are the “burned-up ashes” of hydrogen gas because that’s what the secular astronomers who reject the God of the Bible believe.

Still Farther Out

However, these scientists (astronomers, astrophysicists, and cosmologists) whose professional activities focus on outer space seem to this biased creationist scientist to live in a strange wonderland of relativistic mathematics and quantum theory, which non-initiates find hard to believe. In fact, the evolutionary socialist Jeremy Rifkin (1998, p. 24) says:

Cosmologies are made up of small snippets of physical reality that have been remodeled by society into vast cosmic deceptions.

Cosmologists speak of ten dimensions instead of the familiar three-dimensional space in which “we live, and move, and have our being” (Acts 17:28). We also read about curved space, quantum fluctuations in the infinite vacuum, cosmic inflation, causeless beginnings, and other marvels from their mathematical manipulations.

But if any common purpose can be discerned in all this space research, it seems to be that of explaining the universe without God. A recent survey found that 92.5% of the leading physicists and astronomers (those in the National Academy of Science) reject the idea of a personal God altogether (Larson and Witham, 1998, p. 313).

Still, there are a few theistic astronomers who are telling us creationists that most astronomers accept the Big Bang as the act of cosmic creation recorded in Genesis 1:1. Unfortunately, many leading evangelical Christians today, fearful of being thought anti-intellectual, are buying this notion.

Since the mid-1960s, scientifically informed theists have been ecstatic because of Big Bang cosmology. Theists believe that the best scientific evidence that God exists is the evidence that the universe began to exist in an explosion about 15 billion years ago, an explosion called the Big Bang. Theists argue that ...the cause of the universe is God. This theory hinges on the assumption that it is obviously true that whatever begins to exist has a cause (Smith, 1998, p. 35).

Most scientists have, in the past, assumed the validity of the cause-and-effect principle, that every effect must have an adequate cause. But now evolutionary cosmologists are questioning this most basic of all scientific laws.

An eminent cosmologist at the Fermi Labs “explains”:

One of the consequences of the uncertainty principle is that a region of seemingly empty space is not really empty, but is a seething froth in which every sort of fundamental particle pops in and out of empty space before annihilating with its antiparticle and disappearing—these are the so-called quantum fluctuations.... In a very real sense, quantum fluctuations would be the origin of everything we see in the universe (Kolb, 1998, pp. 42, 43).

To us outsiders, this seems like an unreal never-never land. But evolutionary astrophysicists believe it is “very real,” and that it proves the universe came into existence all by itself

The claim that the beginning of our universe has a cause conflicts with current scientific theory. The scientific theory is called the Wave Function of the universe. It has been developed in the past by Stephen Hawking, Andre Vilenkin, Alex Linde, and many others. Their theory is ... that a universe with our characteristics will come into existence without a cause (Smith, 1998, p. 35).

Probably the most eminent of this group of astrophysicists is Stephen Hawking, whose 1988 book, *A Brief History of Time*, has sold over 2.5 million copies. He has claimed that science is on the verge of developing a “theory of everything” including the origin of the universe.

The problem is that the ultimate theory envisioned by Hawking and others never materialized. Theorists seeking that theory have become lost in a fantasyland of higher-dimensional mathematics that has less and less to do with reality. The theory of everything has become a theory of nothing (Horgan, 1997, p. 39).

But, if the idea of the universe emerging naturalistically as a quantum fluctuation of nothing into something seems bizarre, there is a new theory going around now that seems even more “spaced-out” than that!

We suggest that the Universe emerged from something rather than nothing—and that something was itself... Such a thing is possible because Einstein’s general theory of relativity permits closed time-like curves—loops of time (Chown, 1998, p. 14).

This theory has been advanced by J. Richard Gott III and Li-Xin Li of Princeton University and even suggests that time travel may be possible.

Ruling out the possibility of traveling back in time has turned out to be trickier than many physicists had supposed. Two researchers have now shown that quantum effects do not necessarily pre-

vent the occurrence of loops in time, Li-Xin Li and J. Richard Gott III of Princeton University present their case in the April 6 *Physical Review Letters*... "Hence," the researchers say, "the laws of physics may allow the universe to be its own mother" (Peterson, 1998, p. 231).

Marcus Chown (1998, p. 14) comments that this theory, if true, would mean that

...it's possible that a branch of space-time could loop backwards to form the tree trunk.... Space would have been in a loop of time perpetually recreating itself.

But the observational facts with which to test such notions are very limited. One group of eminent astronomers has disparaged the entire Big Bang theory, with all its strange offshoots:

Cosmology is unique in science in that it is a very large intellectual edifice based on very few facts (Arp et al., 1990, p. 812).

Although these astronomers reject the Big Bang theory, they still believe in cosmic evolution: they are not believers in Biblical creation.

It is sad that so many brilliant space scientists are seeking to comprehend the cosmos without God. If God was not there at the beginning, neither will He be at the end, so they must try also to extrapolate its future without God.

And such a future is dreadfully dark, for the stars must eventually burn out, according to these theories, and even matter itself will disappear.

Therefore, nothing made of ordinary matter—including atoms—will last (Adams and Laughlin, 1998, p. 37).

In the beginning there may have been light, but in the end, it seems there will be nothing but darkness (Matthews, 1998, p. 30).

Not so, however, for those who have trusted the Lord Jesus Christ as their Creator and Redeemer. This created universe will continue forever. "And they that be wise shall shine as the brightness of the firmament; and they that turn many to righteousness as the stars for ever and ever" (Daniel 12:3).

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Everything in life has to do with your world view. You go to the zoo either to rejoice in the Creator or to find some alternative to Him. Your help for the needy is wrapped either in the arrogance that you are godlike and can figure out every detail, or in the modesty and humility that admits even your kindness might be wrong. Your starting point, and your discoveries along the way, determine how you build and manage both your zoos and your governments—if, indeed, these days you can tell the difference.

Joel Belz in *World* (5/20/95)

Assessing Creationist Stratigraphy with Evidence from the Gulf of Mexico

Carl R. Froede Jr. and John K. Reed*

Abstract

We believe that the thirty-eight years of creationist stratigraphy that have followed the publication of *The Genesis Flood* have demonstrated a fundamental incompatibility between the global uniformitarian stratigraphic column and biblical history (i.e., Flood-based stratigraphy). Whitcomb and Morris advocated a refashioning of stratigraphy starting with actual data. Unfortunately, their advice was not heeded and instead creationists have attempted to leverage limited resources and accommodate the global uniformitarian column in a biblical framework. None of these efforts have succeeded in unifying creationists. We evaluate several of these strategies by comparison to the Northern Gulf of Mex-

ico Basin in an effort to consider an alternate conclusion: The absence of profit in continuing to follow the route of uniformitarian-based stratigraphy. We believe that future profitable efforts in creationist stratigraphy will require a different conceptual framework. Unfortunately, this conclusion forces creationists to pursue stratigraphy at a fundamental level; the reintegration of field data absent the “plug-and play” uniformitarian column. There is no denying that this redirection will require significant effort, and will not generate a global synthesis in a short time. But it is just as obvious to us that additional time and resources spent on any attempted synthesis with the uniformitarian column will be wasted.

Introduction: The State of Creationist Stratigraphy

Since the early nineteenth century historical geology has developed along lines defined by the presuppositions of naturalism and uniformitarianism. The revival of an alternative scheme, distinguished by the priority of supernatural revelation and a derivative catastrophism, was coherently launched by the publication of *The Genesis Flood* in 1961. The field of creationist geology has cohered and grown since then. The immensity of the task of constructing a viable Bible-based alternative to accepted geologic history has been little appreciated by many, and has proven even more difficult by the lack of workers willing to undertake such a job. And yet, over the past 38 years, some progress has been made by the dedicated efforts of the numerically-limited creationist community.

In keeping with making the most efficient use of limited resources, creationists have generally attempted to find as much common ground as possible between the demands of Biblical historical teaching and uniformi-

tarian geology. The obvious advantage of this approach was the potential for a relatively quick and easy synthesis of Biblical history with the objective rock record. Many ideas have been proposed since this time in an attempt to bridge Flood geology to modern geology. Since modern historical geology is defined and summarized by the global uniformitarian stratigraphic column (GUC), the logical starting point has been the reinterpretation of the GUC within a catastrophic and short-term framework. The main focus of this effort has been the merging of the first eleven chapters of Genesis into the GUC (Figure 1). From a conceptual standpoint this approach appears reasonable. However, the experience of the past several decades has shown that integration is difficult, perhaps because the extrascientific presuppositions of naturalism and uniformitarianism are pervasively imbedded in the GUC. Thus the task of defining a consistent approach to creationist stratigraphy is more complex than was initially thought. Early warnings, sounded by Woodmorappe (1981), have not been widely heeded.

In the time-weighted framework of the GUC, identifying time periods in the rock record assumes great importance. Classical nineteenth century stratigraphy illustrated this concept with the great debates focusing on the

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Era	Period	Epoch
Cenozoic	Qt	Holocene
		Pleistocene
	Tertiary	Pliocene
		Miocene
		Oligocene
		Eocene
		Paleocene
Mesozoic	Cretaceous	
	Jurassic	
	Triassic	
Paleozoic	Permian	
	Pennsylvanian	
	Mississippian	
	Devonian	
	Silurian	
	Ordovician	
	Cambrian	
	Vendian	
Proterozoic		
Archaean		

Figure 1. The global uniformitarian column (GUC) used to support the age of the earth and the evolution of life.

history (Austin, 1994; Austin and Wise, 1994; Baumgardner, 1990; Snelling, Scheven, Garner, Ernst, Austin, Garton, Scheven, Wise, and Tyler, 1996). Many creationists have attempted to use a modified version of the GUC (i.e., shortening the timeframe of the basic system) to define both the pre-Flood/Flood and the Flood/post-Flood boundaries (Austin, 1994; Austin and Wise, 1994; Garton, 1996; Garner, 1996a, 1996b; Holt, 1996; Robinson, 1996; Snelling, 1996; Tyler, 1997).

All of these attempts have shared one important assumption—that the time-based stratigraphy of the GUC is compatible with the event-based stratigraphy strongly implied by the Bible. Because the time available for geologic work is so compressed by the Biblical record, any effort to understand the relationships between the rocks and time may be actually misdirecting workers away from more profitable investigations of geologic history. A major shortcoming for creationists attempting to utilize the conceptual framework of time-based stratigraphy occurs with the apparent disposition to add multiple high-energy events to the single global Flood event of the

placement of the boundaries within the time/rock record. Today, many secular geologists are using event and environmental parameters to further refine their interpretation of earth history (Berggren and Van Couvering, 1984; Brett and Baird, 1997; Donovan, 1989; Erwin, 1993; Hallam, 1992; Wilgus, Hastings, Kendall, Posamentier, Ross and Van Wagoner, 1988). However, as naturalists, they continue to operate within the framework of the GUC and its formal time/rock divisions. Unfortunately, many catastrophists, though advocates of a young Earth, have adopted the uniformitarian preoccupation with time *per se*.

They have defined their syntheses of Flood geology and the GUC by the correlation of time boundaries in the GUC to those in Biblical history

Bible to explain the rock record. In itself this does not necessarily violate the Bible, because Scripture does not address many things we find in geology (e.g., meteor impacts and their resulting craters, volcanoes, tsunamis, glaciers, sea-level changes, etc.). However the desire to accommodate the GUC has created difficulty in assigning all of the high-energy events to the Flood.

A study of the nineteenth century debate between uniformitarian geology and Christianity reveals a clear trend of compromise on the part of Christians that led to the abdication of Biblical authority in earth history. We are concerned that early steps along this same path appear to be attracting Christians in the twentieth century, too. This path follows the steps of starting with the biblical position of one universal Flood, and then gradually drifting toward uniformitarianism by attempting to reconcile the Flood and the GUC. Inference from the Scriptural account, absent consideration of the GUC would attribute the bulk of the rock record to the Genesis Flood. However, Christians that incorrectly assign an epistemological equity between natural history and the Bible begin to lean toward the dynamic accumulation of “facts” supporting the GUC. As the sophisticated complexity of the GUC became more attractive, other, less-catastrophic events were added to the Genesis Flood to harmonize “science” and Scripture. Finally, in total retreat, Christians developed the consensus that a universal Flood was no longer required, that it was not even wanted, and that it unacceptably interfered with Lyellian stratigraphy. Some Christians tried to preserve a degree of Scriptural integrity by relegating the Flood to the uppermost sections of the GUC, thus allowing an uneasy accommodation of the uniformitarian column, while keeping their belief in the Flood intact. However, this side path merely led to the conclusion that as the number of events increase, the energy requirements of each one diminish, to the logical end point where no significant energy event was required. At that point, the great biblical judgment of the Flood became an overflowing of the Euphrates River Valley (Sauer, 1996), the infilling of either the Mediterranean Sea (Morton, 1995) or Black Sea (McInnis, 1998; Ryan and Pitman, 1998), or even a tsunami associated with the eruption of Santorini (Myles, 1985). Fortunately, all are catastrophic events acceptable to uniformitarians (even though the uniformitarians are inconsistent at this point [Reed, 1998]). The essence of this misguided thought process was captured by Fields (1976, p. 184) where he lamented:

There seems to be an assumption that if Christianity is to realize its full potential of impact on the scientific community, the message that no conflicts exist between the Bible and uniformitarian science must be heralded.

We fear that the first steps of this path may be taken anew in the twentieth century by seeking to harmonize the Bible with the GUC. It is our opinion that a viable creationist stratigraphy requires adherence to Scripture and eschews modification of a biblical worldview to accommodate uniformitarianism.

Introduction: The Current Divide Within Creationist Stratigraphy

We assert that the Bible teaches that the global Flood and its associated events produced the greatest levels of geologic energy (i.e., erosion, sediment transport, deposition, new sediment production, volcanism, tectonism, turbidites, extra-terrestrial impacts, sea-level changes, etc.) ever experienced by the planet, and resulted in the formation of most of the igneous, metamorphic, and sedimentary rocks found in the crust during and shortly after the Flood (Reed, Froede, and Bennett, 1996). These same crustal features have been reinterpreted by evolutionists as the GUC. A close examination of the naturalist worldview reveals that the basis for doing so is derived from non-scientific considerations, although presented as science. The evidence for the GUC is considered powerful by many creationists, and some continue to attempt reconciliation between the GUC and the biblical record. We believe that this approach causes confusion, and remains undefined and inconsistent in its use within creation geology.

The Biblical approach to understanding Earth's short history requires that the physical evidence (i.e., the rock record) fit within the context and constraints of Scripture. There are basically two different ways of looking at dividing the time/rock record stratigraphically: 1) Those who believe that an accommodation with the GUC is possible, and 2) those who reject the GUC for an alternate biblical framework. We fall into the latter category, which must be understood because it influences the manner in which we attempt to resolve Flood-based geology (Figure 2).

Although the present creationist debate has apparently been drawn along the lines of selecting a specific uniformitarian column "golden spike" as a Flood boundary, it has become obvious as work progresses that the real issue is whether or not the GUC has any use within creationist stratigraphy. This issue has been addressed in an indirect manner by the failure of all creationists desiring application of the GUC to reach agreement on the placement of a single Flood-related boundary. It may be true that resolution of the boundaries dispute remains to be resolved in the context of the GUC; however, it is also possible that the inability to reach such a resolution is itself indicative that no resolution can be found within the current context of the debate.

We propose to test the compatibility of any harmonization of the Bible with the GUC by reference to the Northern Gulf of Mexico Basin (NGOMB) sedimentary wedge. This article will compare several proposals made by young-earth creationists for the location of the Flood/post-Flood boundary (based on applying the GUC) to the NGOMB stratigraphic column, widely considered relatively complete in the Mesozoic and Cenozoic eras. We will show the insurmountable physical problems of each proposal. If a consistent Flood-related boundary cannot be identified in the GUC, then we believe that the argument to divorce creationist stratigraphy from the GUC and to develop an alternative synthesis of geologic data with Biblical history should be considered.

There is an additional benefit to this examination. We fear an epistemological imbalance between Scripture and uniformitarian geology. Contrary to modern positivism, we assert that biblical revelation is primary and superior to any naturalist interpretation of history. Thus, there can be no balanced comparison between the "truth of science" and the truth of Scripture in an attempt to reconcile the two. Rather, any interpretation of history that rejects biblical revelation should in turn be rejected and its interpretive results should be carefully examined for all hidden presuppositions implanted by the naturalist framework. A sound young-earth Flood geology should not fear careful examination of proposed historical models, since confidence in the truth of Scripture cannot depend in any way on natural history.

Timeframe	Division
Present Age	Upper
	Middle
	Lower
Ice Age	Upper
	Middle
	Lower
Flood Event	Upper
	Middle
	Lower
Antediluvian	
Creation Week	Day Seven
	Day Six
	Day Five
	Day Four
	Day Three
	Day Two
	Day One

Figure 2. A Young-Earth Creationist timescale based on Scripture and post-Flood sediments found across the Earth. No global synthesis of this approach has yet been established, because the Flood had different effects on various portions of the earth and the correlation of these event-driven sediments and strata has yet to be determined.

Testing GUC-Derived Boundaries in the Gulf of Mexico Basin

The NGOMB provides an excellent setting for testing various Flood/post-Flood boundaries because of its robust sedimentary representation of the Mesozoic/Cenozoic erathems. Three different proposals are tested using the NGOMB sedimentary sequence. Specifically, we will examine proposals for placing the Flood/post-Flood boundary at: 1) the boundary between the Paleozoic and Mesozoic, 2) the boundary between the Mesozoic and Cenozoic and, 3) the boundary somewhere in the Pliocene/Pleistocene. Estimated volumes of Mesozoic, Cenozoic, and Quaternary sediments are presented for comparison in Table I, along with the present day volume of the modern Mississippi River delta plain. Although these numbers are crude estimates, they provide additional information to support the diagrams presented in figures below. Any biblical model of Earth history must be able to explain field evidence (Reed and Froede, 1997). We believe that a careful examination of various young-earth Flood stratigraphic models will disqualify any of them that are built on any attempt to harmonize the Scriptures with the GUC.

Paleozoic/Mesozoic Boundary

Recent support for a Paleozoic/Mesozoic - Flood/post-Flood boundary was presented in a special symposium within the *Creation Ex Nihilo Technical Journal* (see Snelling 1996). Several articles proposed and defended the Paleozoic/Mesozoic boundary as marking the termination of the Genesis Flood. Numerous arguments were advanced to harmonize the GUC with the global Flood of Genesis. Woodmorappe (1996) and Froede (1997) took issue with this approach because of its perceived inherent support of evolution, and because it required multiple large-scale (i.e., global) extra-biblical catastrophes following the Flood to accommodate the uniformitarian column within a young-earth time frame.

How does this proposal explain the sedimentary section in the NGOMB? The Paleozoic/Mesozoic boundary within the NGOMB is presented in Figure 3. If the model proposing that the Paleozoic/Mesozoic boundary represents the end of the Genesis Flood, it must explain the following:

- The tremendous volume of sediment deposited after the Flood (the cross-section reflects a sediment wedge ranging up to 10 miles thick and extending some 720 miles out into the NGOMB along much of its lateral extent),
- The dramatic variations in mean sea level that appear to have ranged from the fall line during the Mesozoic to

well offshore in the present Gulf of Mexico during recent times.

- The difficulty in justifying the high energy levels during post-Flood time required for this volume of sediment to be eroded and deposited in the NGOMB, and
- The difficulty in describing an adequate source for the sediments apart from Flood conditions.

We do not believe that any reasonable explanation can be offered for these conditions in the NGOMB. Thus, either the boundary is incorrectly placed in this proposal relative to the GUC, or the difference between plausibly setting the boundary at the base of the Mesozoic in selected locales but not in the NGOMB suggests that the GUC cannot be harmonized with biblical history. Similar examples of immense volumes of post-Paleozoic sediment can be found in North Africa, the North Sea, Indonesia, etc. In-depth discussion of these areas is beyond the scope of this paper, but offer avenues of further research for any interested creationist. Although examples could be multiplied to demonstrate the difficulties of depositing the combined global Mesozoic and Cenozoic erathems in a youthful, post-Flood world, only one is needed to demonstrate the failure of the proposed global model. We find this proposed Flood/post-Flood boundary inadequate in explaining the Mesozoic and Cenozoic sediment sequences in the NGOMB, and unacceptable within the framework of the young-earth Flood model.

Table I. Rough estimates of sediment volumes for the Mesozoic Era, the Cenozoic Era, the Quaternary Period, and the modern Mississippi River delta plain. Estimates for the first three were derived from cross sections shown in Figure 3 of Jackson and Galloway (1984). The estimate of the modern Mississippi River delta plain was derived from an areal extent of 13,300 square miles from Figure 2 of Kolb and Dornbusch (1975) and a maximum thickness of 1000 feet from Gould (1970). The maximum thickness was used to partially offset deltaic sediments transported offshore by distal sediment distribution processes. These estimates, however crude, reinforce the intuitive intent of the figures regarding the rate of sedimentation needed in the post-Flood era to accommodate the various boundary proposals.

Reference Unit	Estimated volume of sediment (km ³)
Mesozoic Era	24,000,000
Cenozoic Era	6,000,000
Quaternary Period	1,500,000
Modern Mississippi delta plain (6000 years estimated)	100,000

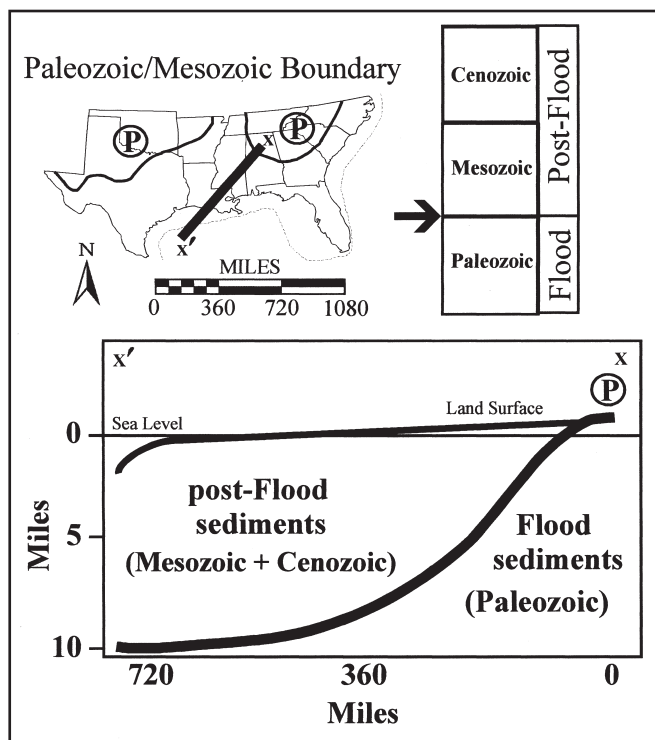


Figure 3. A map showing the United States Southeastern Gulf Coast. The black line across the northern section of the map represents the surface boundary separating the Paleozoic deposits from the overlying younger deposits (Mesozoic and Cenozoic). A cross-sectional line (shown as X to X') extends from the Paleozoic outcrops in northern Alabama to just beyond the shelf edge off of Louisiana, in the Gulf of Mexico. This cross-section shows the extent of the sedimentary sequence required to be deposited under post-Flood conditions if the Paleozoic/Mesozoic boundary represents the Flood/post-Flood boundary.

Mesozoic/Cenozoic Boundary

Other creationists support a Flood/post-Flood boundary at the Mesozoic/Cenozoic boundary. Dr. Kurt Wise, a young-earth creationist, has stated that “virtually all creation geologists accept the entire Cenozoic as post-Flood” (BSN, 1995, p. 18). Dr. Wise’s position appears to establish the Flood/post-Flood boundary at the Mesozoic/Cenozoic contact. This boundary is also proposed in Dr. Steve Austin’s book on the Grand Canyon (1994, p. 58, Figure 4.1). An evaluation similar to that performed above forces us to the conclusion that we do not understand how this proposed boundary can explain the sedimentary sequence found in the NGOMB. We welcome any forthcoming explanation from either Dr. Wise or Dr. Austin.

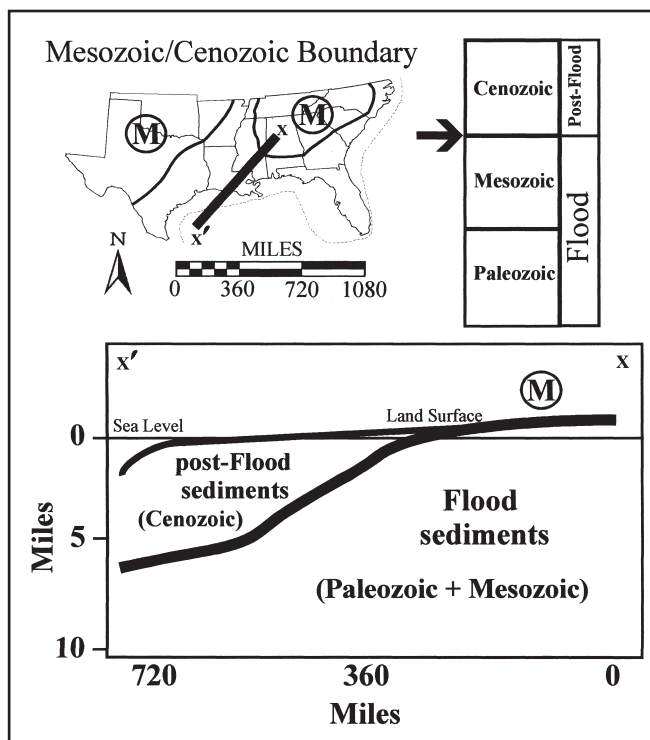


Figure 4. The United States Southeastern Gulf Coast with the black line representing the surface boundary separating the Mesozoic (and underlying Paleozoic) strata from the overlying Cenozoic sediments. The cross-section (shown as X to X') which begins in central Alabama and extends just beyond the continental shelf edge off Louisiana. This cross-section shows the extent of the sedimentary sequence required to be deposited under post-Flood conditions if the Mesozoic/Cenozoic boundary represents the Flood/post-Flood boundary.

How does this proposal explain the sedimentary section in the NGOMB? The Mesozoic/Cenozoic boundary for the NGOMB is presented in Figure 4. This proposal also requires tremendous volumes of sediment to have been eroded and deposited into the NGOMB following the Flood. If the model proposing that the Paleozoic/Mesozoic boundary represents the end of the Genesis Flood, it must explain the following:

- The tremendous volume of sediment deposited after the Flood (the cross-section reflects a sediment wedge ranging up to 6 miles thick and extending some 360 miles out into the NGOMB along much of its lateral extent),
- The dramatic variations in mean sea level that appear to have ranged from near the fall line during the Cenozoic to well offshore in the present Gulf of Mexico during recent times.

- The difficulty in justifying the high energy levels during post-Flood time required for this volume of sediment to be eroded and deposited in the NGOMB, and
- The difficulty in describing an adequate source for the sediments apart from Flood conditions.

Like the Paleozoic/Mesozoic boundary proposal, we do not believe that any reasonable explanation can be offered for these conditions in the NGOMB. Again, either the boundary is incorrectly placed in this proposal relative to the GUC, or the difference between plausibly setting the boundary at the base of the Cenozoic in selected locales but not in the NGOMB suggests that the GUC cannot be harmonized with biblical history. We find this proposed Flood/post-Flood boundary inadequate in explaining the Cenozoic sedimentary sequence in the NGOMB, and therefore unacceptable as a viable young-earth Flood model.

Pliocene/Pleistocene Boundary

Many young-earth geoscientists support moving the Flood/post-Flood boundary well up the global uniformitarian stratigraphic column toward the Pliocene/Pleistocene boundary. Of the choices that would harmonize the GUC and the biblical record, this approach appears to be the most reasonable when looking at the changing geologic-energy levels implied by the strata. However, if some parameter other than time (such as changing energy levels) is the basis for judging the goodness of fit between a Flood model and the GUC, then why not abandon the time-centered methodology of the GUC. For many young-earth geoscientists the location of the boundary at the Pliocene/Pleistocene boundary is believed to satisfy the transition from the Flood into the Ice Age. However, problems with this approach occur when moving offshore in a clastic setting and/or with biogenic carbonates of this “age” in areas such as the Bahamas, Florida Keys (see Froede, 1999), and the Great Barrier Reef.

How does this proposal explain the sedimentary section in the NGOMB? The Pliocene/Pleistocene boundary of the NGOMB is presented in Figure 5. This proposed Flood/post-Flood division is placed near the “top” of the NGOMB uniformitarian stratigraphic column. This approach correctly suggests that most stratigraphic deposition occurred during the high-energy period of the Flood. The post-Flood continental and nearshore deposits are relatively minor and reflect lower energy levels. However, in offshore settings the Pleistocene deposits can be many thousands of feet thick (both clastics and carbonates). What processes eroded and then deposited the thick blanket of Pleistocene clastic deposits far offshore, and could this have formed within the short time

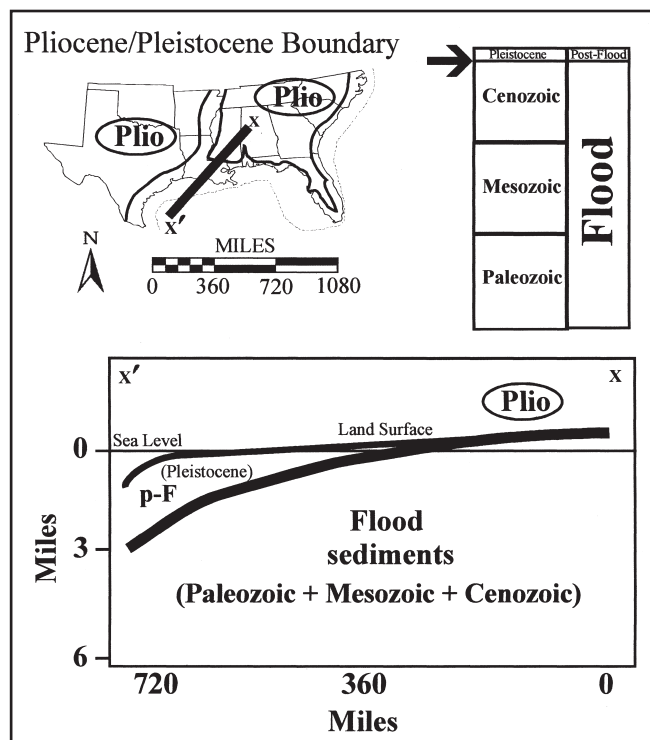


Figure 5. The United States Southeastern Gulf Coast with the black line on the surface representing the contact between Pliocene (and older) deposits and the overlying Pleistocene (and Holocene) strata. The more restricted area of post-Flood sedimentation implied by this boundary is much closer to predicted decreasing geologic-energy levels. However, this boundary still requires large volumes of offshore clastic or biogenic carbonate sediments to have been deposited or formed in very short time following the Flood.

constraints of the post-Flood world? Likewise, how do creationists account for the hundreds of feet of Pleistocene carbonate strata in a post-Flood setting? We believe that the volume and location of these offshore Pleistocene deposits present similar, though less dramatic, problems for this boundary proposal relative to the preceding two.

Another important issue related to the proposed Pliocene/Pleistocene boundary is the method whereby these offshore deposits are stratigraphically defined. It is typically done by the transition of microfossil assemblages. The old problem of dating sediments by the evolution of biota once again is an issue here. Presently, young-earth creationists have not devised an environmental means of using microfossils to explain sedimentary units within the Biblical framework. Hence, we recommend that the basis for harmonizing the GUC boundary with the Flood boundary be rejected until creationists can show that there is a stratigraphically significant, but non-evolutionary explanation for the microfossil assemblages.

Implications of the Gulf of Mexico Record

The publication of *The Genesis Flood* in 1961 will be remembered as a revolutionary event in creationist hydrology and geology. The dominant naturalist-uniformitarian paradigm was challenged on the most fundamental levels, and even today the implications of that challenge have not yet been fully realized. Since 1961, even geologists who continue to claim the naturalist-uniformitarian worldview have been affected by creationist challenges. The movement away from the strict nineteenth century uniformitarianism of Lyell can be partly attributed to Whitcomb and Morris' work.

Advances in creationist stratigraphy have been frustratingly slow in the last four decades. There has been no direct impact in the secular geologic community. This is because the naturalists have been quick to realize the fundamental nature of the challenge of creationism not just to their historical scenarios, but to their very worldview. With few workers, creationist geology has been both slow to develop alternate interpretations and confusing to those workers who have insisted on the priority of following the GUC in their work. Some researchers have discovered that the gulf between the GUC and the Bible is wider than first hoped. Some have not been able to shift their assumptions toward the Scriptures, and have become advocates of a theistic version of uniformitarianism that does no justice to Genesis. Others have not vigorously pursued their models to logical conclusions, and thus work with inconsistencies in their framework.

The stratigraphy comprising the NGOMB provides a setting where we can compare the GUC to several creationist Flood/post-Flood boundary proposals. This area provides an excellent test of the various theories because it represents a relatively complete uniformitarian rock section spanning the Mesozoic and Cenozoic. We consider this not only a test of the boundary proposals *per se*, but also of the entire strategic approach of reconciling the GUC to the Bible. As expected, each of the creationist models tied to the GUC fail to explain the observed stratigraphic sequence in a logical and defensible manner. This is because the uniformitarian rock column emphasis is on evolutionary biology and "time" and not on the tremendous geologic forces experienced during and following the global Flood.

Assessment of Previous Work

We are not condemning the work of the last forty years. The road to progress in knowledge does not always proceed in a straight path. Glover (1984) called Scholasticism the most fruitful failure in the history of ideas

because the process of critically comparing the Aristotelian and biblical worldviews was a necessary step in modern western thought. If the comparison of current creationist proposals that seek reconciliation between Scripture and the GUC to the NGOMB stratigraphic section is an adequate test, then the failure of creationists to reconcile the GUC and the young-earth Flood-dominated geologic history of the planet should be acknowledged, recognized as progress, and another strategy pursued. Ironically, Whitcomb and Morris (1961) described another strategy. They realized that their work would require a vast reassessment of geology; not on a shallow level of readjusting interpretation, but on the more fundamental level of replacing governing assumptions and following the implications of the new structure to a logical conclusion. They advocated the reinterpretation of geologic data within a biblical framework, rather than the reinterpretation of the uniformitarian framework within the biblical framework. Human beings naturally search for the most efficient manner to achieve goals. However, the goal of refashioning geology in a biblical worldview cannot be done in a cursory fashion. It will require exhaustive research to reinterpret that data, not simply to reinterpret the interpretations.

An Alternate Strategy

Several authors have pointed out the incompatibility of pursuing a reconciliation of the GUC and the Bible (Froede, 1995, 1998; Reed, 1996a, 1996b, 1998; Reed and Froede, 1997; Walker, 1994; Woodmorappe, 1981 - to cite the most recent). A new alternative rejects the GUC because it rejects the use of time as the primary parameter in interpreting geologic history. The emphasis in this method is on events and their associated energy requirements (Froede, 1998; Reed, Froede, and Bennett, 1996). As with any proposal seeking to match the stratigraphic record with the Bible, it must also be able to successfully explain the physical rock record in order for it to be used in young-earth Flood studies. Regardless of whether or not this particular energy approach is successful, we believe that only in a move away from the GUC will we be capable of defining creationist geology.

Our approach to understanding Biblical geologic history is presented in Figure 6. It examines the changing geologic-energy levels as they affected Antediluvian sediments, flora, and fauna (and new materials added during and following the global Flood). It does not use traditional evolution-based methods (i.e., biostratigraphy) to define time. It instead infers the energy required for materials to be eroded, transported, and deposited, and compares those relative levels to Scripture. Note that our energy-based stratigraphic col-

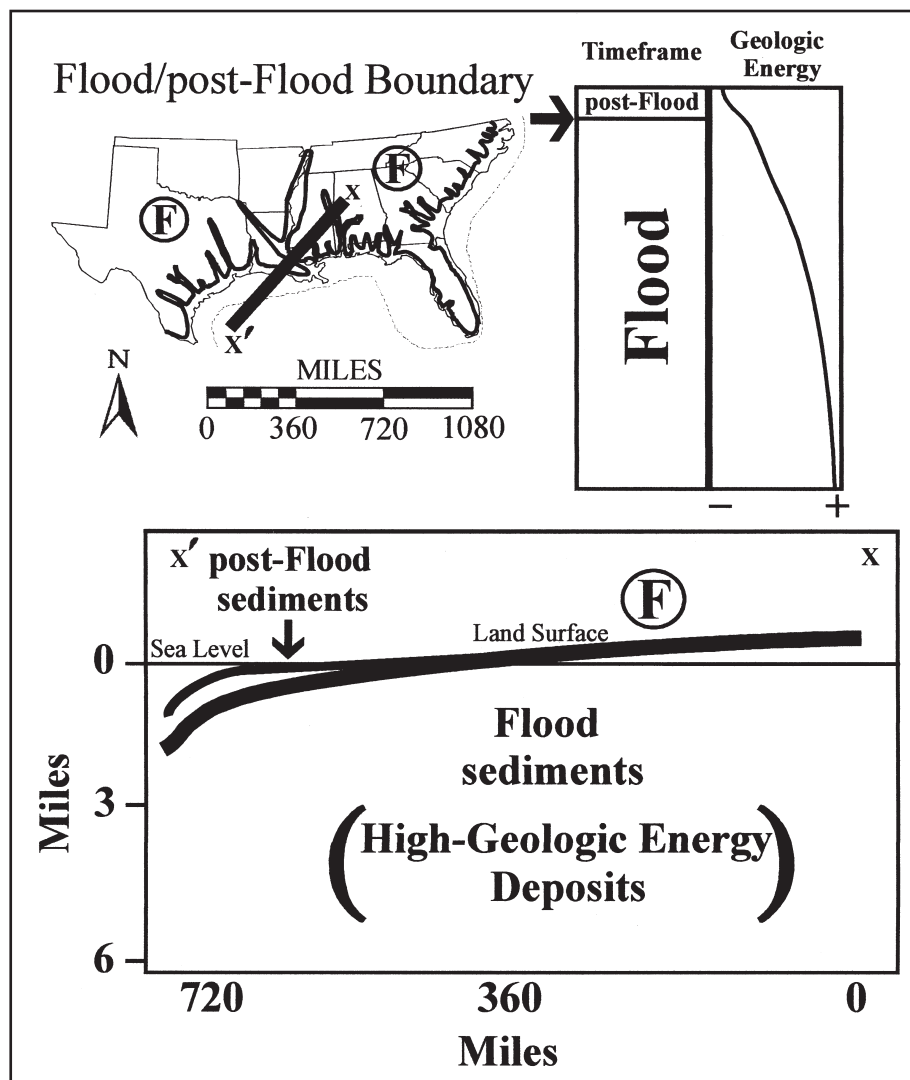


Figure 6 - The United States Southeastern Gulf Coast with our proposed Flood/post-Flood surface boundary (i.e., black line) running parallel to the present shoreline and moving landward in some instances following the major river courses upstream. Floodwater withdrawal and wet weather conditions associated with the single ice age first carved out and later filled these river channels with post-Flood sediments. Biogenic carbonate regions likely developed during the Flood and continued until Floodwater retreated and sea-level dropped enough to prohibit further growth (see Froede, 1999). Rapid sea-level changes associated with the waxing and waning of the continental glaciers during the Ice Age deposited clastic sediments (both freshwater and marine) out on the continental shelf.

umn is completely independent of the GUC. The Flood/post-Flood boundary is defined environmentally by the subsidence of high-energy Flood events and the transition into more “uniformitarian” depositional patterns, rather than by correlation to a uniformitarian boundary “golden spike.” Although high-energy events occurring after the Flood may blur the boundary, these Ice Age and Present Age Timeframe deposits could be diagnosed by being more local in their aerial extent. We propose that this manner of interpreting the strati-

graphic record can be rewarding in revealing the tremendous power of the Flood. At a minimum, it meets the necessary criterion of divorcing creationist stratigraphy from the GUC, and shifts the interpretation of Earth’s history back to a Biblical approach and away from naturalism.

Conclusion

Concepts, models, and interpretive theories depend on the physical supporting data. The GUC is an illustration of the reliance on non-scientific presuppositions that may or may not be readily apparent to the user. Scientists are trained to develop models using available physical data. However, difficulty occurs when attempting to evaluate the non-scientific components of these models. Examining the GUC “model” against the Bible’s presentation of earth history demonstrates the complete failure in unifying these two worldviews. Over the past four decades various strategies for using the GUC as a framework for biblical history have been proposed by creationists. We have examined three of these proposals against the strata found within the NGOMB. All of these approaches fail either because of the time/energy demands of the sedimentary record relative to a short post-Flood history. While the Pliocene/Pleistocene boundary comes the closest to what we expect with ever-decreasing geologic-energy levels, it too falls short when examining offshore clastic and carbonate accumulations. There appears to be too great a volume of Pleistocene sediments offshore requiring too much energy for too short a period of time to define all of these strata as post-Flood deposits. Many of the Pleistocene sediments were deposited under high-energy conditions that could only have occurred with the closing stages of the Flood. Hence, we propose that creationists examine the various sediments with some understanding about the energy necessary to precipitate or grow them (as in the case of carbonates), or erode, transport, and deposit them (for clastics).

Any ongoing effort to join the GUC to creationist geology must by definition explain how it can be harmonized globally. If a given model fails at the NGOMB, it has failed. If these efforts fail (and we believe they have) the model(s) must be abandoned or modified! Failure to discard bad ideas will only lead to greater confusion in creation science. Both creationist and secular scientists require internal corrections to their models and ideas. We believe a new approach to creationist stratigraphy is required. We hope that other creationists will focus their efforts developing concepts and models that eschew the GUC. By changing this conceptual framework, we can open new doors to understanding geology and the Bible, we can focus our studies on understanding the Flood's impact on the Antediluvian world, and we can jettison the evolutionary baggage that permeates the GUC. We hope this will lead to greater productivity as we base our investigations more consciously on Scripture instead of worrying about how to make the Bible work within a system based on evolution.

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Book Review

C.S. Lewis & Francis Schaefer:

Lessons for a New Century from the Most Influential Apologists of Our Time

by Scott R. Burson and Jerry L. Walls

InterVarsity Books, Downers Grove, IL. 1998, 308 pages, \$14.99

Reviewed by Donald Ensign

This is an elegantly and lucidly written book by the director of communications (Burson) and professor of philosophy of religion (Walls) at Asbury Theological Seminary. Undoubtedly the perspectives set forth in this volume are influenced by the theological distinctives (Wesleyan holiness) of the authors' academic home. This volume is an exploration of the significant apologetic contributions of the 20th century's two foremost Protestant apologists, C.S. Lewis and Francis Schaeffer. Not only is there an exploration of the apologetic writings of Lewis and Schaeffer, but also a comparison of their views on specific areas of theological import. After an introduction stressing the importance of Lewis and Schaeffer to our emerging Post-modernist era comes brief biographical sketches of both apologists. Following this are a series of extended essays tackling such weighty matters as the “Nature of Salvation,” “God's Sovereignty and Human Significance,” “Mystery,” “Biblical Authority and Divine

Inspiration” and various aspects of Apologetics. Burson and Walls perform a commendable service in sifting out the positions of Lewis and Schaeffer on these issues, comparing and contrasting the strengths and weaknesses of each thinker's apologetics. This review will leave the evaluation of most of these theological issues (which there are many) to others. However, Burson and Walls clearly seem to favor Lewis' overall positions, over Schaeffer's, despite the Briton's lack of formal theological training.

For the Biblical creationist the most important part of this book is chapter 8—“Defensive Apologetics.” In this chapter Burson and Walls describe two theodicies (“the attempt to demonstrate the justice of God in the face of evil” p. 201). The first is the Augustinian theodicy which is the dominant position of both the Roman Catholic and Protestant churches. This view is characterized thus:

...Adam and Eve were created morally and spiritually perfect in a world that was also fully perfect...

the Fall was an act of profound rebellion that deserved severe punishment. So God cursed the world. The Fall... was a cataclysmic event that introduced suffering and evil into a previously perfect world. All evil... is the direct or indirect result of the misuse of freedom (p. 202).

The second theodicy has to do with “soul-making” and is labeled the Irenaean theodicy after the early church father, Irenaeus, and has been popularized in recent decades by Cambridge philosopher John Hick. This theodicy states that the world was created by God as a place of soul-making or character development. Burson and Walls note that, “Human beings, as originally created, were not fully perfect but rather immature and in need of further growth... In this view, the world had a certain amount of adversity and suffering built in as part of God’s original plan. It is only by facing and overcoming such difficulties that human potential can be fulfilled.” (p. 202)

Francis Schaeffer comes down decisively on the side of the traditional Augustinian viewpoint. Perhaps this is so because of Schaeffer’s strong stands for scriptural inerrancy and the historicity of Genesis (pp. 114-120, 225). C.S. Lewis combines elements of both the Augustinian and Irenaean for a more eclectic theodicy. Lewis thought animal suffering, death and animosity (p. 206) were caused by Satan’s fall before the creation of Adam and Eve. Lewis noting that the consequences of the fall were severe believed along with Irenaeus that “our current world has become a “vale of soul-making” (p. 207). Schaeffer confirmed that the evil in the world can have an effect in the process of sanctification—that evil was not God’s original design or intent. The Fall caused an

abnormal or “fractured” world that “ushered in the enemies of pain, anguish, estrangement, diseases, suffering and death” (p. 208).

It seems that this would account for a primary difference between the young earth creationist and the old earth creationist approaches. The young earth proponents with their insistence that all evil and death (human and animal) stem from the Fall are more in line with the Augustinian theodicy. Conversely the old earth or progressive creationist advocates with their acceptance of million or billions of years of animal death (and perhaps pre-Adam humans) seem to follow more favorably the Irenaean theodicy. Burson and Walls conclude:

It is possible, then, to have a profoundly good God, objective moral categories and a base from which to challenge evil in our world, apart from Augustinian theodicy and a literal reading of Genesis (p.226). This returns us to the question of how we interpret Genesis (i.e. literally or figuratively) and what the scriptures actually say—not what we want them to say. If the writers are correct the roots of the controversy between young and old earth creationists stem, at least in part, not just from the last two centuries, but from the early days of the Church.

In summary, this extremely readable volume only slightly decreased my admiration for Lewis (he subscribed to theistic evolution, p. 137, and other problematic issues) while enhancing my appreciation for Schaeffer. Read carefully and critically this is a good introduction to the work of the two seminal Protestant apologists of the 20th Century, C. S. Lewis and Francis Schaeffer, and what they have to offer the church in the 21st century.

Embryology and Evolution

Wayne Frair*

Some teachers and textbooks still are presenting a simplistic nineteenth century Darwinian hypothesis that a developing embryo summarizes the evolutionary history of that organism. Mainstream embryologists have rejected this view, called *recapitulation*, for more than one-half century.

The main promoter of recapitulation was anti-theistic Ernst Haeckel who was guilty of falsifying

illustrations in order to support his views. Even today some authors unwisely continue to use some of these misrepresentations in evolution sections of textbooks.

Because of studies on developmental processes including homeotic genes, our understanding of the origin of life forms is changing rapidly. Design with Divine creation of unrelated types is becoming an increasingly more viable option.

Current Issue

Recently a college student wrote to the Creation Research Society asking about the status of embryology with relation to evolution because his zoology professor had presented the so-called “biogenetic law” to their class. This “law” states that as embryos develop they pass through the various stages attained by their ancestors as they climbed the “evolutionary ladder”.

Considerations in Earlier Years

I empathized with this student because in the spring of 1947 when I was a freshman taking my first semester of zoology at the University of Massachusetts in Amherst, I had a similar experience. My professor, Gilbert L. Woodside, a Harvard-trained embryology Ph.D. and then a leader in this field, presented to our class the embryology argument for evolution. Usually this concept is called recapitulation because the developing embryo is assumed to “summarize” or “epitomize” the entire history of its race. When certain embryonic observations are presented in a convincing way, the argument compels acceptance of a macroevolutionary sequence of animal or plant species. I recall thinking after that class, “How could anybody possibly doubt evolution when they understand this evidence?”

I was driven to know more biology, and so I switched my major from psychology to zoology, taking physiology and entomology in my sophomore year. I had become a Christian while in the Navy before my collegiate education, but

after two years at the university my Christian beliefs were being challenged in ways that were difficult to handle. I was slated to be a laboratory assistant in the physiology class the next fall, and would have enjoyed that greatly, but I transferred to a Christian college (Houghton in New York), majoring in zoology along with minors in Bible and in chemistry. I obtained a BA degree in 1950, and in the summer of 1951 a BS degree, also in zoology, from another Christian college (Wheaton in Illinois). In the latter I expanded my science and theology backgrounds. Then I taught science to middle and high school level students for one year at the Ben Lippen School which was then in North Carolina. In 1952 I returned as a graduate student to the University of Massachusetts where I obtained teaching and research assistantships.

Change of View

To my surprise I found myself in an experimental embryology course with Dr. Woodside, who now was Chairman of the Department of Zoology and of the Graduate School. I became captivated by Dr. Woodside and his field of embryology. I did research and wrote a master's thesis on chick embryology and the first cancer-inhibiting drug, 8-azaguanine (see Frair and Woodside, 1956).

During my reading and research I became determined to plumb the depths of embryonic recapitulation, but to my utter amazement I learned from Dr. Woodside that the “biogenetic law” was dead! So the man who had convinced me of the importance of recapitulation when I was a freshman, then five years later was convincing me of the opposite. Dr. Woodside not only disbelieved it, but also he virtually despised it. Recapitulation no longer could be

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any more than a hypothesis at best, and he wanted me to have nothing to do with it.

Professor Woodside believed that embryology as a discipline was retarded because of recapitulation. He told me that by the mid-20th Century no informed embryologist could accept the recapitulation concept. Many investigators had given up their work in disgust because they ran into dead ends trying to fit their embryological data into an evolutionary context. Professor Woodside also believed that there had been *only* one Nobelist in embryology (Hans Spemann) because so many other good embryology investigators had been focusing on evolution and failing. An example of the many exceptions to the hypothesis of recapitulation is that in an evolution scheme the spinal cord is present before the brain, but in embryology the brain develops first. But, has not evolution been the thread that holds all of biology together? At least we knew 50 years ago, and still realize today, that Darwinian recapitulation is not part of any such thread (see Bergman, 1999; Wells, 1999a).

Ernst Haeckel

Charles Darwin often has received credit for ideas he promoted even though these thoughts actually had originated in the minds of other people. This is true of recapitulation which appears to have had its earliest roots among the Greeks more than one half a millennium before the time of Christ (see Osborn, 1929). Some thoughts regarding recapitulation were expressed in the eighteenth century, but the most famous popularizer of recapitulation was the German zoologist and philosopher, Ernst Haeckel (1834–1919). He was Charles Darwin's most prominent dogmatic and outspoken supporter of evolution in Germany, but his influence spread around the world. Having met Darwin in 1866, Haeckel tried to place not only science but also philosophy and religion under an atheistic evolutionary umbrella (Jenkins-Jones, 1997).

It is interesting to realize that since the 1860's it has been known that Haeckel falsified his illustrations used to "prove" recapitulation. The most comprehensive treatment of the topic in English is the 1915 book by Assmuth and Hull. These authors refer to a massive amount of material revealing that members of the scientific community recognized that in promoting his views Haeckel relentlessly and shamelessly perpetrated frauds and forgeries. Significant exposures of these date back to 1908, 1875, and at least as early as 1868. Many scientists joined in this condemnation of "the methods of Haeckel, in the instances which had been exposed ...by eighty-three men [a group of 46 plus another of 37] of good posi-

tion in various branches of science and learning, besides others who published their condemnations apart" (Assmuth and Hull, p. 23). Also see Rusch, 1969. The many dozens of Haeckel's frauds and forgeries included embryology and other fields of science.

Scientists during the time of Haeckel and today have recognized that researchers need to be free to construct their hypotheses and theories on the basis of the empirical evidence. But they uniformly have recognized as improper the support of these concepts by unidentified imaginary data or misrepresentations of facts collected or presented by others. As examples of Haeckel's misdeeds see Plates I and II (Figures 1 and 2) from Assmuth and Hull.

Haeckel's endeavors (other than possibly his actual scientific research in systematic zoology) seem to have been so intimately yoked with his philosophy that it appears impossible to separate his actions from his attitudes. For example when someone objected to the embryological contentions of Haeckel and his followers they would be told:

"This affair belongs to embryology, and therefore you, who are not embryologists, are incompetent to form a judgment in the matter." Even if their opponent happened to be an embryologist, they would still discredit him if he retained the slightest vestige of belief in God, freewill or the human soul. He would immediately be dubbed a theologian, a clerical obscurantist, whose dualistic superstitions deprive him of the free use of his reason. Haeckel's pages are peppered over with this sort of "ruling out of court"... (Assmuth and Hull, p. 54).

One outspoken critic of Haeckel was J. Reinke, Professor of Botany at the University of Kiel.

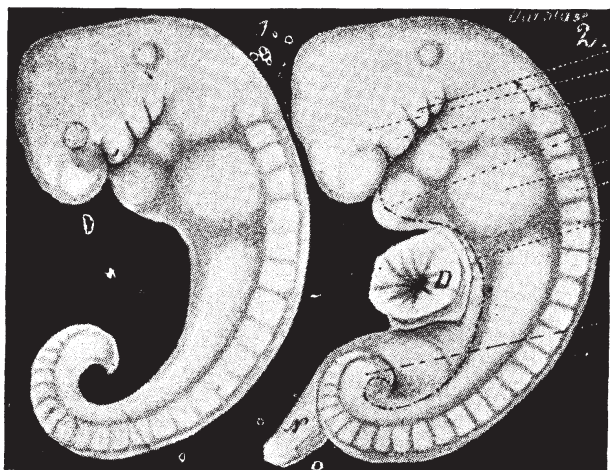
In a pamphlet entitled "*The Latest about Haeckelism*" (Heilbronn 1908) Reinke fills seven pages with parallel columns; the one containing "what Haeckel says," the other "what the truth is". He gives twenty-four instances of misrepresentation perpetrated by Haeckel, and adds: "These are samples taken at random. It would be possible to multiply their number many times" (Assmuth and Hull, p. 31).

But Haeckel, the *popularizer*, apparently failed to profit from such exposures and maintained his misleading maneuvers into his later years, sometimes trying to justify himself by claiming to be following standard biological procedures. As a result, countless scientists and students of science including many authors have been misled, an influence lingering to the end of the twentieth century. Even though many current scientists tend to believe that the demise of the "biogenetic law" was a

PLATE I. SPECIMENS OF KEIBEL'S EXPOSURES.

(See page 9.)

(1) HAECKEL'S "COPY." (2) SELENKA'S ORIGINAL.



Folds
Eye
Jaws
Heart

Arm
Backbone

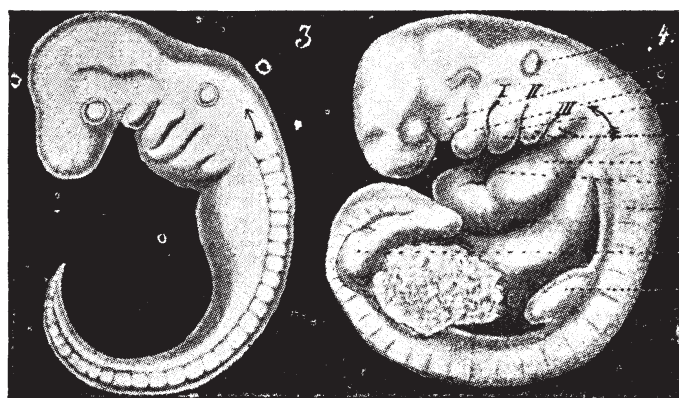
Line showing
what Haeckel
has cut off. }

Leg

D. Yolk-Sac
N. Navel

Haeckel takes Selenka's genuine figure of a *Macaque* embryo, cuts off such essential parts as the arms, legs, heart, navel, yolk-sac, so as to make it as much like a fish-embryo as possible, and then labels it "Embryo of a *Gibbon* in the fish-stage." Haeckel excuses himself by pretending that the omitted parts are *not* essential.

(3) HAECKEL'S "COPY." (4) HIS'S ORIGINAL.



Ear
Jaws
Folds

Heart
Nose
Backbone

Leg

Arm

Compare the full embryo of a man, figured by His from life, with Haeckel's diminished figure. Haeckel omits such essential parts as the arms, legs, heart, so as to make it as much like a fish-embryo as possible, and then labels it "Embryo of a man in the fish-stage." This is not merely a mutilated copy, but a free invention, and is absolutely unlike the reality as observed by others.

middle-to-latter twentieth century phenomenon, even as early as 1915 it was possible to make the following very clear statement:

Hardly any scientist of note will be found today who accepts the law as it stands. The convincing reason is because recent research has clearly proved that the exceptions to this law are far more frequent than the realisations of it. The majority of the stages through which the individual embryos of different animals pass, do not for the most part correspond to the gradations which, according to the evolution theory, make up the history of the development of life (Assmuth and Hull, p. 98).

Haeckel likely was aware of these difficulties, for he distinguished embryonic changes leading to evolutionary progress ("palingenesis") from other deviations ("coenogenesis"). But so called coenogenetic changes are so numerous, they do not support the "law" but disprove it.

As indicated at the beginning of this paper some teachers still are presenting the "biogenetic law" in support of macroevolution, moribund as it has been for decades in the light of the teachings of many leading scientists including the late Canadian biologist, W. R. Thompson, who in 1956 published an "Introduction" for a reprint of Darwin's *Origin of Species*, noting:

When the 'convergence' of embryos was not entirely satisfactory, Haeckel altered the illustrations of them to fit his theory. The alterations were slight but significant. The 'biogenetic law' as a proof of evolution is valueless (pp. xv-xvi).

In the past several years Haeckel's illustrations again have been in the news because some textbooks in support of evolution still have been republishing Haeckel's bogus material (see Richardson, et al., 1998).

Figure 1. Haeckel's fraudulent copies of embryos (1 and 2) compared to the originals of Selenka (2) and His (4) (Assmuth and Hull, 1915).

**PLATE II.
SKELETONS OF APES AND OF MAN.**

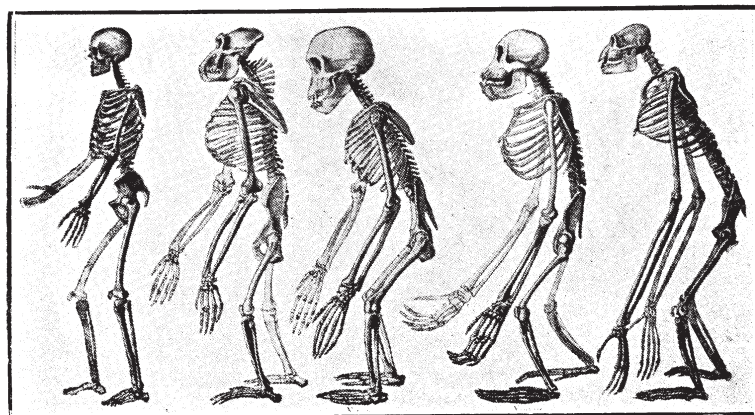
(See Page 85.)

I. HUXLEY'S ORIGINAL PLATE (REVERSED.)
Man. Gorilla. Chimpanzee. Orang. Gibbon.



Huxley's plate displays many differences between man and the apes; e. g., the bent posture of the apes, the turned-up position of their feet, etc.

II. HAECKEL'S MODIFICATION OF THE ABOVE.



Haeckel substitutes two new figures, makes the feet of the apes flat like those of man, straightens up their backs, cuts off the neckbones of the gorilla, and creates an impression of sequence altogether untrue to nature, so as to support his theory of descent.

Figure 2. Haeckel's fraudulent drawings (II) misrepresent Huxley's original plate (I). Haeckel's skeletons are drawn to look more alike, thus suggesting an evolutionary sequence rather than a heterogeneous group as Huxley more realistically drew them (Assmuth and Hull, 1915).

Sir Gavin de Beer

Sir Gavin de Beer (1899–1972) was a British zoologist and evolutionist who was well-known and influential in the field of embryology. He was Director of the British Museum (Natural History) 1950–1960. In 1930 he published a

book, *Embryology and Evolution*, in which he rejected the embryonic concept of recapitulation. He published enlarged versions of his anti-Haeckel views in *Embryos and Ancestors* copyrighted in 1940, 1951, and 1958. Gavin de Beer, 1958, referred to Haeckel's theory as outworn and "a mental straight-jacket which has had lamentable effects on biological progress" (p. 172), and he concluded that "evolution does not explain embryology" (p. 173). For example, according to phylogeny teeth came before tongues, but in mammalian embryos tongues develop before the teeth (p. 7). With chick embryos the heart functions very early in development, but in the frog (which supposedly is closer to ancestral stock) the heart appears much later in development. Specifically the dissimilarity is related to the developing chick's need to receive yolk; whereas the frog egg has much less yolk. Therefore, the differences are based upon structural and functional conditions within the two animals, not their presumed evolutionary relationship.

Often a considerable period of time is required before established views in science are modified on the basis of new evidence. This is illustrated by Perry, 1952, who seems to have understood that the biogenetic law had been falsified; but when writing his general zoology textbook he appears to have been rather restrained in referring to recapitulation.

Several facts have been discovered which are contradictory to the theory of recapitulation, or at least are difficult to interpret in this light. Many reputable biologists today question the significance of the seemingly apparent agreement of some of the facts with the theory (p. 519).

Gavin de Beer used many examples to show how so-called homologous (structurally similar) organs could come from very different embryonic regions among various embryos. Also, he disclosed that homologous structures commonly are not determined by identical genes (see de Beer, 1971). A recent evaluation of this topic by Wells and Nelson, 1997, emphasizes that:

Subsequent research has overwhelmingly confirmed the correctness of de Beer's observation. Homology, whether defined morphologically or phylogenetically, cannot be attributed to similar developmental pathways any more than it can be attributed to similar genes (p. 17).

In other words, similar organs in the bodies of different organisms apparently would not be produced by similar nucleotide sequences in the DNA of the genes. Recent research appears to be leading toward some greater comprehension of a solution to this conundrum.

Homeotic Genes

For about two decades there has been an expanding understanding regarding homeotic genes which are small nucleotide sequences behaving somewhat like *master switches* to control the development of various parts of the organism. The homeotic genes play critical roles in the production of arms, legs, eyes and other body parts within developing animals of many kinds. In each homeotic gene there characteristically is a particular sequence of about 180 base pairs of DNA which are very similar to the sequence in the corresponding homeotic genes of other animals whether mouse, man, fruitfly, or amphioxus. For example, in a fly a particular type of gene will affect the antenna, and in a mouse a very similar gene influences the hindbrain. Another homeotic gene appears to be a master controller for development of eyes including the compound eyes of insects and the greatly-different visual organs of squids and even humans (see Wells, 1998).

Each homeotic gene produces small protein molecules which serve to switch on the transcription of other genes by attaching to their promoter loci. As a result there is a cascade of chemical events which lead eventually to the formation of a body structure such as an eye or a leg.

During recent past years it has been baffling to learn that genes and their mutations are not coupled to structural components of the body. For example, a spectacular illustration of this discrepancy has resulted from DNA hybridization experiments indicating an estimated 98–99% similarity of DNA in chimpanzees and humans; whereas people morphologically and physiologically would be more like some 70 to 80 percent like apes. The DNA would be located in the 48 chromosomes of chimps and the 46 chromosomes of humans. Therefore, in addition to the basic nucleotide sequences in DNA there must be other factors which very significantly influence development. These factors could include effects related to the different arrangements of the DNA in the chromosomes of chimps and people (see Hopkin, 1999).

Discussion

One of the earlier *Drosophila* researchers exploring homeotic mutants was W.J. Ouweneel who analyzed evolutionist and creationist perspectives on the subject. He concluded that views of older evolutionists such as Goldschmidt, Schindewolf, and Nilsson were preferable to neo-Darwinism. He considered classical neo-Darwinists naive to perceive "the impressive complexity of biological systems...to have originated by random processes" (1975, p. 153).

In a recent creationist paper, developmental biologist J. Wells, 1998, discusses the serious problems with macroevolutionary conceptions of the origins of homeotic genes and the adaptations they control. Most homeotic genes are theorized by evolutionists to have arisen early in evolution *before* the adaptations they influence had been selected. This is a problem for Darwinists. Wells is opposed to "reductionistic DNA-based neo-Darwinism". In addition to DNA, he discusses other factors which supply developmental information. Within the cytoplasm there are at least three important influences: the cytoskeleton, membranes, and regionalization of other components. DNA is pictured as indicating what building materials are needed; and other features determine how the materials will be assembled. Although these processes are only vaguely understood at this time, Wells feels that recent developments in embryology are best understood using a design approach (Wells, 1999b).

So the issue centers on whether the data fit better into an evolutionary pattern in which homeotic genes would be "conserved" (phylum to phylum) over long periods of time, or if they fit better into "end-directed" processes. Perhaps now is the time for a shift toward a teleological paradigm which will enable us to conceptualize development in a new way. We may be on the threshold of opening a new vista of thought which will unveil laws which so far have escaped our realization.

Consideration should be given to a creation alternative which states that God created separate types of physically unrelated plants and animals (see Frair and Davis, 1983). Genetic research (including homeotic genes) has revealed what most creationists would recognize as the work of God who employed similar genes for different organs in a diverse array of organisms.

In my response to the college student who in 1999 was having the same problem I had 52 years before, I shared with him much of the above information. So what further advice can we give to our students of science today? We should try to dig up all possible relevant facts, weigh them carefully, and be prepared to change our mindset when the data and their implications so indicate. As is true of science in general, we must maintain a degree of tentativeness regarding our conclusions.

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The Second CRS Monograph on Astronomy

Due to the popularity of the first CRS monograph on astronomy, *Design and Origins in Astronomy*, edited by the late George Mulfinger, the CRS has decided to publish a second astronomy monograph. We are interested in original papers, but would consider revisions of papers that have appeared in the *Creation Research Society Quarterly*

in the past 15 years. Submissions on all topics of astronomy are encouraged.

For submissions or additional information, contact Danny R Faulkner, 1402 University Dr., Lancaster, SC 29720. H: 803-286-9781 O: 803-285-7471 e-mail: Faulkner@gwm.sc.edu

The Van Andel Creation Research Center A Unique Creationist Resource

John R. Meyer*

Almost since the beginning of the Society, it was recognized that we needed a research center for the pursuit of origins' studies from a creationist perspective. Unencumbered by operation within a prejudicial, evolutionary-oriented government or state university, it had long been felt that an independent creationary research center, which was dedicated to quality field and laboratory research, could effectively challenge the evolutionary establishment through the pages of the *Creation Research Society Quarterly* (CRSQ). Nearly twenty years ago the first steps in this direction were taken with the purchase of land in North Central Arizona. Over the years, this property was slowly developed as funds allowed. We were committed to "pay as you go" type financing, so development was slow. A little more than seven years ago, the Jay and Betty Van Andel Foundation provided the funds to buy additional property and to develop a facility, which carries their name. We now have a beautiful and functional Research Center which is providing a growing number of papers for the CRSQ.

The Van Andel Creation Research Center is located on five acres fronting U.S. Highway 89, five miles north of Chino Valley, Arizona. This well-situated property is in the desert grasslands of the upper Sonoran biological province and the geological transition zone of Northern Arizona. It is surrounded by a large number of interesting volcanic features and is located close to the heavily-mineralized areas of Mingus and Bradshaw Mountains. The Mogollon Rim, eight miles to the north, marks an abrupt change from the Colorado Plateau to the transition zone of North Central Arizona. The property is about a mile from the confluence of several major drainage areas and the headwaters of the Upper Verde River.

The main research building is a 3,000 square foot frame structure with a large porch, which provides protection from the Arizona sun (Figure 1). It is composed of two offices, a reception/library room, a biology/chemistry lab, an electronics lab (which houses the Stardust meteor observatory), two wet labs, a workshop for fabrication and repair of equipment, a visiting scientist's quarters, and a small kitchenette.

The new research greenhouse is designed with two separate rooms, each with independent environmental control systems. It will be used for studies relating to



Figure 1. The main research building at the Van Andel Creation Research Center. It was the first building built at the facility.

intelligent design characteristics in plants and for projects evaluating the limits of the Genesis kinds in the modern plant world. This building is a 1,100 square foot structure with polycarbonate glazing (Figures 2 and 3).

The new Publications Building provides room for all aspects of our literature outreach (Figure 4). It currently stores all back issues of the CRSQ (about 40,000 copies) and all creation books and tapes that we handle. Last year we shipped materials to twenty different countries. Considerable expansion of CRS publications outreach is now possible. The building is divided into three separate rooms. One is for book and journal storage; one is a packing and shipping room; and one serves as a double-car garage/storage area for larger items.

In addition to the visiting scientist's quarters, we have facilities available for two long-term recreational vehicle hookups for visiting scientists and workers. A new motel is being built in nearby Chino Valley and can provide for additional short-term housing as needed in the future.

Major research equipment at the Research Center includes a Hewlett Packard gas chromatograph, various light microscopes, a scanning electron microscope, microscope slide preparation equipment, a modestly-equipped electronics shop, a partially-equipped mechanical shop, an analytical balance, and a lab rock crusher. We also inventory various types of centrifuges, lab ovens, computers, and an astronomical telescope for educational purposes (Figure 5). Our research library includes more than 3,000 technical scientific works and 500 reprints, written both from the creationary and evolutionary presuppositions. We also have a fine collection of past creationist works of great historical and scientific

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Figure 2. The new greenhouse, built with a separate grant from the Jay and Betty Van Andel Foundation.



Figure 4. The new Publications Building is the home for all of our back issues of the CRSQ and for all of the books and tapes we handle. It was made possible through a grant from the Jay and Betty Van Andel Foundation.

value. A recent donation from a church mission group has provided seven additional shelving units which will be a great help in the library.

Some of the current projects under development at the Van Andel Creation Research Center include the Stardust meteor observatory, currently collecting data on an average of 3,000 meteor falls per day (Figure 6). Our stalactite research project will undergo considerable redesigning this summer and should be fully operational by early fall (Figure 7). A number of plants are currently under cultivation in the greenhouse in studies relating to taxonomy, limits of the Genesis kinds in the modern world, and intelligent design characteristics in the plant world. Continuing studies on ring muhly grass and lichen growth rates are being conducted on undisturbed areas at the Research Center.

Future projects will likely include the influence of carbon dioxide enhancement on plant growth, the genesis of thermoregulation in honey bees, fossils of the Coconino sandstone, biochemistry and taxonomy in pine trees and



Figure 3. Environmental control units for the research greenhouse.



Figure 5. Bert Frye, visiting scientist, makes adjustments on a ten-inch astronomical telescope that he donated to the Research Center. It will be used for educational purposes and for preliminary work in anticipation of a possible future instrument of much larger dimensions.

the genesis of multiple yearly tree rings of bristlecone pine trees.

The Van Andel Creation Research Center is strategically located in or near a very large variety of biological and geological areas of great importance to the creationist position. The Grand Canyon, just two hours to the north, is perhaps the most geologically interesting area in the U.S. A wide variety of biological habitats is relatively easy to access from the Research Center. Both high altitude montane communities and Sonoran Desert Saguaro cactus communities are within a two-hour drive.

A growing number of school and church groups are visiting the Research Center (Figure 8). While we are not a museum, we can provide an exciting look into the ongoing research projects which relate to scientific and Biblical creationary studies.

The Research Center now represents a creationist asset of great significance. With the Lord's guidance, we have assembled an outstanding facility. While we are always short on equipment, our next major challenge will



Figure 6. Jack Meyer, visiting scientist from Virginia, puts finishing touches on the Stardust Radiometer observation station. Stardust detects and automatically records about 3,000 incoming, high altitude, ionized meteor trails on an average day.



Figure 8. Christian school groups, such as this one from Mesa, AZ, are finding that a trip to the Van Andel Creation Research Center makes for an inspiring and educational field trip. Visits to the Research Center should be made by appointment.

be to staff the Van Andel Creation Research Center with full-time scientists and technicians to face the challenge of evolutionary teaching in the next millennium (Figure 9).

For a more detailed description of the Research Center, available facilities and equipment, accessible field research sites, and potential projects please write, e-mail, or telephone us.

In funding the Van Andel Creation Research Center buildings, Mr. Van Andel said his goal was "to give creationists a fighting chance." With his generosity and the partnership of hundreds of creationists from all walks of life, this is being done. As we face the future together, we invite the support of a growing number of creationists to partner with us in one of the greatest enterprises of the



Figure 7. These canisters contain limestone used in a research project to study the rates of stalactite formation. This research is based on a growing body of scientific data first published in the CRSQ.



Figure 9. Del Dobberpuhl, a prominent laser physicist, examines an electro-mechanical device. Continued acquisition and employment of full-time, competent research scientists will be the key to future progress and impact.

coming millennium—to challenge the theory of evolution at the technical level, to develop a positive creationist model of origins, and to use this as a basis for world outreach through creation evangelism.

Since this is a spiritual battle, we covet your prayers and personal encouragement. Since scientific research is expensive, we need your financial support through regular giving and through planned gifts, trusts, and wills. Since we are involved in technical research, we need the assistance of highly-trained scientists who are dedicated to the Creator and His work.

For those preparing for retirement, we remind you that the Prescott area is usually listed as one of the top retirement hot spots in the U.S. We can provide opportunities for significant, meaningful, volunteer technical

work for those scientists and others with vital skills who may retire to this area.

We are extremely grateful to the Jay and Betty Van Andel Foundation for capital developments at the Research Center. Their continued support of the work has changed the course of creationist history. In addition, our many members and friends are providing increasing levels of support as we face the new millennium. Our sincere thanks goes to all of our friends and supporters for their key roles in the development of this superb

Research Center. Not everyone can perform field and laboratory research and publication, but partnering together, we have made a significant impact on the evolutionary humanism that pollutes our culture.

Members and friends who are visiting Northern Arizona are invited to visit the Research Center. Our guests find the work we do to be an interesting part of their visit to this area. Those who have sacrificed to support our work will have opportunity to examine the results of their partnership with us.

Photo Essay

Tree Stumps in Santa Rosa Sound

In late August of 1998 an interesting discovery was made in the waters of Santa Rosa Sound in the Florida panhandle. Santa Rosa Sound separates the mainland from Santa Rosa Island, a long, narrow barrier island stretching from the Pensacola area to Fort Walton Beach. While marine utility workers were in the process of installing a freshwater pipeline to Navarre Beach on Santa Rosa Island, they ran into tons of tree stumps and trunks six feet underneath the sound floor. Installation of the waterline was delayed as crews were forced to remove the numerous stumps, many of which appear to be in situ. According to navigational charts the Sound at this position ranges from shallow 4-5 feet to a deeper trench of 16-20 feet. The stumps appear to be cypress or juniper, and scientists from the University of West Florida estimate they are the remains of a coastal swamp from around 7,000 years ago (based on the carbon-dating of similar stumps found at Grayton Beach, Florida, ca. 70 miles away). The UWF scientists propose to study the stumps and search for pollen in order to determine the local environment of the original forest. The discovery of this "prehistoric sunken forest" helps support the thesis behind recent sea-level changes as

put forth in the 1998 article by Rucker and Froede (*CRSQ* 35: 53-64).

The preservation of these stumps is remarkable, and they appear no different from tree stumps or trunks only a few years old. This discovery will enable creation-based researchers to challenge uniformitarian (long-age) assumptions about coast-line changes. Photographs courtesy Mr. Obie Cram.



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The Philosophy of Sequence Stratigraphy Part I — Philosophic Background

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Abstract

Sequence stratigraphy has, to a notable extent, supplanted traditional uniformitarian stratigraphy. Some creationist geologists have embraced sequence stratigraphy as a singular opportunity for the redemption of the science of geology, while others have rejected it as the latest mutation in uniformitarian thinking. Still others re-

main unaware of the principles of this approach or undecided as to its merits. To properly evaluate the scientific validity of sequence stratigraphy and its applicability to geologic research within the context of a Biblical worldview one must have a basic understanding of the philosophy of science.

Introduction

Stratigraphy is the study of the arrangement of earth materials (particularly stratiform rocks), especially as to geographic position and chronologic order of sequence (Bates and Jackson, 1984). Various schools of thought have arisen within the discipline of stratigraphy during the past two centuries (Table I). These schools of thought have arisen from specific presuppositions and have been inextricably enmeshed in the specific philosophies or worldviews from which they sprang. "Classical uniformitarianism" or "quietism," attributed primarily to Hutton and Lyell, has dominated the history of stratigraphy, and its naturalistic worldview has been incorporated relatively seamlessly into neocatastrophism.

Several helpful works on the historical development of stratigraphy have been published (Ritland, 1981, 1982; Sunderland, 1986; Taylor, 1991). Particularly useful are papers by Woodmorappe (1996) and Mortenson (1997a, 1997b, 1998). The inconsistencies of traditional stratigraphic methods (principally the Lyellian approach) have been abundantly documented (Berthault, 1998; H. Clark, 1968, pp. 29–36; Froede, 1995; Mehler, 1986; Snelling, 1992; Whitcomb and Morris, 1961, pp. 136–211; Woodmorappe, 1980, 1981, 1982; Zeller, 1964). Nevertheless, no consensus on how one should approach stratigraphy has emerged among creationists to date. Sequence stratigraphy, a recent development within the geologic establishment, has been suggested as a solution or partial solution to this problem by some (Bartlett,

1997; Berthault, 1997, 1999; Davison, 1995; Froede, 1994, 1997; Holt, 1996; Robinson, 1995, p. 57; T. Walker, 1996, p. 379), though others (both evolutionists and creationists) present objections (Jeletzky, 1978; Miall, 1986, 1992; Thorne and Watts, 1984; R. Walker, 1990; Woodmorappe, 1996). Evaluation of the scientific validity of sequence stratigraphy and its applicability to geologic research within the context of a Biblical worldview requires a basic understanding of the philosophy of science.

I will begin by reviewing basic principles of the philosophy of science. This will necessarily require discussion of the influence of worldviews, particularly uniformitarianism/naturalism and Christianity, and the subject of "mixed questions," in which more than one discipline or method is required to provide an answer. The philosophy of science will be applied to geology in general and stratigraphy in particular. A summary of stratigraphic methods, themselves outgrowths of the historic contexts intimated in Table I, is then examined in the light of essential philosophic principles.

Some readers lacking a background in the philosophy of science will probably wish to jump right to the application of stratigraphy (Part II) or sequence stratigraphy (Part III) within the Biblical worldview. This would be disastrous! Merely rehashing various examples would serve only to reinforce existing biases, accomplishing nothing constructive. Thus, it is only after understanding the philosophic basis (Part I) that sequence stratigraphy can be analyzed in relation to other stratigraphic principles and methods to determine its suitability and utility for use by creationist geologists.

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Table I. Historic schools of stratigraphic thought.

System	Dates ¹	Description
Diluvial	1550–1850	Emphasis on local geology and general explanation; belief that the Deluge was primarily responsible for sedimentary rocks (notable opposition from rationalists and deists; Arduino introduced terminology <i>Primary</i> , <i>Secondary</i> , and <i>Tertiary</i>)
Wernerian	1780–1840	Emphasis on lithostratigraphy; belief in successive worldwide lithologies (e.g. <i>Carboniferous</i> , <i>Cretaceous</i>)
Cuvierist	1810–1850	Emphasis on biostratigraphy and unconformities; belief in successive regional or global catastrophes (Deluge being most recent)
Lyellian ²	1830–1980	Emphasis on biostratigraphy; belief in successive worldwide ages characterized by fossil assemblages (e.g. <i>Cambrian</i> , <i>Devonian</i> , <i>Permian</i>)
Neocatastrophist ³	1970–present	Emphasis on unconformities; belief in successive regional or global catastrophes separated by long periods of quietude (uniformitarianism interrupted by catastrophes) ⁴
Sequence Stratigraphy	1980–present	Emphasis on unconformity-bounded sequences (or flooding surface or physical boundaries); belief in eustatic cyclicity

¹Approximate period of popularity, recognizing that individuals holding more or less to a particular perspective on stratigraphy may be found before or after the indicated dates.

²Also called *Gradualist*, *Quietist*, or *Classical Uniformitarian*.

³Many creationists of this century have much in common with mainstream neocatastrophism; however, this table is a simplification and meant to represent only the scientific mainstream.

⁴Creationists who believe in multiple regional or global catastrophes (only one of which was the Biblical Deluge) are sometimes referred to as “Neo-cuvierists” (or neocuvierists); their view differs from that of Cuvier in that one or more of these catastrophes are postdiluvial.

For many, philosophy is an endless maze of useless mind games far removed from science. To be sure, as many philosophies can be generated as there are people to philosophize. But science is itself a branch of philosophy, formerly called “natural philosophy,” and wholly dependent upon such branches of philosophy as logic (what is proper reasoning?) and metaphysics (what is the nature of reality?). To neglect the question “What is proper reasoning?” before attempting to practice science is to prepare for failure. Several notable examples may be readily found of geologists who turned their backs on the biblical worldview, to some extent at least on the basis of stratigraphy. Some of them even wrote for this journal. To ignore the philosophic underpinnings of this issue is a dangerous mistake.

It is my objective to assemble the fragments of stratigraphic method and application presented over the past three-and-a-half decades into an understandable mosaic that will assist the reader in comprehending sequence stratigraphy—and stratigraphy in general—within the overall philosophic context in which it necessarily functions. In Part I of this series, the relationship between philosophy and stratigraphy is examined. In Part II, the scientific veracity of various stratigraphic methods will be

evaluated. In Part III, a more detailed examination will be made of sequence stratigraphy due to its increasing dominance and potential importance. I have attempted to provide a representative sample of citations to assist readers in studying particular issues in greater depth. The reader unfamiliar with geological and philosophical terminology may wish to consult the glossary at the end of this paper.

The Philosophy of Science

Much has been written on the philosophy of science, some of it from a Christian perspective (Ancil, 1983, 1985; Bartz, 1987, 1989, 1992; Bergman, 1982; Brand, 1985, 1996; Brown, 1994; J. Clark, 1976; Frangos, 1991; Hoffman, 1993; Hull, 1989a, 1989b; Johnson, 1991, 1993, 1995; Kofahl, 1986, 1989; Lillo, 1987; Lumsden, 1992; Malcolm, 1997; McGhee, 1987; Middelmann and Wilder-Smith, 1980; Moreland, 1989; Pearcey, 1987; Plantinga, 1990, 1997a, 1997b; Renard, 1993; Riemen, 1987; Schaeffer, 1968a, 1968b, 1972, 1976; Sproul et al., 1984; Sire, 1988; Verbrugge, 1985; Øhrstrøm, 1990). Some have attempted to provide a Biblical approach in

applying the philosophy of science to geology (Brand, 1974; Howe and Williams, 1994; Reed, 1996a, 1996b; Reed and Froede, 1996; Reed et al., 1996; Williams, 1992). Many of these authors have pointed out the dependence of the scientific enterprise on the following presuppositions:

- A reality exists external to man.
- This external reality is ordered and causal.
- Our senses can provide reliable information about the external world.
- Man has the mental capacity to comprehend this ordered reality through induction and the laws of logic, epistemology, ontology, and truth (and, by extension, moral values).
- Natural laws are unifiable and isotropic.
- Parsimony is desirable (“elegance” or “Occam’s Razor”).

It is evident that the scientific method (described below) could not have arisen from the nonchristian worldviews of current society, and it is not surprising that the science of postchristian occidental society increasingly resembles the “armchair” science of the ancient Greeks and other pagan cultures (Middelmann and Wilder-Smith, 1980; Schaeffer, 1976). Nor is it coincidental that empirical science arose within the Reformation culture (Middelmann and Wilder-Smith, 1980; Morris, 1984; Titus et al., 1979, p. 220; Schaeffer, 1976; Sire, 1988). Today, the geologic establishment largely operates within the confines of the uniformitarian-naturalist worldview (Johnson, 1991, 1993, 1995; Reed, 1996a), a worldview which is logically incoherent (G. Clark, 1978; Schaeffer, 1968a, 1968b, 1972, 1976; Sire, 1988), and which seeks knowledge, causality and order where none is assured (Sire, 1988; Zeller, 1964). Reed (1996a, p. 12) summarized this in a recent article in the *Quarterly*:

In summary, *the naturalist-uniformitarian system fails the formal comparison of its conclusions*

and methods with its axioms. Ironically, axioms that are crucial to its very existence are shown to be theological conclusions derived from the Biblical doctrine of creation, and derivative God-man-nature relationships. Naturalists have not, and probably logically cannot provide a non-theistic formulation that would justify those axioms foundational to modern science (emphasis mine).

Although no precise definition of natural science is universally accepted (Moreland, 1989; Plantinga, 1997b; Schoepflin, 1982), the problem is not intractable, as evidenced in the similarity of various descriptions of the scientific method. One is given by Copi (1982, pp. 468–475), summarized by the following five points:

- *Relevance*: the phenomenon of interest must be deducible from the proposed hypothesis.
- *Testability*: a proposed explanation must be testable (verifiable/falsifiable).
- *Compatibility with Previously Well-Established Hypotheses*: it must exhibit logical coherence.
- *Predictive or Explanatory Power*: the greater the number and range of deductions that follow from the hypothesis, the greater its predictive power.
- *Simplicity*: a bias is encouraged for the acceptance of the least complicated explanation; this is also known as parsimony, elegance, and “Occam’s Razor.”

The scientific method is essentially inductive, using deductive reasoning to test hypotheses and direct research. Although induction has been criticized by some, including Karl Popper, it remains an essential component of the scientific process (Copi, 1982; Lillo, 1987; Malcolm, 1997, p. 174; Titus et al., 1979). The differences between inductive and deductive reasoning are illustrated in Table II.

Empirical science, occupied with the analysis of data collected from the natural world, deals with probabilities. Hence, “scientific proof” is an oxymoron. Hypotheses may be deduced from an extrascientific philosophical

Table II. Induction versus deduction.

Inductive Reasoning	Deductive Reasoning
The conclusion probably follows from the premises. Often comes to general conclusions from particular cases. Conclusion is more probable with more substantiating data.	The conclusion <i>necessarily</i> follows from the premises. A general principle is applied to a particular case. Can be disproved with a single contradictory case.
One strengthens one’s case by collecting more supporting evidence. An inductive argument cannot be proved or disproved, but can be arguably more or less likely (verifiability). This is the traditional hypothesis or “scientific argument.”	Supporting evidence (verifiability) does not “prove” one’s argument, though the conclusion can be disproved (falsifiability). “Natural laws” and paradigms are deductive arguments and reflect imposition of one’s worldview upon the data.

viewpoint or arrived at intuitively or inductively using various models or statistical techniques. However, all models, including mathematical (statistical) ones, are still mental constructs and are only as good as their underlying presuppositions (Baker, 1996; Molnia, 1996; Pilkey, 1996; Rojstaczer, 1996). They must be testable, by both verification and falsification criteria (Copi, 1982; Frangos, 1991; Johnson, 1991, p. 71; Malcolm, 1997, p. 174; McCluskey, 1995). The strength of the scientific method (as codified by Francis Bacon et al.) is its limitation to empirical data, i.e. what can be directly observed and measured. *Science is that branch of philosophy which limits itself to the empirical.*¹

This has direct application to geology, as asserted by Koch and Link (1970, p. 8):

The sampling results—raw data, derived observations, and conclusions—should be verified before being accepted as valid information on which to base an analysis. Verification, an essential requirement of the scientific method, is too often done informally or not at all in geology.

- Titus et al. (1979, pp. 201-208) divide the scientific method into two components: logical methods and technical methods. Technical methods would include means of observing or measuring the natural world, and are often matters of agreement between creationists and evolutionists. Logical methods would include direct inferences, models, and paradigms derived from worldviews. These are often matters of disagreement between creationists and evolutionists. Both types of methods within natural science are subject to three tests for truth:
- *Correspondence*: the idea fits with data obtained from nature
- *Coherence*: it is logically consistent
- *Utility*: it is practical and “useful”

Scientific Models

The relationship between empirical science, worldview, and scientific models can be conceived as illustrated in Figure 1. As used in this figure, *worldview* refers to how one views reality based on a set of presuppositions one holds. Because no one can exist without a worldview, such presuppositions are often reflective of the culture into which one is born; hence, a given worldview is often shared by members of a particular society and defines their culture. *Paradigm* refers to a belief system derived from that worldview relative to a particular field of inquiry, e.g. ethics or politics. Inferences and hypotheses

are attempts to correlate data (measurements of natural phenomena) or interpret their relationships. Hypotheses about specific phenomena are inevitably integrated with inferences from other sources when they encounter a researcher’s paradigm, resulting in the birth of a *model*. The model is the interface between the metaphysical worldview and the empirical scientific research enterprise. It is here that the researcher seeks—as he must—to reconcile what he believes and what he observes. This is not, however, an essentially objective process. As indicated in Figure 1, the researcher’s worldview, expressed through a particular paradigm (usually shared with other researchers), influences his choices in phenomena to be investigated and data to be acquired.

According to Koch and Link (1970, p. 18), “A model is a representation of a natural phenomenon or process.” Geologic models may be grouped using their classification scheme as:

- physical (e.g. sedimentation in a flume)
- geological (e.g. a molasse basin)
- mathematical (deterministic or stochastic)

“In choosing between a deterministic or a statistical model for a mathematical study of a geological problem, one relies on taste and judgment, influenced above all by one’s view of the real nature of the world (Koch and Link, 1970, p. 24)”

Mixed Questions

Clearly, the criteria of Copi, especially testability and predictive power, are not applicable to all fields of knowledge or endeavor. They are not, for example, relevant to fine art or jurisprudence. Nor are they applicable to the study of history. However, scientific methods can have some applicability as adjuncts to historical study, for example in the fields of forensic science, archaeology, and historical geology. Here we concern ourselves

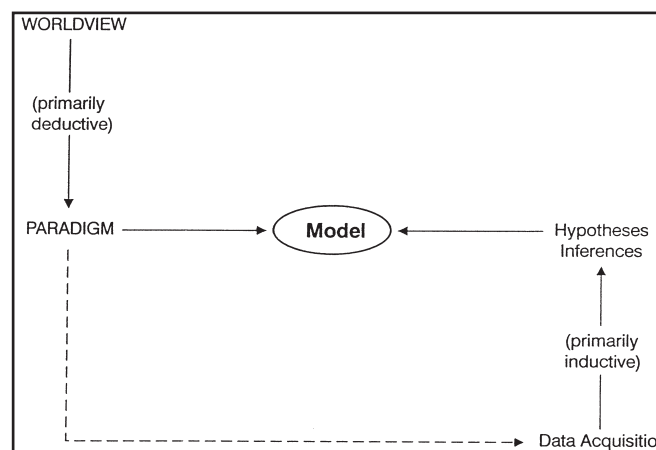


Figure 1. Construction of a scientific model.

¹This definition is consistent with the idea of “Duhemian science” (Plantinga, 1997b).

Table III. Science versus history.

Science	History
ongoing	unique
repeatable	unrepeatable
directly observable	not directly observable
primarily inductive reasoning	primarily deductive reasoning
relies principally on measurement/observation	relies principally on testimony/observer
Failure to recognize the limitations of science leads to distortion of science and produces faulty conclusions.	Failure to recognize the limitations of historical methods leads to distortion of history and produces faulty conclusions.

with historical geology. Fields in which knowledge may be properly acquired from more than one source or using more than one method require proper attention to their differences lest false conclusions be reached (Ancil, 1985; Brand, 1985; Frangos, 1991; Plantinga, 1997a, p. 23). These interdisciplinary questions are sometimes termed “mixed questions” (Adler, 1965). (Readers unfamiliar with the “mixed question” concept may see the appendix for a more detailed explanation.) Any geologic research which involves the past—and a great deal of activity in geology does—is a mixed question. Mixed questions require input from a plurality of disciplines and methods.

Mixed Questions and Stratigraphy

Stratigraphy could avoid the mixed question problem if it were limited to strictly empirical methods. This would require that the discipline be limited solely to a descriptive function, describing the spatial arrangements of various rock bodies defined on purely empirical grounds. However, stratigraphers have always insisted on meddling in natural *history*, thus introducing nonempirical elements into stratigraphy. Reed (1996a, p. 8) suggests some “ground rules for the interpretation of earth history”:

The first step in such a critique is the recognition that historical analysis is a much larger and more complex question than is commonly presented in geologic interpretations. Key issues to be addressed prior to developing any model are: (1) the severely limited potential for human neutrality in historical analysis; (2) the proper domains and relationships of the various areas of human knowledge; and (3) the criteria for establishing a critical framework within which competing models can be evaluated (emphasis mine).

The differences between the historical and scientific methods are illustrated in Table III. Naturalistic science

(the “modern modern science” of Schaeffer²) has not only failed to observe these differences, but has actively subsumed other fields of knowledge into “science,” scorning any method as “unscientific” that differs with empiricism (Becker, 1932; Johnson, 1995; Plantinga, 1990; Schaeffer, 1968a, 1968b; Sire, 1988). “Social science” fails by *a priori* rejecting the possibility of the human soul and ignoring man’s spiritual capacities. “Historical science” fails by *a priori* assuming a positivist viewpoint, confusing imagination with evidence, and being unwilling to admit that in many cases we simply cannot know (aside from divine revelation). This is the fallacy of reductionism, looking for truth *within* the scientific enterprise instead of using the scientific method as *one means among several* to arrive at truth.

Historically, this fallacy has resided in geologic circles in the form of uniformitarianism, a paradigm now being challenged. But the worldview behind it remains entrenched, as Bartlett (1997, p. 13) describes:

Secularists agree that uniformitarianism is false and stifling to hypothesis construction as well as scholarly discussion. In the past, the issue was the burial of the question of divine intervention. The whole issue involves recognition of and submission to the Christian God—Jesus Christ. ‘We will not have this *man* to reign over us’ (Luke 19:14c) was the clarion battle cry of Enlightenment scientism (emphasis his).

This reveals the true motivation behind the naturalist/secularist worldview. This was the worldview that gave birth to the traditional geologic column. This is the

²Schaeffer coined the term “modern modern science,” in contrast with “modern science,” to point out the fundamental transformation that occurred when the idea of uniformity in nature based on the immutability of God was replaced by the idea of uniformity in nature *a priori* without God. Schaeffer’s analysis is profound and very readable. Those of you who are not familiar with his works would do well to read them.

worldview from which some suggest sequence stratigraphy may deliver us (Bartlett, 1997). Can it?

Acknowledgments

The author thanks Messrs. Michael J. Oard, John Woodmorappe, K. Bill Clark, and the two reviewers for their helpful criticisms. *Deum laudo* (James 1:5).

Appendix

With a little thought, one can quickly see that we are faced daily with a myriad of mixed questions. Most of our decisions are attempts to reconcile several competing factors, a fact easily discerned in maintaining a budget. Abortion can be thought of as a mixed question, since it involves moral, political and scientific issues. However, Scripture rather clearly indicates that the unborn are individuals created in the image of God (Psalm 51:5, 139:13; Jeremiah 1:5; Luke 1:15) and that murder is sin (Genesis 9:5,6; Exodus 20:13; Psalm 106:36-40; Proverbs 24:11,12). Thus, this is really more of an example of sin than of a mixed question. Similarly, denying the authority of Scripture by interpreting it based on current "science" or some other human basis more closely resembles sin than a "mixed" theological and scientific question (Exodus 20:1,2; Psalm 118:8,9; II Timothy 3:16,17; II Peter 1:19-21). In contrast, many of the questions that arise in geology must be addressed *within the framework* of a Biblical worldview, since the Scripture does not give us these details. Where these questions involve earth history, they are mixed questions.

Consider the following example of a mixed question. The United States government is considering whether to provide financial assistance to the government of a developing nation. At a minimum, this decision involves the following factors:

1. The political effects on the United States
2. The political effects on the developing nation
3. Potential impacts on political power balances in the region
4. The motives and character of those in both governments who are responsible for overseeing the program
5. Ethical/moral questions about the process itself
6. Ethical/moral questions about this specific application of principle
7. The sociological impacts on the citizens of the U.S. from sending tax monies overseas
8. The sociological impacts on the citizens of the developing nation
9. The economic impacts on the citizens of the U.S. from sending tax monies overseas
10. The economic impacts on the citizens of the developing nation

Clearly, the first three factors are political. In analyzing the political factors, however, elements of sociology, psychology, and history will be prominent. Factors 4–6 are clearly ethical or moral. Factors 7 and 8, though obviously sociological, will incorporate elements of psychology and economics. Factors 9 and 10, clearly economic in nature, are closely related but not identical to Factors 7 and 8. Obviously, these various factors and the fields of knowledge upon which they impinge are inter-related, but just as clearly, different methods must be used for each. Principles of macroeconomics must be used, but can only address a portion of the questions raised in considering the foreign aid issue. The sociological impacts will be closely linked to the political and economic effects, but neither economics nor politics will be adequate to describe the sociological impacts. The ethical/moral questions leave relativistic cultures in a quandary³. As this example illustrates, mixed questions require input from a plurality of disciplines and methods.

Glossary

- axiom: an assumed or accepted principle, often regarded as self-evident
- biostratigraphy: correlation of rock units based on fossil content
- causality: the relation between effects and their causes ("cause and effect")
- Cuvierist: one holding to the view that Earth history has been dominated by several global or near-global catastrophes, the Deluge being the most recent
- deduction: a form of logic in which the conclusion necessarily follows from the premises (cf. Table II)
- Deluge: the global water cataclysm described in Genesis
- deterministic: a constrained process generating a certain outcome
- empirical: capable of physical observation or measurement
- epistemology: discipline concerned with the theory of knowledge or how one can know
- eustasy: global sea level and its fluctuations in time
- induction: a form of logic in which the conclusion probably follows from the premises (cf. Table II)
- isotropic: having uniform properties throughout space; the assumption that space is uniform

³These questions can only be properly answered from the Bible, which must govern research in the other fields as well lest false conclusions be reached (Psalms 36:9; 119:89–91, 130. Proverbs 2:1–6)

jurisprudence: the body, system, or philosophy of law and its application

lithostratigraphy: correlation of rock units based on lithology (rock type)

macro/microeconomics: economics on the national/global scale and business enterprise/individual scale, respectively

metaphysics: study of the nature of ultimate reality

neocatastrophist: one who stresses the importance of catastrophic or episodic geologic events

Neocuvierist: a term loosely applied to neocatastrophists who envision large scale catastrophes and hold to periodicity (secular) or accord great importance to presumed postdiluvian catastrophes (creationist)

Occam's Razor: the principle, attributed to William of Occam, that the simpler of competing views is more likely to be correct

ontology: study of the nature of being

oxymoron: a self-contradictory term (e.g. compassionate cruelty)

paradigm: a mental framework for integration of particular data (cf. Figure 1)

parsimony: stinginess or thriftiness; in philosophy, avoidance of superfluous premises

positivism: the belief that only empirical propositions are meaningful and that metaphysics is impossible

quietism: the belief that Earth history has been free of major (inter-regional or global) catastrophes

scientism: idolization of science; the view that true knowledge comes only via natural science

stochastic: an unconstrained (random) process generating an uncertain outcome

stratigraphic sequence: a package of conformable strata, often cyclic; in sequence stratigraphy, the term is applied at a regional scale, usually comparable to a group; otherwise, it is usually a smaller sedimentary package of formation or lesser rank

unconformity: a contact between rock units that does not conform to the geometry or fabric of the adjacent beds; it often represents an erosion surface

unifiable: the idea that natural phenomena are capable of being related logically (often mathematically) to each other

uniformitarianism: the doctrine that geologic processes in the past did not differ substantially from those observed in the present

Wernerian: the stratigraphic school of thought that taught that successive ages were characterized by predominant lithologies (e.g. Carboniferous, Cretaceous)

worldview: a person's (or group's) view of reality, sum of beliefs, philosophy of life

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- BSN: *Bible-Science Newsletter/Bible-Science News*
- CENTJ: *Creation Ex Nihilo Technical Journal*
- CRSQ: *Creation Research Society Quarterly*
- JSP: *Journal of Sedimentary Petrology*
- N: *Nature*
- O: *Origins*
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Unfortunately, 19th-century scientists were just as ready to jump to the conclusion that any guess about nature was an obvious fact, as were 17th-century sectarians to jump to the conclusion that any guess about Scripture was the obvious explanation . . . and this clumsy collision of two very impatient forms of ignorance was known as the quarrel of Science and Religion.

Thomas Aquinas

An Introduction to the Geology of Verde Valley, A Different Perspective

Van Andel Creation Research Center Field Study Note

Emmett L. Williams, George F. Howe, and John R. Meyer*

Abstract

The geology of Verde Valley in central Arizona near the Van Andel Creation Research Center is introduced. Characteristics of the Verde Formation are discussed along with the possibilities that it may have been deposited either from water being ponded by a lava dam blocking water flow out of the valley or from water being ponded in a closed graben. The development of the Mogollon

Rim and the various gravel beds near or on the Rim are presented from the aspect of Flood geology. A monoclinical fold feature within the valley is examined. The many volcanic formations within the valley need to be studied to determine if they were deposited either subaqueously or subaerially. Suggestions are offered for possible creationist field work in Verde Valley.

Introduction

The Verde Valley of central Arizona is in the transition zone (formerly called the “mountain or central highlands region”) between the Colorado Plateau and Basin and Range physiographic provinces (Figure 1). It is 20 miles wide and 30 miles long. The valley has as its boundaries, the Mogollon (muh-ge-own) Rim to the northeast, and the Black Hills to the southwest (Figure 2). The Black Hills separate Verde Valley from Chino Valley where the Van Andel Creation Research Center is located. As you drive from Chino Valley along U. S. Highway 89A, the first views of Verde Valley are from Mingus Mountain in the Black Hills (Figure 3).

The Valley has been inhabited by man for probably over 1000 years. An adequate water supply, particularly along the Verde River, which drains the valley, encouraged human habitation. The first white man entered the valley in 1583. Mining activity in Jerome was considerable from the late 1800's until 1953. Jerome, once a ghost town, is mainly a tourist attraction today with the Jerome State Historical Park Museum recalling the mining era. Camp Verde, Clarkdale and Cottonwood (Figure 4) are

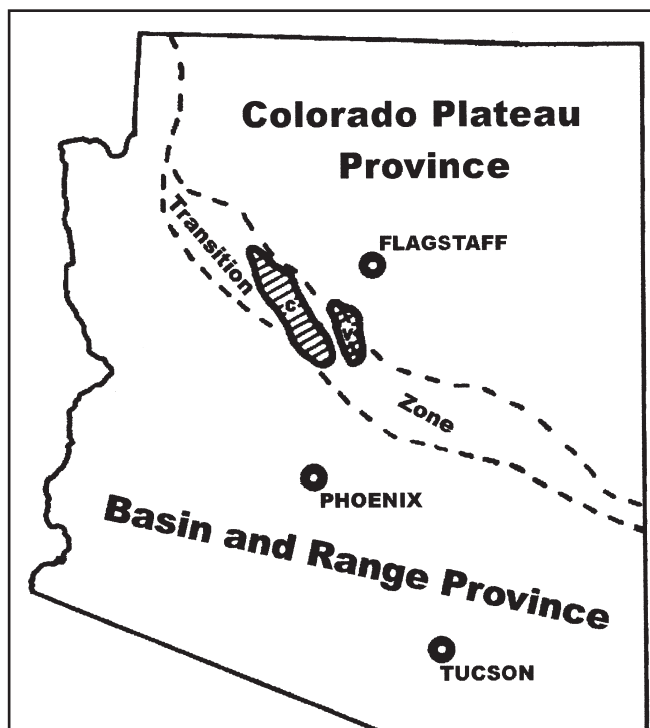


Figure 1. The locations of Verde Valley and Chino Valley within the Transition Zone physiographic province in Arizona (after Nations, Hevly, Blinn and Landye, 1981, p. 134). C: Chino Valley; V: Verde Valley.

main towns in the valley. Sedona, in the beautiful red rock country just below the Mogollon Rim, is a center of the New Age movement and an artist's community catering to tourists.

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Figure 2. The Black Hills (in the background) as seen from Chino Valley, looking east on a cold March morning. Verde Valley is on the opposite side of the Black Hills.



Figure 3. Looking northeast into Verde Valley from Mingus Mountain in the Black Hills. The Mogollon Rim can be seen on the horizon forming the northeastern boundary of the valley.

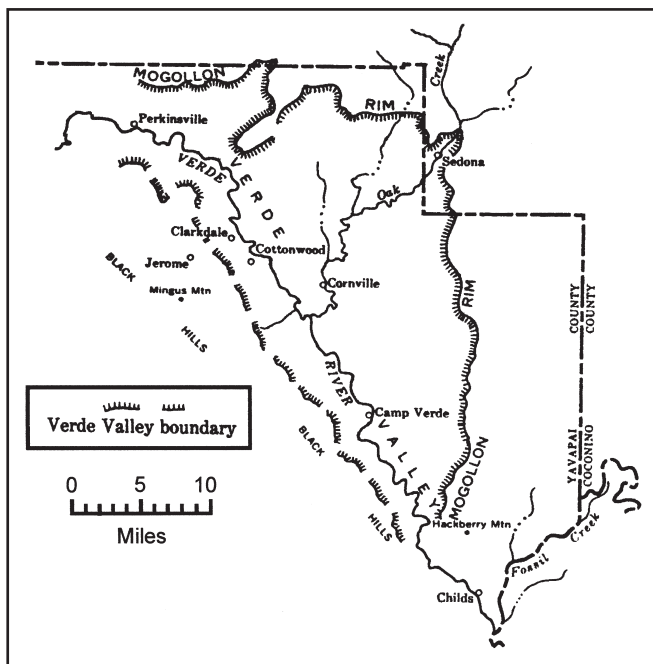


Figure 4. A map of Verde Valley in Yavapai and Coconino Counties, Arizona (after Twenter and Metzgar, 1963, p. 6).

Verde Valley has been downfaulted (Figure 5) from the surrounding landscape (Nations, Hevly, Blinn and Landye, 1981, p. 133; Chronic, 1983, p. xiii; Lindberg, 1986, p. 136) which suggests that the entire valley and the Black Hills were once part of the Colorado Plateau (Lindberg, 1986, p. 138). However Peirce and Nations (1986, p. 112) postulated that the southern margin of the Colorado Plateau (Mogollon Rim) may have developed by erosion in Oligocene time and not by later Miocene faulting. (Also see Peirce, Damon and Shafiqullah, 1979.) A discussion of these concerns will be presented later.



Figure 5. Looking northeast into Verde Valley from the town of Jerome which was built along the trace of the Verde Fault. The vertical displacement along this fault is about 6000 feet (Ranney, 1989, pp. 7, 28; also see Lehner, 1958, pp. 572-573). The Mogollon Rim can be seen on the horizon.

A reconnaissance was conducted to investigate the geology of Verde Valley. Creationist interpretations are needed for the origin of several interesting geological features in the region. Introductory comments are presented to acquaint creationists with field work opportunities near the Van Andel Research Center. It would be helpful in the future to perform an in-depth examination of the valley.

Verde Formation

Olaf Jenkins (1923, pp. 65-81) named and described the characteristics of the Verde Formation. This formation is unique to Verde Valley and covers an area of about 300



Figure 6. An outcrop of the Verde Formation along Highway 30 in Yavapai County where the highway crosses the Verde River near the town of Cornville.

square miles. Jenkins (p. 69) noted that the formation consisted "...of white limestones, gravels, clays and saline materials." He claimed that the deposits developed:

...as the result of sedimentation, produced both mechanically and chemically, from a body of inland water, a lake of varying briny content, which was formed through the damming of the Verde River by surface lava flows (p. 69).

Mahard (1949, p. 104) measured two incomplete sections of the Verde formation and observed that it:

...is not composed of beds of material which were spread uniformly over wide areas but instead is built up of thin lenses of material of varying composition, the lenses overlapping and interfingering with one another.

Mahard identified limestones which he suggested "...were deposited in a series of playa lakes as marls" (p. 106). He found sandstones, siltstones, and claystones cemented by calcium carbonate within the formation. He speculated that salt bed deposition occurred by evaporation in an arid climate possibly in separate playas (p. 107) and he also found lava flows interbedded with members of the Verde Formation.

Lehner, in his study of the Clarkdale Quadrangle (1958, pp. 557, 559), noted that the Verde Formation is a thick limy lacustrine deposit consisting of fine-grained carbonate rocks including limestone, calcareous sandstone, limy siltstone and marl. He explained that gravel beds and basalt flows are marginal to and intertonguing with the carbonate rocks. Ranney (1989, p. 29) stated that the Verde Formation is composed of white limestone, brown mudstone, salt and other evaporites. He claimed that the formation is over 3000 ft. thick in the central portion of the Verde Basin. Nations, Hevly, Blinn and Landye (1981, p. 134) described the formation as "...a sequence of interbedded limestones, mudstones, sand-

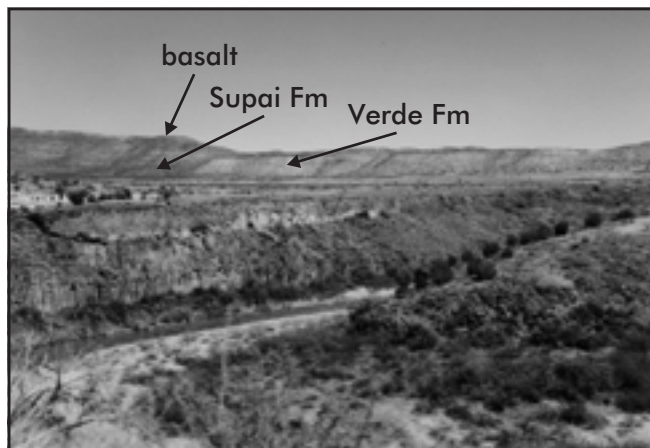


Figure 7a. A view from the Verde Canyon Railroad across Duff Flat which is underlain by lava flows. The Verde River has incised a steep wall gorge in the flows. Likely more water flowed in the Verde River in the past to form this box canyon. On the horizon, the limy beds of the Verde formation (on the right) unconformably overlie the Supai Formation. A basalt layer caps the Supai. (Jenkins, 1923, p. 68; Mahard, 1949, p. 108, plate 4).

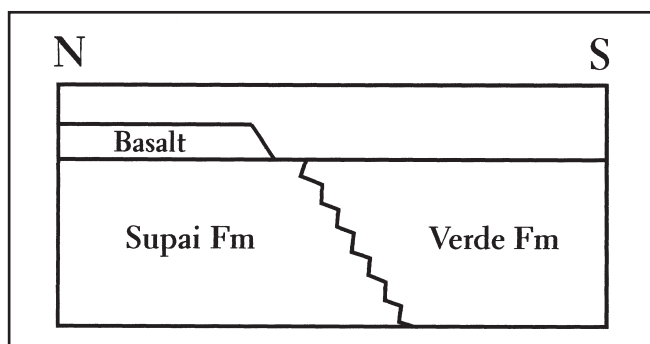


Figure 7b. Generalized stratigraphic relationship of the Supai and Verde formation contact in Figure 7a.

stones, conglomerates, evaporites and volcanic rocks..." They discussed the types of fossils found within the formation (pp. 139–146). Anderson and Creasy (1958, p. 59) claimed that the Verde formation is lithologically diverse and its beds are lenticular or as Twenter and Metzger (1963, p. 49) so aptly commented that the formation "...is a complex assemblage of rocks having a variety of lithologic characteristics." Figures 6 and 7 show some outcrops of the Verde Formation. Concerning the postulated dam that supposedly ponded the water within the Verde basin, Mahard (1949, p. 104) explained:

Jenkins' (1923) original hypothesis regarding the origin of Lake Verde required blocking of the Verde River by a basalt and pyroclastic dam 7 to 15 miles south of Camp Verde. No detailed study of the dam was attempted.... but a reconnaissance of the area reveals a series of flows and tuff deposits now deeply trenched by the Verde River, which are judged to be



Figure 8. Looking north and upstream along the Verde River from Childs, Arizona where a lava deposit could possibly have blocked any water flow from exiting Verde Valley in the past.

more than adequate to effectively impound the river waters.

Figure 8 shows a view in the lower Verde Valley where the river has cut through lava deposits. Nations et al. (1981, p. 133) noted that tectonism coupled with volcanic activity dammed the Verde Valley to allow accumulation of the sediments that comprise the Verde Formation. Ranney (1989, pp. 28–29) offered a different interpretation of how the waters became entrapped in the Verde basin. After the Verde Fault was active, causing the downdropping of 6000 ft. of rock to generate the Verde Valley,

Continued and rapid subsidence of the valley floor caused the Verde River to become sluggish and, eventually, impounded. (Initially geologists believed that lava from the Hackberry Mountain volcano, near Childs, had caused the river channel to become dammed, but recent studies on the age of these lavas suggests that they are too old) [p. 29].

Deposition of the Verde Formation — Young Earth Perspective

How did the water, from which the Verde Formation was deposited, become ponded in Verde Valley? Creationists (Austin 1996; Austin and Snelling, 1998; Snelling 1999a, b) have shown that potassium-argon and argon-argon dating of volcanic rocks often is unreliable. Thus the radiometric age of the lava that could have dammed water in Verde Valley is likely subject to the same errors. Therefore a volcanic rock dam in the valley cannot be ruled out as being too old to be involved in the ponding of water.

There is certainly a possibility that a lava dam upstream from Childs, Arizona (Figure 8) may have tem-

porarily prevented water flow away from Verde Valley. Also downfaulting of the valley could have trapped water in the graben. Possibly after more field work, the following issues may be addressed.

- Was it a lava flow that dammed water in Verde Valley or did downfaulting accomplish the task or did both contribute?
- Was the water that was ponded in the valley, trapped Flood water?
- If it was trapped Flood water, was it enriched by precipitation during the post-Flood ice age?
- Did Flood water escape or evaporate either before the formation of a dam or before continued downfaulting closed the graben? Did a later lake form because of considerable ice age precipitation in the closed basin resulting in the deposition of the Verde Formation.
- How deep was the postulated lake or lakes? The Verde Formation is over 3000 feet thick at the center of the valley (Ranney, 1989, p. 29). The uniformitarian postulate of many playa lakes evaporating over thousands of years could cause the accumulation of 3000 feet or more of sediment. However from a young earth viewpoint, the evaporation of one sediment-laden deep lake in a brief period of time could account for thousands of feet of deposit.
- Was water being fed into a ponded lake from higher elevations on the Colorado Plateau during the period of deposition of the Verde Formation? Was this an occasional or a continual early post-Flood drainage?
- When did the trapped water in the valley finally breach or overtop any possible geographic obstacle initiating the flow of the ancestral Verde River? The Verde has incised lava flows (Figures 7 and 8) along its path and it appears that considerably greater volumes of water must have flowed along its course in the past because the present river is underfit.
- Was there any erosion of the Verde Formation as the newly-developed flow drained the valley?
- Possibly during a post-Flood drying period did a drop in the regional base-level and ground flow discharge cause a reduction in the flow volume of the Verde River? For a similar proposal, see Froede, 1996b.

The Mogollon Rim and “Rim Gravels”

The term, Mogollon Rim or Escarpment, (Figures 3 and 5) has been used to identify the southern topographic boundary of the Colorado Plateau province in Arizona. It has been suggested that the Rim is actually the southern terminus of the Permian cliff formers (Coconino, Toroweap and Kaibab formations) in central Arizona (Peirce and Nations, 1986; Peirce, Damon and Shafiquallah, 1979). Peirce (1984, p. 8) noted that:

The Mogollon... Escarpment of central Arizona is one of the State's spectacular natural attractions, especially when viewed from the rim of its precipitate cliffs. The name "Mogollon" was apparently derived from Juan Iguacio Flores Mogollon, a former Governor of New Mexico during the period 1712-1715...

In the past the Rim frequently was called the Verde Breaks in the Verde Valley region (Mahard, 1949, p. 103).

There has been considerable discussion in the geologic literature whether the rim has resulted primarily from the process of either erosion or faulting. Now, however, it is considered that erosion was the major actor in producing the rim with faulting playing a lesser role (Hunt, 1956; Lehner, 1958, p. 516; McKee and McKee, 1972; Peirce, Damon and Shafiquallah, 1979; Nations et al., 1981, p. 133; Peirce and Nations, 1986; Ranney, 1989, pp. 24-28; 1990, pp. 52-57). And it is thought that continual erosion has caused the ancestral rim to retreat about 4 to 5 miles to its present position (Ranney, 1990, p. 53), leaving isolated buttes and mesas as remnants of the Plateau cliff formers in Verde Valley (Mahard, 1949, p. 103; Lehner, 1958, p. 516; Beus, 1999). A generalized stratigraphic column of the valley is shown in Figure 9.

Deposits of gravel have been found on the Colorado Plateau near the Mogollon Rim as well as just below it. The deposits on the rim are referred to as "Rim gravels", which likely were transported from the south to their present position. A different deposit of gravel, located at the foot of the rim is the Beavertail gravels. They consist of two types of gravel, the lower deposit contains angular cobbles from the Kaibab and Coconino formations. The upper gravel deposit of rounded pebbles are considered to be Paleozoic and Precambrian in the uniformitarian scheme. The lower layer of gravels is thought to be talus debris from the ancestral Mogollon Rim and the upper layer likely was transported from the south as the "Rim gravels" were. Another recognized deposit—Slide Rock gravel—probably was derived from the north and trans-

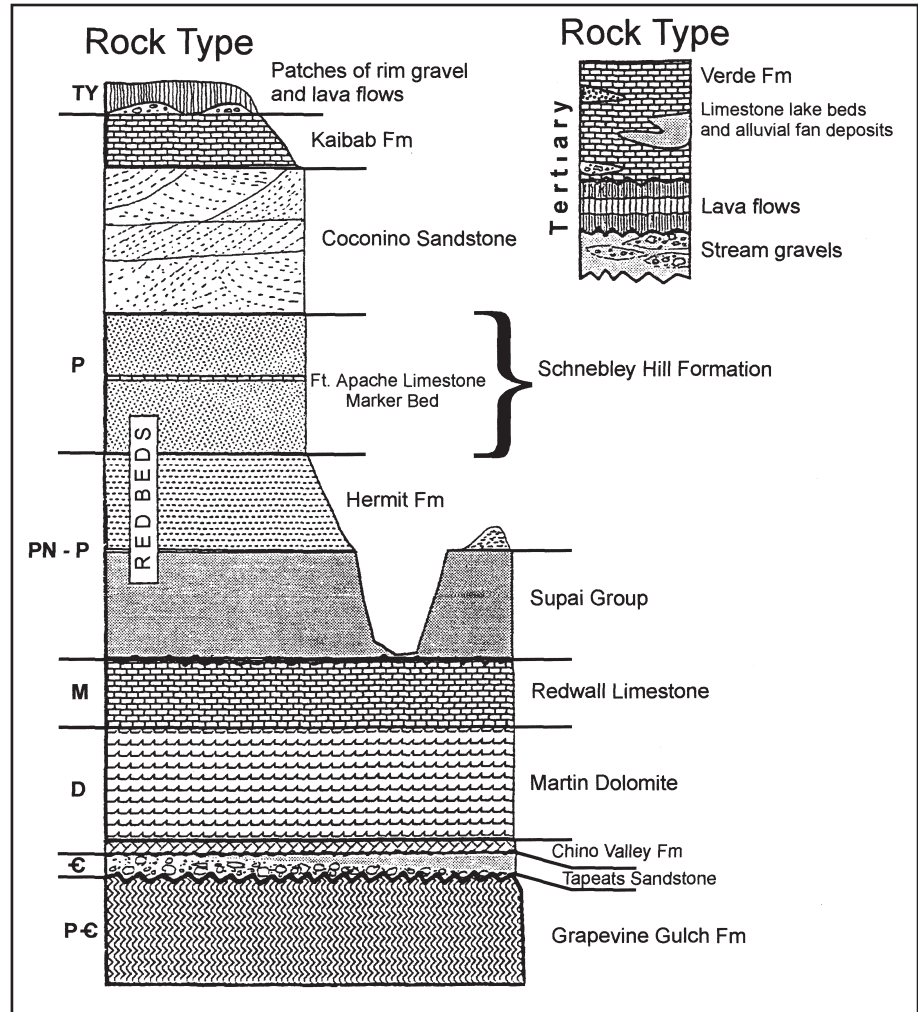


Figure 9. Stratigraphic column of Verde Valley (after Beus, 1999)

PC: Precambrian

C: Cambrian

D: Devonian

M: Mississippian

PN-P: Pennsylvanian-Permian

P: Permian

TY: Tertiary

ported southward. For discussions and locations of these deposits, see Ranney, 1989, pp. 24-28; Peirce and Nations, 1986.

All of the gravel beds have been employed to suggest a uniformitarian history of the region including the location of the ancestral Mogollon Rim. These deposits need to be interpreted within a Flood framework as Klevberg (1998) did with the Big Sky Paving gravel in Montana. For instance, the Arizona gravel deposits discussed above are considered to be fluvial in origin. However some of the gravels may have been deposited by late-stage Flood currents, eroding recently deposited sediments and moving the debris northward. Other gravel beds may have been left by retreating Flood water.

Both the development of the Mogollon Rim and the placement of the gravel deposits need to be cast into a creationist framework and time table.



Figure 10a. The railroad bend structure, a monocline, along the Verde River approximately seven miles north of Clarkdale, Arizona.

Railroad Bend Structure

About seven miles north of the Verde Canyon Railway depot at Clarkdale is a railroad cut along the Verde River where the river enters the box canyon shown in Figure 7. Along the cut is a unique geological feature (Figure 10a) which Mahard (1949, pp. 122–123) called the railroad bend structure. This feature, where the Verde Formation is in contact with the Supai Formation, was described by Jenkins (1923, p. 70). The Verde overlies a gravel bed which rests on a basalt layer (Figure 10b). Jenkins identified a fault between the Supai, the basalt and the lake deposits of the Verde Formation.

However Mahard identified the feature as a monoclinal fold. He did not find a fault between the lava and the Supai, but he detected some evidence of baking at the contact. The gravel layer consists mainly of Supai cobbles. It maybe of interest to carefully examine this fold and interpret the timing of the events that led to the development of this feature in the context of the Flood and its aftereffects.

Volcanics and Mineral Deposition

Verde Valley contains many volcanic rocks in the form of basalt, rhyolite (Figure 11), tuff and gabbro. Thus any creationist speculation concerning the geologic history of the valley must account for this volcanic activity. Particularly it would be helpful to identify which lava flows possibly formed under either subaqueous or subaerial conditions.

It is known that the massive sulfide (copper ore) deposits in the Jerome area were deposited subaqueously along with adjacent volcanic formations (Anderson and

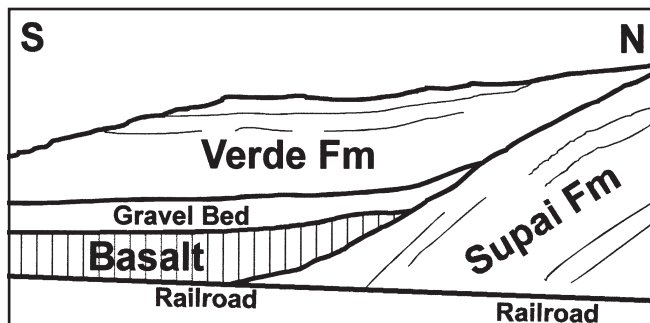


Figure 10b. A schematic diagram illustrating the relationship of the geologic formations in the railroad bend structure (after Mahard, 1949, plate, 9).

Nash, 1972; Lindberg, 1986; Ranney, 1989, pp. 2–8). The presence of pillow lava structures convinced geologists that these materials were deposited subaqueously. However pillow lava is not the sole indicator of subaqueous lava flows. It is now known that sheet flows of lava occur subaqueously without the formation of pillow lava (Fisher, 1984; Kennish and Lutz, 1998). Even welded tuff has been reported to be formed underwater (Kokelaar and Busby, 1992). These changing concepts may encourage creationists to view volcanic rocks in a different light to determine if they were deposited underwater during the Flood (Froede, 1996a; 1999; Williams, 1998; Williams, et al., 1998). Possibly some volcanic rocks once thought to have formed after the Flood may have been deposited during the Flood.

Conclusions

An introductory examination of the geology of Verde Valley from a creationist perspective has been completed. Possible young earth-Flood model applications have been suggested. The Van Andel Creation Research Cen-



Figure 11. Spires of Deception rhyolite in Deception Gulch southwest of Jerome, Arizona.

ter (VACRC) offers a location from which field studies of Verde Valley can easily be accomplished. Also John Meyer's knowledge of the region could facilitate any future field work. It is hoped that other field workers will examine this beautiful valley and present ideas on its origin in relation to the Flood.

Major items of study in the valley may include a careful delineation of the Verde Formation with the timing and conditions of deposition. It appears that 3000 feet or more of sediment may have accumulated from a deep body of water in the late stages of the Flood or soon thereafter. This body of water could have maintained considerable depth for sometime if continual or intermittent drainage from the Colorado Plateau supplied water into the closed graben. Also high amounts of post-Flood precipitation could have added water to the lake. A study of the development of the Mogollon Rim—whether by erosion or faulting—is encouraged. The relationship of the various gravel deposits around the rim to the Flood dynamics could be analyzed. The volcanic layers within the valley can be studied to determine if the formations developed subaqueously or subaerially which may yield evidence of the timing of the origin of the valley. These and other subjects would provide enjoyable research close to the VACRC.

Acknowledgments

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Appendix

Prior Creationist Efforts on the Colorado Plateau and Transition Zone of Arizona

Creationists have done considerable field work on the Colorado Plateau. Much of this work has been summarized in Froede et al., 1997. References for the work of Steve Austin and Walter Brown on the plateau can be found in this article as well as previous studies sponsored by the Creation Research Society. Included are reference to canyon formation papers, Kaibab squirrel investigation, biological isolation study, Arizona meteor crater effort, strata interbedding work and ichnofossil speculations. This research was done by Jeremy Auldane, Don DeYoung, George Howe, the late Walter Lammerts, John Meyer, Paul Rosnau, Bill Waisgerber, Emmett Williams, and Glen Wolfrom.

The geomorphology of Arizona was discussed in Froede et al., 1997. The Pikes Peak Iron Formation was the subject of Froede et al., 1998a. An early Flood setting was proposed for the origin of this banded iron material. Intrusive and extrusive volcanic rocks around VACRC were examined by Froede et al., 1998b who suggested that the intrusive volcanics were formed subaqueously, whereas the extrusive deposits formed after the Flood.

More ichnofossil work (Auldane et al., 1997a, b) has been reported as well as a study on the origin of Kanab Canyon on the Colorado Plateau (Williams, Goette, Meyer, 1997).

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It is absurd for the Evolutionist to complain that it is unthinkable for an admittedly unthinkable God to make everything out of nothing, and then pretend that it is more thinkable that nothing should turn itself into anything.

Thomas Aquinas

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Book Review

Creation and Change: Genesis 1.1–2.4 in the light of changing scientific paradigms by Douglas F. Kelly
Christian Focus Publications, Great Britain. 1997. 272 pages, \$15.

Reviewed by John K. Reed

One of the interesting aspects of modern creationism is the leadership vacuum displayed by the professional theologians of the nineteenth and twentieth centuries and the filling of that vacuum by the laity, especially professional scientists. As we are all aware, sometimes the most vigorous defenders of evolution and uniformitarianism (and most vociferous critics of creationists) are theologians and church leaders. This has resulted in the inability of Bible-believing Christians to affirm God's truth and respond to the assaults of modern naturalism with the full spectrum of truth. And yet naturalism has shown itself to be the most vulnerable to arguments from the theological and philosophical disciplines once the scientific facade is penetrated. Integrating those foundational insights with scientific experience will result in the more rapid downfall of the naturalist-uniformitarian establishment. This reviewer has attempted to highlight both the need for and the potential of this type of “combined-arms” assault (Reed, 1996, 1998). One of the major conclusions of those works was the need for professional Christian theologians and phi-

losophers to take a key part in the battle against naturalism.

Dr. Douglas Kelly, Professor of Systematic Theology at Reformed Theological Seminary in Charlotte, NC, has stepped into the breach with a remarkable book that integrates his deep theological insight with the efforts of many creation scientists. Many names familiar to the CRS readership jump out from the numerous footnotes. Although Dr. Kelly is not a scientist, he has obviously become familiar with many aspects of the scientific debate. He brings the refreshing candor of a theologian committed to the plain truth of God's revelation as the only reliable basis for certainty in understanding earth history. He admits frequently to his scientific shortcomings, but always returns to the position that God's Word is preeminent over any scientific “fact” in defining historical truth. He understands that exegesis is defined by first understanding the biblical text itself, and not assessing its truth by reference to modern natural history. In short, his position appears to avoid the error of so many modern theologians who want to balance the Word of God

against the conclusions of Sagan, Gould, Dawkins, et al., and then inevitably bow to the pressure of the secular “experts”. Dr. Kelly defends the epistemological primacy of the Scripture, and stands firm, even when challenged by the scientific elite. In the ongoing debate in conservative reformed circles between advocates of sound biblical interpretation and those who want to maintain their “intellectual-elite-stamp-of-approval ratings,” Dr. Kelly’s book will provide timely support to the former and a challenge to the latter. That challenge is to move to the forefront of what he terms a “paradigm shift” away from naturalism and towards an integrated Christian worldview.

Creation and Change is presented as an expanded outline and interpretation of the creation account of Genesis. Successive chapters step through the six days of creation (yes, they were real days), and add supporting discussion of key theological issues. The wealth of footnotes and end-of-the-chapter expanded notes is tremendously beneficial. These combine with sufficient indexed references to make the book useful to a broad audience. Neophytes can plow through the basic text without being sidetracked, and old hands can follow many interesting side trails. Although CRS members may be familiar with many of the scientific arguments woven into the text (and may pick a few nits one way or the other over pet theories), any and all will benefit from the author’s expertise in Hebrew, Old Testament studies, and systematic

theology. Creation from preexisting matter, the Gap Theory, the Day-Age Theory, and the more trendy “Framework Hypothesis,” popularized by Dr. Meredith Kline, all emerge tattered and tarnished by Dr. Kelly’s insistence on proper exegesis and a theologically sound interpretation of the relevant passages. Those who assert the primacy of science and seem to use the Bible to add theological shine to their scientific theories (Hugh Ross, Davis Young, etc.) will have reason to regret the publication of this book.

I strongly recommend this book. It has much to offer to a broad audience. It is well researched and referenced. It presents significant exegetical and theological insights. Most of all, it hopefully presages a vanguard of theologians that stand firm on the truth of God’s Word in the face of intellectual pressure from the scientific elite, see from their unique perspective the many weaknesses of modern naturalism, and join the scientists in the trenches.

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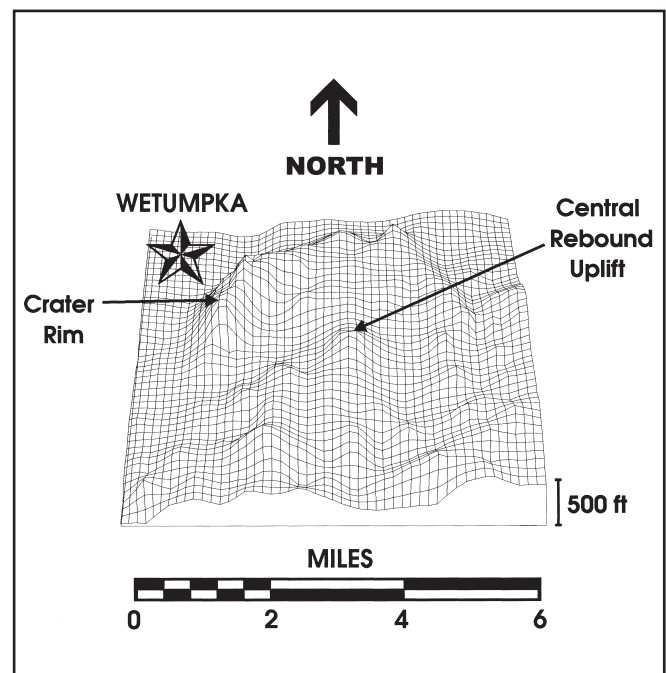
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Errata

CRSQ 36(1), June 1999, page 8. The first sentence of the first full paragraph should read, “The chloroplasts also possess an electron transport system for producing ATP.”

CRSQ 36(1), June 1999, page 34. The wrong picture was used in Figure 4. The correct picture is shown to the right.



Notes from the Panorama of Science

Creation Research Society Board Member Teaches at Russian University

Through the efforts of Natasha Kolosov, a committed Lutheran creationist who has an M.S. in Molecular Biology from Novosibirsk State University (NSU), a course entitled "Philosophy of Science: Creation v. Evolution" was approved to be taught at NSU during April/May, 1999. NSU is one of the top three scientific universities in Russia rivaling the University of Moscow and the University of St. Petersburg for the best reputation in scientific research and instruction. It is the site of the Siberian Division of the Russian Academy of Science and has 22 institutes each with 50 to 100 experimental laboratories. It is located in the city of Novosibirsk (New Siberia), the capital of Siberia with a population of approximately 1.5 million people. It is famous for the "Akademgorodok," a 500-acre campus on the west side of the city. The Creation Research Society (CRS) encouraged Dr. David A. Kaufmann, a retired Professor of Exercise Science at the University of Florida, to teach the course. Kaufmann was told that he would face an antagonistic audience since for seven decades atheistic evolution has been the dogmatic doctrine taught as the foundation of all scientific disciplines at the University. NSU is the scientific home of Doctors V. Ratner, N. Kolchanov, I. Zacharov and D. Kondakov, all avowed evolutionists.

Kaufmann also gave lectures on scientific creationism and theistic evolution at the Lutheran Theological Seminary at Novosibirsk, a seminary sponsored and supported by the Russian Project of Concordia Theological Seminary (CTS), Fort Wayne, IN. Mrs. Kolosov, whose husband Vladimir is a seminary student at CTS, was the administrator and translator for the course. Kaufmann presented seminars on scientific creationism, theistic evolution and abortion to the laypeople of Bible Lutheran Church, Novosibirsk. He prepared 120 transparencies, some translated into Russian, on every aspect of creation v. evolution. He studied conversational Russian for two months and often interjected clauses or sentences in Russian during his presentations. The course was offered for five weeks: two one-hour lectures each week followed by discussion and debate. The room assigned for the course had only 30 chairs in it, but when 49 faculty and students attended, it was transferred to a larger classroom.

Sessions 1 and 2: Kaufmann greeted the class in Russian saying it was a honor for him to be invited to teach the latest developments in creation vs. evolution at a Russian University. His lecture: "Is Evolution a Fact, Law or Theory or None of the Above" was received with caution by the audience. He was immediately attacked by

Dr. Dimitry Kondakov, who said that "creationistic professors are unfit to teach at a university." Then Dr. Yuri Kulakov, a Professor of Physics, took the floor and gave a 15 minute polemic on how basic physics cannot explain higher reality so there must be a "higher reality" that is the Supreme Being. Kaufmann was surprised but pleased to have a Russian Professor defend the doctrine of creation. After the discussion, Kaufmann was surrounded by faculty and students who asked him many questions through the translator. Dr. Kulakov invited Kaufmann and translator Kolosov, to his apartment the next day where they discussed a scientific paper he had written. Kaufmann encouraged him to submit it for publication in the *Creation Research Society Quarterly* (CRSQ).

Lectures 3 and 4 were on "Models or Origins" and "Presuppositions not Facts Determine the Conclusion". Again Kaufmann was attacked by Dr. Kondakov who said that creation science was really religion. Kaufmann replied that he did not bring a Bible, mention anything in the Bible or even anything that was theological. He only referred to the "Creator" of the creation model. He then differentiated between Biblical Creationism and Scientific Creationism claiming he was teaching Scientific Creationism. Kondakov adamantly claimed that creation science was religion. Heated debate followed. The Head of the Philosophy Department, Dr. A. Ademenko, stood up and verbally castigated Dr. Kondakov for his narrow view. Then Dr. Yuri Ivanov took the floor and gave a short polemic on why he scientifically believes that changes in species are very limited. This too was quite a surprise: A second creationist was on the faculty of NSU. Dr. Ilia Zacharov, Head of the Laboratory in the Institute of Cytology and Genetics and who teaches a course in Evolution, took the floor holding up an American textbook on biological evolution. He claimed that "real American scientists were evolutionists." He claimed Kaufmann's denial of the phyletic trees of macroevolution is a denial of the scientific method. After a short discourse against creationism, he demanded that CRS send books defending creationism for the three libraries at NSU. Kaufmann replied: "It will be done." At the end of the debate, Kaufmann was surrounded by faculty and students. Two students thanked him for his presentation and patience with the faculty antagonists. One student said he was a practicing member of the Russian Orthodox Church and wanted to know if he could adopt theistic evolution. Kaufmann said it was a "logical contradiction" and disloyal to the Word of God. He gave the student a copy of his article "Can A Lutheran Believe in Theistic Evolu-

tion? No Way! No Way! ” As Dr. Kondakov was leaving the room, Kaufmann shook hands with him and gave him a Creation Research Society pen.

Lectures 5 and 6 were on: Creative Processes, Scientific Laws Correlating with Creationism and the Age of the Earth. There was general acceptance of the definition of creating something out of nothing (Heb. bara) as distinguished from making (Heb. asah) and forming (Heb. yatsar) something more complex out of already created matter. God created time, space and matter and from them He made non-living and living structures. Man cannot create anything in the strict sense; he can only make/invent more complex structures from already created matter. Kaufmann then demonstrated how the laws of biogenesis, thermodynamics and mutations are predicted by the creation model and go against natural processes creating or making anything. A big argument arose over the Second Law of Thermodynamics. Dr. Kodakov claimed the law applied only to closed systems. Kaufmann replied it applied to all systems, both open and closed. Kondakov said Kaufmann was wrong. Kaufmann quoted a Dr. Ross of Harvard as stating: “There are no known violations of the Second Law of Thermodynamics. The Second Law applies equally well to open systems. It is important to make sure this error does not perpetuate itself.” Kondakov said Ross was wrong. Dr. V. Ratner, the primary author of an English textbook, *Molecular Evolution*, took the floor saying that systems can become more complex naturally; they did not need a program and converter mechanism. He foolishly denied the facts about mutations (they are random occurrences, they are very rare, 99% are neutral or harmful, and you need millions of beneficial mutations to occur at the same time on different genes on the same organism to produce a significant structural change). Kaufmann mathematically showed how the chances of two beneficial mutations happening at the same time on the same gene are 10 to the 14th power or 1 in 100 trillion. Kaufmann stated “When you pile improbability on improbability on improbability, you get an impossibility.” Ratner continued to deny this mathematical truth. The arguments for a young earth (non-geophysical reason for the seven-day creation week which was established in Genesis 1 and Exodus 20:11, primary evidence of ancient history only goes back to 3500 B.C., the total invalidity of all geochronometric dating methods in which 76 studies resulted in 76 vastly different answers for the age of the earth, and population statistics that predict it would take only 6875 years to produce today’s world population of 6 billion people using reasonable assumptions of population growth) generated peaceful discussion, and many were impressed that there are strong arguments for a young earth. At the end of the session, Dr. Kondakov again attacked the presentation as religious and not sci-

entific. Kaufmann replied there are three great bodies of knowledge drawing on the blackboard three intersecting circles of science, philosophy and religion. Kondakov adamantly stated that religion was not a body of knowledge. At the end of the discussion, Dr. Boris Chadov, Professor of Biology, asked for copies of Kaufmann’s notes as he wanted to use them in his course on Evolution. These were copied and given to Chadov. This is a real accomplishment: A Russian scientist teaching about creation in a course on evolution. Although the lectures were scheduled from 5:45 p.m. to 7:45 p.m., Kaufmann and the translator rarely left before 8:30 p.m.

Lectures 7 and 8: Kaufmann discussed the fossil record and the origin of life. He claimed that if evolution were true, there would literally be millions times millions of intermediate forms found in the fossil record. In actuality, we really find none. After the lecture on the fossil record, Dr. Yuri Ivanov, a Research Scientist at the Institute for Cytology and Genetics, took the floor and gave a 20 minute presentation on why he believed the fossil record showed “no intermediate forms” and that the alleged half-reptile, half-bird, Archaeopteryx, was an extinct bird. Kaufmann then lectured on “Can Evolution Make A Functional Protein?” in which he demonstrated that to make a functional protein 1) you must have only left-handed amino acids (A.A.’s), 2) you must have only peptide bonds, 3) the A.A.’s must be in exactly the correct sequence and 4) you must keep any organic molecules floating around in the environment from entering the chain of A.A.’s. When isomers are left to themselves in nature, they racemize or change back to a mixture of left-handed and right-handed A.A.’s. Evolution does not have a program and converter mechanism to assure only left-handed A.A.’s will enter the chain. There must be a program (DNA) and power converter mechanism (RNA) to accomplish this task. Both DNA and RNA were designed and developed by the Creator. Evolution has only a source of energy and an open system, but its mechanisms of mutation and natural selection cannot make DNA and RNA. Using the example of a scrabble game, Kaufmann showed how random methods of evolution spell a jumbled, nonsense word that has no meaning or function. For the first time the audience appeared to be absorbed with the impact of the presentation. Dr. V. Ratner took the floor and agreed that it is statistically impossible for chance mechanisms to make a functional protein, but he claimed scientists in the future would discover an evolutionary mechanism for this supposed process. For 25 minutes a debate between evolutionists Kondakov, Zacharov and Ratner and creationists Kulakov, Ivanov and theistic evolutionist, Chadov, occurred. Kaufmann was asked what was his personal religious belief. He replied he was a Lutheran. He stated that Martin Luther was a creationist, and all true Lutherans

were creationists. He was taught evolution in high school, college and two secular, research universities, but the argument for evolution was based on speculations (pre-suppositions), and he did not see the scientific data correlating with the predictions of the evolution model. At that point, a woman biochemist claimed the formations of crystals can overcome the thermodynamic law of entropy production and that the biochemical evolution of the first life could do it also. Kaufmann replied that crystals and highly ordered organic molecules are not in the same class. When a crystal is broken, the smaller crystals are physically and chemically identical to the original crystals. This is never observed with organic molecules; when the original molecule is split, lesser organic molecules result and part of the original information is lost. She was in effect proposing a pseudolaw of decreased entropy by crystallization. After the session ended, Dr. Ivanov approached Kaufmann inquiring whether it was possible to submit a research paper to the *Creation Research Society Quarterly* (CRSQ) on the impossibility of mutations creating a new species. During the week Kaufmann read the manuscript and told him it had potential for publication. He was asked why he did not submit it to a Russian scientific journal. The translator replied it would have no chance of being published. Dr. Ivanov has submitted the paper to the CRSQ.

Lectures 9 and 10: This was the last and final session of the course. Up to this time, Kaufmann was very careful and diplomatic for he was a guest lecturer, and the course could have been cancelled anytime by the administrators. He decided to be bold in his final appearance. He gave a presentation on "The Two Natures of DNA;" the first nature is a biochemical code, the second nature is one of interpretative information. He explained that a sentence written on the blackboard has a chemical coded nature (chalk chemicals written on blackboard chemicals). We can analyze the chemistry and geometry of the chemical sentence, but we will not get any meaning from it unless we can somehow read the language and understand the meaning of the written words. Information from the sentence can only be read and interpreted by coded functional proteins in our nervous system which gives conceptual meanings to the coded chemical sentences we see on the blackboard. The audience was keenly interested in this as this was the first time they heard of an analysis of this type. Kaufmann stated: 1) information does not appear spontaneously in nature. Information scientists cannot explain the origin of information. Using a posteriori reasoning (effect to cause), it is reasonable to assume that a Supreme Intelligence is the cause of the informational effect. 2) all transfers of information result in the loss of information (noise) and never to an increase in information. This appears to be a form of the effect of the Second Law of Thermodynamics (an increase in the

entropy of information) on the transfer of information. Matter, energy and an open system cannot increase the information of any system. Water can fall from high to low positions, but it takes an intelligent source (human engineers and construction workers) to plan and build a water turbine to harness energy from the waterfall.

Kaufmann then said the study of origins is very important, because belief systems have consequences. He then quoted various evolutionary leaders as to their belief in relativistic, immoral actions such as Dawkins (the selfish gene), Durant (no moral code of evolution), Provine (no inherent moral code in man), Dobzhansky (evolution favors egotism, hedonism and cowardice), Murdy (evolution promotes unbridled self-indulgence on each generation), Keith (Hitler was an evolutionist and used the German word "Entwicklung" over and over again in his book *Mein Kampf*) and finally from Marx (*Origin of Species* contains the basis in natural history for our view of Communism). The audience was silent, and no one challenged the obvious conclusion of the results of believing and teaching evolution.

Kaufmann showed that many great scientists were creationists. He showed visuals of 26 great contributions to science by 26 outstanding scientists who were all creationists. Another visual showed 41 scientific discoveries that were developed by scientists who operated from a Biblical world view. Some of the greatest scientists were creationists: Lord Kelvin, Louis Pasteur, Michael Faraday, Francis Bacon, James Clerk Maxwell and Isaac Newton. The evolutionists replied that most scientists of the 20th century have been evolutionists. Kaufmann replied that this is true and this is why with all our recent technological advances man is no better off, because our science is focused on improving man's material needs and not his spiritual condition. He then talked about academia in the United States. He then showed visuals how he teaches his course "Applied Human Anatomy" at the University of Florida from a creationist viewpoint. He demonstrated how he taught the students that the Creator gave them a gift of a superbly, designed living machine (their bodies), and they should be good stewards of their bodies, because health is wealth. He showed how he teaches the students that they should reject materialism/hedonism and practice humanitarian capitalism in the respective professions. The audience was in awe of this unique approach to education and responded with some great practical questions.

Kaufmann's closing appeal to the faculty and students was that it was wise to consider creationism because of natural revelation. He stated the Bible was a verifiable historical book that revealed scientific phenomena. He claimed the great designs in nature reveal the mind and purpose of the Creator. He said that when scientists invent things, they are really copying the designs of the

Creator in nature. He cited the telescope and camera coming from the human eye, hydrologic pumps coming from the human heart, mechanical pulley systems coming from the knee and ankle joints and the dialysis machine copying the human kidney. He astounded the audience when he told how Russian scientists who knew that a wheeled vehicle could not easily move over the pits, cracks and small craters on the moon, copied nature when they invented the "Lunakod", a scientific measuring box on articulated legs that moved like an insect. He said they were following the intelligence of the Creator that put this type of transportation in insects for the very same purpose. At the end of the discussion, Dr. Chadov and Dr. Adomenko took the floor separately and commended CRS for encouraging Kaufmann to teach the course. They both agreed that Russian scientists need to explore the creation model of origins. Although the class was supposed to end at 7:45 p.m., Kaufmann did not leave until about 9 p.m. as he was surrounded by questioners. A physiologist, Dr. Amikishieva told him there was a great need in Russia for books on creation for high school students, and she was willing to translate them. He said that when he returned to the states, he would have CRS Books contact her about translating some of their books into Russian and publishing them. A Social Psychology Professor asked for a copy of the predictions of the creation model for the social sciences. This was immediately copied and given to her. Finally, Dr. Kondakov, who for the entire course was a vocal critic of the creation model, came up to Kaufmann, shook his hand and gave him a Russian pen and asked the following questions: 1) If he wrote an article defending the evolution model of origins, would the CRSQ publish it? Kaufmann responded that he thought the present Editor of the CRSQ would not consider it for publication, 2) What secular scientific journals in the USA would be interested in publishing a defense of evolution? Kaufmann responded by suggesting *Science*, *Nature* or *American Scientist* and said he would have these journals send Kondakov information on their manuscript requirements, 3) He suggested that in the future there should be a round table symposium by American creationists and Russian evolutionists on creation v. evolution. Kaufmann suggested that the Siberian Division of the Russian Academy of Science sponsor it and that he would be glad to participate.

Presentation At Kemorova: Kaufmann and translator, Kolosov, traveled by bus 200 miles north of Novosibirsk to lecture to High School 91 in Kemorova, a city of 600,000 in north central Siberia. The auditorium was packed with students and faculty. Kaufmann gave a 75 minute presentation on 1) both creation and evolution are not theories but models of origins, 2) presupposition determine your conclusions, 3) the three scientific laws that

correlate with creationism, 4) evidence for a young earth, 5) the fossil record, 6) the origin of life and 7) the best scientists are creationists. The question and answer session for 45 minutes was phenomenal. The students/faculty asked questions on the age of the earth, fossil intermediates, left-handed amino acids, the Genesis creation account, the deity of Christ, the way of salvation, the millenium, Nostradamus, cloning, organ transplants and the bombing in Serbia. This was one of the highlights of the entire trip as it was felt the entire audience was open and receptive to the creation model and Biblical Christianity.

Presentation at Ekaterinaborg: Kaufmann and translator, Kolosov, traveled by plane 3000 miles to Ekaterinaborg, the capital of the Ural State of Russia. There he lectured to a philosophy class at the Ural State University. The highlight was the attendance of Tatiana Tagieva, Head of the Ministry of Religion for the city of Ekaterinaborg, which has a population of 1.4 million people. She was an oldtime Russian Orthodox believer who was a top official in the city government. She and her assistant took copious notes of the lecture many times nodding their head in agreement with the creation argument. After the lecture she, her assistant and two philosophy students stayed and asked many questions. She complained bitterly about the problems in the Russian Orthodox Church, i.e., indifference to creation vs. evolution issues, homosexuality among priests and arguments on the correct way to make the sign of the cross. She invited Kaufmann and the translator to her office at the State Capital Building the next day for an educational discussion. She stated her main function is to clarify the separation of church and state and to incorporate new forms of religion in the culture of Ekaterinaborg. She stated that a recent survey of the Russian people indicated that 75% say they are Orthodox, 50% say they are believers in Christ's teachings, but only 6% practice faithfully. Kaufmann told her that the key to keeping the visible Christian Church truly Christian is to respect the Word of God by using it as the standard to determine all doctrines (Norma Normana) and as a means of developing a mature faith.

Presentation to Campus Crusade: One Sunday night Kaufmann spoke to the Campus Crusade for Christ meeting at N.S.U., where over 30 students were jammed into a dormitory bedroom. Only about one-third of the students were Campus Crusaders; the rest were visitors. He presented the case for scientific creationism and the work of the Society. For over an hour he answered questions on Genesis 1 and 2, life on the moon, the age of the earth, the lack of intermediate fossils, Adam's offspring and genetics, UFO's, extraterrestrials, cloning and abortion and the bombing in Serbia. The students, mostly science majors who have been indoctrinated in

macroevolution, were very open to the tenets of scientific creationism. Kaufmann emphasized it is better for Christians to place their faith in God's inerrant Word and not the errant ideas of professional scientists. When theological questions arose, he gave them a short course in Biblical Christianity, i.e., the Bible is the only rule and standard for faith and practice, good works, intelligence, money or good looks will not get you into heaven, the only way to heaven was by grace alone through faith alone, all religions of the world are "do religions" (man must do something to please God) except Christianity, which is a "done religion" (God out of love for sinful man has declared man righteous by a completed sacrifice on the cross of God Himself), the two great teachings of the Bible are Law and Gospel, abortion is the killing of an unseen, innocent, unborn baby (breaking the Fifth Commandment) to hide the consequences of breaking the Sixth Commandment (fornication or adultery). The students were encouraged to practice chastity before marriage and fidelity after marriage. He told the students to acquire spiritual maturity, a Christian must study the

Bible each day for faith cometh by hearing the Word of God. Reading the Bible is acquiring spiritual nutrition. A number of students stayed after the presentation to ask specific questions about Christianity in the USA. The Campus Crusade Adviser, David Whitman who spoke English, thanked Kaufmann for his clear, crisp presentation.

Another achievement of this effort was the distribution of over 200 copies of *Studies in Creation* by Dr. John Klotz, which was translated and published by the Lutheran Heritage Foundation, a missionary agency of the Lutheran Church-Missouri Synod. The Creation Research Society and the Russian Project of Concordia Theological Seminary, Fort Wayne, IN, should be commended for sponsoring and funding this first of a kind educational event. This resulted in exposing one of the top Russian universities to the validity of the creation model of origins as a correct world view of the universe and life.

David Kaufmann

"White Space" Is A Terrible Thing To Waste

The term used in the printing industry for areas on a page where there is nothing printed is "white space." A certain amount of white space is a good thing, adding to the attractiveness and readability of the pages. However, big blocks of it that result from not having anything available to print are something else. They are a waste of space that could be used to communicate with the readers of the *Creation Research Society Quarterly*. They are the combined result of a lack of skill on the part of the Managing

Editor (yours truly) and a lack of short pieces of material that could be used to fill such spaces.

I will be working on the lack of skill on my part. Won't you please work on the lack of available material with which to fill these spaces? Please submit appropriate quotations, photo essays, letters to the editor, etc. to the Editor and book reviews to the Book Review Editor.

Lane P. Lester
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Letters to the Editor

The Principle of Symmetric Variation As It Relates to Silent Mutations

The way in which amino acids are coded ensures that certain changes in the order of nucleotide bases in nucleic acids result in no change in the amino acids of the polypeptides subsequently produced during translation. In the literature, these mutations which leave the amino acid sequence unchanged are called "silent" mutations. I include them, however, under the topic of "symmetric variation" which I have used in previous publications (Brown, 1987). The term symmetric variation relates the topic to the order, balance, and symmetry of creation.

Variations come in several forms, three of which are: (1) those which lead to the inclusion of the very same amino acid, (2) those that lead to the inclusion of an amino acid from the same "family" of amino acids, and (3) those that produce a polypeptide having an amino acid from a different amino acid family. Changes of the first type generally yield no change in polypeptides, the second type of variation may produce minor changes in proteins, and changes of type three can yield broad changes in proteins. Organisms also have repair systems that often returns the mutated bases back to their original configuration. If one links all of this to the organism's genetic potential (which is enormous and powerful in its control), I believe you have the main reason why organisms remain within their respective kinds.

One of Britain's mathematicians used the term symmetric in a comment of his on the genetic code. He used the term to refer to any DNA change that causes no change in the amino acid sequence in the resultant polypeptide (Stewart, 1994). I was pleased to note that I used the term this way in my own publications seven years earlier (Brown, 1987).

How symmetric variation works can be illustrated in the following involving the chemical bases coding for the amino acid valine and the amino acid family group to which valine belongs. Experts vary slightly in their classification of amino acids, but a reasonable arrangement of the valine family has been provided by Dolittle (1985) and his scheme is very similar to Swanson's (1984). It is shown as follows:

Valine Family Amino Acids	Alternate RNA Codons for each Amino Acid
Phenylalanine	UUU UUC
Leucine	UUA UUG CUU CUC CUA CUG
Isoleucine	AUU AUC AUA
Methionine	AUG
Valine	GUU GUC GUA GUG

It takes three RNA bases to code for the insertion of one amino acid into a polypeptide. Each set of three such

bases is called a codon. For example the amino acid valine is coded for by the bases GUU (using the initials if the RNA bases involved). But valine, like most amino acids, has other RNA codons – GUC, GUA, and GUG — which also code for it. This means that wherever any one of these codons appears in the genetic make-up of an organism, valine will be the amino acid incorporated into the resultant polypeptide.

Furthermore, if the initial base (G) in any of the four codons for valine were changed or mutated to U, A, or C; that modified codon would still call forth one of the other amino acids belonging to valine's own amino acid family (methionine, isoleucine, leucine, or phenylalanine). As we have already seen, mutations of the third bases in each of the valine codons would code for valine anyway. Only changes in the second base in the valine codons would result in the incorporation of amino acids outside the family group to which valine belongs. The changes outside the group that are allowed to remain can produce broader changes. The outcome of amino acid substitutions also depends on the protein environment in which they are located.

Comparisons of amino acid substitutions between related organisms show that changes of amino acids with similar chemical properties are the most common (Dolittle, 1985, p.81; and Graur, 1985, p.55). Clearly in such organisms the other changes take place but to a lesser extent.

We have seen something of how versatile the DNA is in both maintaining the code and policing itself by way of its repair systems. I invite additional comment on this subject.

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A Commentary on Coral Growth in South Florida after the Flood

I have a few comments on Carl Froede's article that appeared in the March, 1999, *Creation Research Society Quarterly* (Froede, 1999). Carl concludes that Floodwaters remained after the one-year Flood for at least 500 and possibly more than 1,000 years to deposit the coral reef of the Key Largo Limestone. The limestone is up to 25 feet above sea level, as much as 170 feet thick, 8 to 10 miles wide, and 220 miles long. Since real reefs are not expected to form during a violent global Flood, the surficial, linear Key Largo Limestone is very likely a post-Flood feature. The problem then is how to account for this reef after the Flood, especially since the top of the reef is currently above sea level.

The first question I would like to ask is: What is the definition of "Floodwaters" after the violence of the Flood has ended with sea level higher than today? Would this higher sea level still be considered Floodwaters?

Secondly, even if sea level was higher (I will present a case that sea level was higher just after the Flood), does not Scripture indicate the Flood was finished and the land and ocean basins stable at the end? I believe Scripture implies that the large-scale vertical tectonics that drained the Floodwaters (the only way continents can emerge from a totally flooded earth) was finished. The geophysical and hydrological mechanisms that caused the Flood—the fountains of the great deep and the windows of heaven—were stopped by day 150 of the Flood (Genesis 8:2). Then the waters steadily subsided and were expected to continue to subside until the water reached a more or less stable sea level. Genesis 8:13 states that "... the water was dried up from the earth," and Genesis 8:14 follows by stating that "... the earth was dried." Since the context of the Flood was for the entire earth, I believe "earth" in these verses refers to the entire earth and not just the portion Noah could see from the top of the Ark. Of course, there can still be local tectonics and sea level changes, but the implication is that after 371 days, the Flood was finished and sea level was stable. This is also implied in Psalm 104:9 at the end of the Flood: "Thou didst set a boundary that they may not pass over: that they may not return to cover the earth." It seems to me that God would not set a boundary until the water of the Flood had subsided to a stable sea level.

I agree with Carl that the present sea level was not required at the end of the Flood, but I maintain the Flood likely was finished everywhere on the earth, the great vertical tectonics that drained the Floodwaters had ended, and sea level stabilized at the end of 371 days. From my study of the ice age (Oard, 1990), sea level would be approximately 130 feet higher than today immediately at the end of the Flood. This is based on the lack of a Greenland and Antarctica ice sheet and the ther-

mal expansion of warm ocean water with an average temperature of about 86°F (30°C). Without compensating factors, sea level would rise about 180 to 200 feet if both ice sheets melted. There are several factors that would compensate somewhat for the higher sea level: 1) isostatic depression of the ocean basins due to the greater mass of ocean water, 2) water in pluvial lakes remaining after the Flood, and 3) water in Flood sediments that had not been squeezed out yet. Supposedly, the ocean basins would sink to about 30% of the depth of the added water, making a sea level about 120 to 130 feet. However, when Lake Mead filled, the lake basin sank only about 20 centimeters, much less than the 30% of the added water depth (Oard, 1990, p. 176). On the other hand, the basin of pluvial Lake Bonneville, which was 285 meters deeper than Great Salt Lake, was depressed about 70 meters in the middle, which is not far from the 30% estimate (Oard, 1990, p. 176). The second variable likely would lower sea level very little and the third variable is difficult to evaluate but probably would have a small effect (Roy Holt, personal communication believes these variables would have lowered sea level more than I postulate). In summary, it is likely that sea level was 100 to 160 feet higher at the end of the Flood than it is now.

Sea level then slowly subsided as ice built up on the land during the ice age. After roughly 500 years, when the ice age peaked, the sea level would be approximately 150 feet lower than it is now. The ice would then have melted rapidly and sea level rapidly increased to above today's value because of isostatic rebound (which continues today). The continued building of the Greenland and Antarctica ice sheets could not compensate for this rapid melting. (See graph in Oard, 1990, p. 174). In this scenario, sea level would fall from its end-Flood high to the current level in about 300 years. The fall of sea level from 100 to 160 feet to current sea level is within the proper depth for coral reef growth, as stated by Froede (1999, pp. 190, 191).

The problem boils down to this: How fast can coral grow? Is 300 years enough time, or do we need 500 to over 1000 years as Carl presumes? The problem is that we really do not know how fast a reef can grow, especially when we attempt to factor in the differences between the paleoenvironmental conditions after the Flood and those presently operating in south Florida. Ariel Roth (1998, pp. 235–240) presents a good analysis of living reefs and so-called fossil reefs in his new book. Given the right conditions, coral reefs can grow quickly. Roth (1998, pp. 236, 238) states: "A moderate rise in temperature of a few degrees favors more rapid growth, while ultraviolet light at the ocean surface inhibits growth." It is probable that the warm water after the Flood, likely several degrees

warmer than the ocean water around south Florida now, would increase the growth rate. The growing reef would have been submerged well below the water surface and protected from UV rays during most of the 300 years. Of course, increased nutrients are required for faster growth, as Carl mentions (Froede, 1999, p. 189). Several unique oceanic factors could aid increased nutrient flux to south Florida early in the ice age: 1) rapid turnover of a warm ocean as it cools, 2) faster currents due to the left-over momentum of the Flood and the ice age storm belt along the east coast of the United States (Oard, 1990, pp. 54, 77, 94). Thus, conditions would likely favor rapid reef growth in south Florida.

Another factor involved in the growth of these coral reefs likely was local tectonics after the Flood, as indicated by shorelines up to several hundred meters above current sea level, for example on the Huon Peninsula, Papua New Guinea. It is possible that South Florida was slowly rising tectonically after the Flood, so that the reef area was underwater for a longer time. We do not know. I noticed that several corals in the reef were overturned (Froede, 1999, p. 187, Figure 4 and p. 190, Figure 15). Is it possible that reef growth both vertically and laterally was aided by strong storms spreading coral debris laterally, initiating a more rapid regrowth?

In summary, a post-Flood higher sea level potentially can account for the reefs in the Florida Keys. This higher level could easily be caused by the lack of Greenland and Antarctica ice sheets without any need to postulate remaining "Floodwaters" for 500 to over 1000 years after the Flood ended.

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- Michael J. Oard
Great Falls, Montana

Aerodynamics of Wind Pollination in Living and Fossil Plants

Computer analyses and wind tunnel experiments have been carried out on a number of plants, from cone-bearing forms to various angiosperm plants (Niklas, 1984; 1987). The results show almost perfectly engineered methods to capture pollen. Life-sized models were made of certain fossil plants, particularly those of about 300 million years ago that were likely wind pollinated. Such fossil plants have shown less of this aerodynamic nature. There are modern plants that have various methods of being pollinated, however, and these also lack the same aerodynamic nature of pollen capture. Could the fossil plants of 300 million years ago have had a number of ways to be pollinated—could there have been a difference in density of the air which may have also made a difference? In both wind tunnel experiments and computer analyses, creationists could carry out work on various plants and try

to make models of fossil forms. If only by computer models, they could try to analyze various changes in density of air to see what results are produced. For further reading on this subject, see (Niklas, 1984; 1987).

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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.

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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.

CRSQ

The background of the cover is a monochromatic blue-toned photograph. It depicts several bare, thin tree branches reaching upwards and outwards. Some of the branches are heavily coated with a thick, white, crystalline substance, likely ice or snow, which clings to them in irregular, textured masses. The sky in the background is a deep, dark blue with some lighter, wispy cloud patterns.

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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

Editor's Comments

As the twentieth century draws to a close the struggle between theism and atheism continues. The bloody 1900s reflect the retreat of Western Civilization from biblical principles and the slow, but visible decay of Christian culture throughout Europe and the Americas. Involved in the spiritual warfare is the creationism vs. evolutionism battle for the minds of men. True science is on the side of creationism, but you would never know it listening to the rhetoric of atheists and their media allies. Likewise theistic evolutionists spend more time blasting creationism than they do defending biblical truths. These hybrid Christians must love the praise of men more than the praise of God.

Decades ago I had a discussion with a Christian who was a scientist in a national laboratory. Initially he quizzed me on my belief in the Word of God, Did I believe the Bible from cover to cover, etc.? He would not enter into any discussion of creationism with a man who did not believe the Bible. I then eagerly looked forward to exchanging creationist viewpoints with a like-minded person. The conversation went along smoothly until we ventured into the area of the age of the earth. Then "the bottom fell out." The scientist proclaimed that he would not believe in a young earth because he did not wish his scientific colleagues to think that he was a dummy! Peer pressure was too much for him. The discussion ended abruptly.

I am sure many of you know Christians who attack creationists, particularly young-earth creationists, because they wish to be thought of as scholarly by their unbelieving friends in the scientific arena. Unfortunately the issue is not a young earth or old earth, but belief in a Creator Who governs the affairs of man! No matter what you believe otherwise, if you accept biblical injunction, you are an enemy of the world's "intellectuals". So Christians accomplish nothing by siding with the enemies of God.

In an interview with a reporter from *Insight* magazine 15 (38):37-39, Phillip Johnson, a Christian law professor and well-known critic of naturalism "hits the nail on the head" (p. 39):

Question: Why is the intellectual world so attracted to naturalism and agnosticism? Johnson's answer: It follows along on my own experience of the intellectual arrogance that comes naturally to an academic winner, an academic gold-medal winner such as myself. Scientific naturalism is a thing that's attractive to that sort of people because it says that the secular intellectuals are the people to whom the world should look for all wisdom.

The secular intellectuals become the priesthood. Their cultural story dominates. It feeds their sense that they have a wisdom the masses don't have. Naturalism is their vehicle to replace the [religious] clergy with the scientific and intellectual professionals, the priesthood being the people who tell society its creation story, and in this case the creation story being the naturalistic one.

All creationists are bent on replacing the naturalistic priesthood and that is their chief "sin." The world's priesthood will not have the Lord rule over them! If a Christian believes the creation story taught by the naturalistic priesthood, he by default becomes an opponent of and often he hates true creationists.

The issue is not scholarship or its lack thereof. Creationists who think they can please naturalists by being "scholarly" or criticizing creationist writings as mainly garbage miss the point. When the supernatural is invoked, the entire effort is garbage as far as the priesthood of the world is concerned. Those in our ranks who think that they appear scholarly to the world's intellectuals when they unjustly criticize our work cast their influence, innocently or not, on the side of naturalism. They become enemies of the cause they claim to support.

Let us continue to do battle for the principles in which we believe. It is our privilege to serve you and the Creator. In spite of our religious foes—the priesthood of this world—we will keep on our pathway of scientific creationism. Enjoy Christmas and have a successful new year.

Emmett L. Williams

Learning About God

Nature in her laws tells of God, but the message is not too clear. It tells us nothing of the love and grace of God. Conscience, in our inmost being does tell us of God, but the message is fragmentary. The only place we can find a dear, unmistakable message is in the Bible.

Billy Graham

Precambrian Plant Fossils and the Hakatai Shale Controversy

Carl R. Froede, Jr.*

Abstract

Within the global uniformitarian stratigraphic timescale, plant fossils have been found in Precambrian strata dated to approximately 3.5 billion years in age. Evolutionists have not successfully explained when or how life formed to produce these ancient and wide-spread plant fossils. Young-earth creationists have also investigated Precambrian plant fossils, focusing primarily on Precambrian rocks found in the Grand Canyon. Controversy has developed around the plant fossil content of the 1.25 billion year old Hakatai Shale. Several studies suggest that modern and ancient fossilized plant material might be present within the shale. Other Precambrian stratigraphic units in the Grand Canyon contain plant fossils. Precambrian strata

of much greater age than the Hakatai Shale are known to contain plant fossils. However, some young-earth creationists have rejected the presence of plant fossils in the Hakatai Shale, or in abundance in any other Precambrian strata. This position is not required by either uniformitarian or creationist frameworks and it ignores documented evidence of Precambrian plant material. The author proposes that Precambrian plant fossils exist, and reflect the effects of the global Flood on Antediluvian sediment and plant material. However, only the additional study of plant fossils within the various Precambrian outcrops at each locale can determine their specific position within the young-earth Flood model stratigraphic column.

Introduction

Many creationists have generally followed the framework of the global uniformitarian timescale in attempting to define geologic history within a biblical time frame. Weaknesses in this approach, however have led several young-earth creationists to propose other Scriptural methods of understanding strata (Froede, 1995, 1998; Froede and Reed, in press; Reed and Froede, 1997; Reed, Froede, and Bennett, 1996; Walker, 1994). This foundational change in defining Earth's history offers a different solution to many seemingly complex issues. One of these is the presence of plant fossils within Precambrian strata. These fossils have been a perplexing problem for some creationists, but one which can be resolved within a new biblical framework.

Uniformitarians continue to collect evidence of fossilized plant life further and further down their global stratigraphic column. Creationists can and should assist in this search, but for different reasons. The presence of Precambrian fossils has created controversy for uniformitarians and creationists. One specific stratigraphic unit,

the Hakatai Shale of the Grand Canyon, has been a focus of investigation and controversy among creationists. Why is identifying plant fossils within this shale layer considered a problem by some, and what bearing does it have on the creationist approach to understanding earth history? Some background about these supposed ancient plant fossils is necessary.

Precambrian Plant Fossils

Uniformitarian geologists divide the Precambrian into two Eons: the Proterozoic, and the underlying Archean (Figure 1). Proterozoic strata have yielded plant fossils which have been investigated for more than one hundred years (Hofmann, 1971; Link et al., 1993; McMenamin and McMenamin, 1990). For some uniformitarians, life did not exist when the underlying Archean strata were deposited because the atmosphere was not believed to have contained sufficient oxygen to allow aerobic life to have formed or developed (Cloud, 1968; 1976; 1983; Knoll, 1992). This concept has recently been challenged with physical evidence of aerobic plant fossils in Archean rocks. At present, uniformitarians have reported plant

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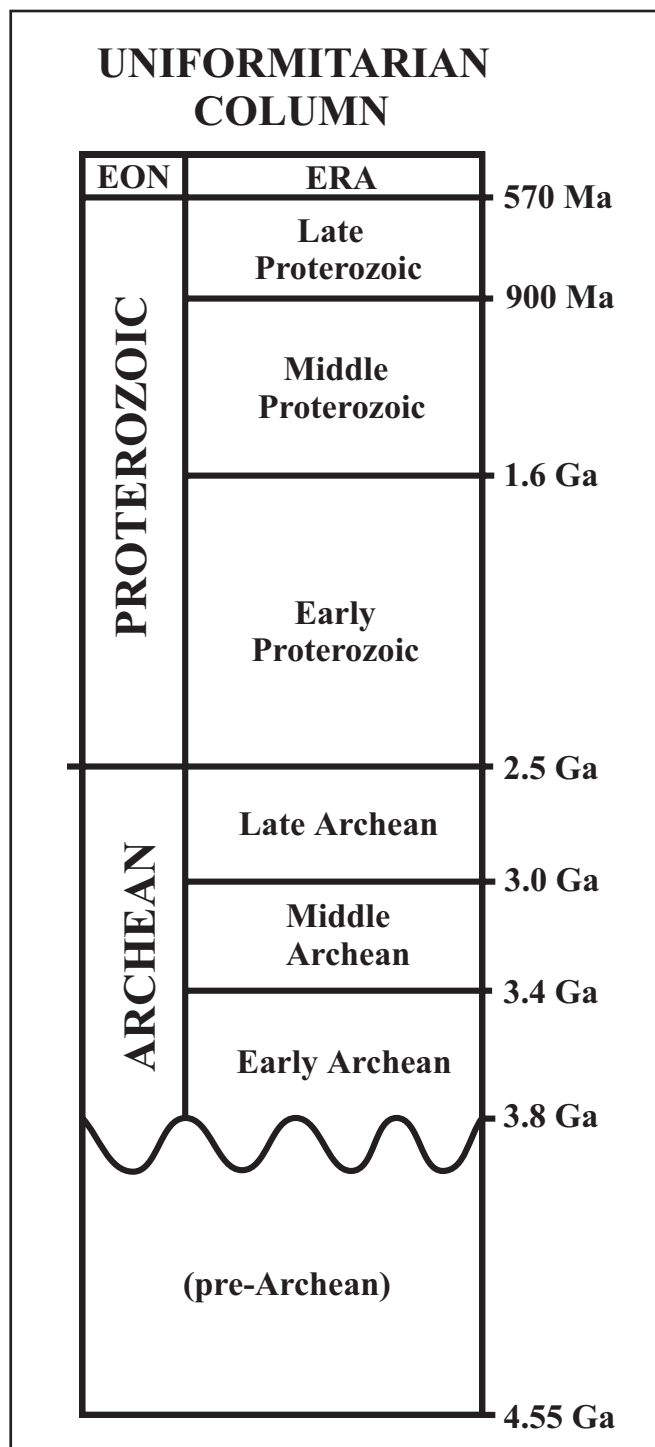


Figure 1. The Precambrian stratigraphic column (modified from Harrison and Peterman, 1982). The lowest and oldest strata have been held out as generally being devoid of fossils—until recently. Uniformitarians continue to find plant fossils in these ancient strata. Presently, plant fossils have been found in Archean rocks dated to approximately 3.5 billion years old. Hence, even by their own evolutionary model, life has been on earth for a very long time, and no one knows how or where it originated.

fossils in 3.4 to 3.5 billion year old (commonly abbreviated Ga) Archean strata in Australia and South Africa (Margulis, 1988; McNamara and Long, 1998; Read and Watson, 1975; Schopf and Walter, 1983; Schopf, 1994; Strother, 1989; Walter, 1983). According to Schopf (1994, p. 193), evidence of plant life in the Early Archean consists of:

...(1) megascopic microbially produced stromatolites; (2) microscopic cellularly preserved microorganisms; and (3) particulate carbonaceous matter (kerogen), identifiable on the basis of its carbon isotopic composition as a product of biological activity.

The discovery of these Archean fossils has created a problem for the paleontological community. Fossils of this age contradict models of the origin of life on this planet¹(Schopf, 1999). Whatever the requirements that evolution might dictate, plant fossils clearly exist within these ancient rocks.

These fossils force uniformitarians to deal with the sudden appearance of life in Earth's supposed very distant past. These plant fossils have been found in Precambrian rocks across the globe (Cooper, Jago, MacKinnon, Shergold, and Vidal, 1982; Glaessner, 1979; Hofmann and Schopf, 1983; Iltchenko, 1972). Within the evolutionary model this suggests that plant life was flourishing very early in Earth's history, and that it must have evolved and expanded rapidly (Schopf, 1982, 1999). No credible explanation of these discoveries has been provided to explain the presence of these fossils through evolution and dispersion.

The organic remains of Precambrian plant fossils are found within ancient sedimentary and metasedimentary² rocks and strata found on the continents. However, extracting the organic remains of these plant fossils remains a complicated and exacting science, and contamination is believed to be a serious problem (Schopf, 1999; Schopf and Walter, 1983).

¹This article will not cover the evolutionary explanation for the origin of life or how theistic evolutionists might interpret these Precambrian fossils. Rather, this article will focus on the supposed extreme age of these plant fossils as they occur within the global uniformitarian stratigraphic column, and their relevance to the young-earth Flood model.

²Note that some Precambrian fossils are found within very low-grade metamorphic rocks which were originally sedimentary deposits that experienced burial and subsequent alteration. Their alteration, however, did not completely destroy all evidences of the plant material within the strata.

Precambrian Plant Fossils and the Hakatai Shale

How do young-earth creationists explain the Precambrian strata that contain plant fossils? Unfortunately, not much has been written about these plant fossils by creationists. The Hakatai Shale, found within the Grand Canyon, has received the most intensive investigation to date. Several varieties of plant fossils have been identified and reported within the Hakatai Shale (Burdick, 1966, 1972, 1974a); however, challenges have been raised causing some to question their relevance within a biblical framework (Rusch, 1968, 1982). Further confusion has resulted from some creationists incorporating a compressed version of the global uniformitarian column in their creationist model³ (Austin, 1994; Austin and Wise, 1994, and in preparation; Baumgardner, 1990; Snelling, Scheven, Garner, Ernst, Austin, Garton, Scheven, Wise, and Tyler, 1996). One creation scientist has proposed that Precambrian plant fossils might have been created during the creation week to fit them within his model (Wise, 1992). Counter to this uniformitarian-column-based approach, other young-earth creationists have proposed that Precambrian strata containing plant fossils formed during the global Flood, and have no link to the uniformitarian stratigraphic column (Froede, Howe, Reed, and Meyer, 1998; Hunter, 1992; Snelling, 1991; Woodmorappe, 1983).

The most interesting and controversial creationist Precambrian plant fossil study was conducted by Clifford Burdick (Burdick, 1966, 1972, 1974a). He examined the Hakatai Shale strata within the Grand Canyon and reported finding a wide variety of pollen and spores. Following this study, other scientists confirmed Burdick's work (Chadwick, DeBord, and Fisk, 1973). In a later effort to buttress his position, Burdick documented other areas across the planet where Precambrian and Cambrian pollen were reported (Burdick 1974b, 1975, 1982). A subsequent investigation of the Hakatai Shale (Chadwick, 1982), however, found no evidence of any plant fossils, and proposed that contamination was the cause of the earlier findings of pollen and spores. This raised doubts about Burdick's work.

The controversy surrounding Burdick's work centered around his finding *both* modern and ancient fossilized forms of plant spores and pollen in the Hakatai Shale. Evolutionists would not have had any problems with Burdick's work if only ancient fossilized forms were found. Finding modern forms of spores and pollens cre-

ated a serious age issue with this shale layer. In the creationist community Burdick's work creates controversy for those who define the Flood/pre-Flood boundary as the contact between the Precambrian and Cambrian. They should not find plant fossils in rocks which they define as having formed early in the Creation Week (before plants were created). For both these groups Burdick's findings created different problems for different reasons.

To resolve this lingering controversy over the presence or absence of pollen grains and spores within the Hakatai Shale, members of the Creation Research Society (CRS) collected and analyzed their own samples in an effort to confirm or refute Burdick's earlier findings (Howe, 1986; Howe, Williams, Matzko, and Lammerts, 1986, 1988; Lammerts and Howe, 1987). Their results supported Burdick's findings of *modern* spores and pollen within the Hakatai Shale. Of course this confirmation remains counter to the evolutionary model (Chaloner, 1967; Cloud, 1968), and is *very* controversial. The uniformitarian model does not predict or allow for the presence of modern pollen and spores within the Hakatai Shale as it is too old to contain these "advanced" types of plant fossils. The incorrect sequence contradicts the global uniformitarian column, which may explain why certain creationists remain skeptical of the conclusions of this latest confirmatory study. For whatever reason, some creationists have also rejected the possibility of modern or ancient pollen, spore, or any other plant material within the Hakatai Shale (Austin, 1994, pp. 63, 137; Austin and Wise, 1994, pp. 38–39).

Recently, questions were raised regarding the validity and methodology of the CRS confirmation study from an Internet post forwarded to the Quarterly Editor. Answers to the post's issues were provided explaining why earlier studies failed to identify the modern and/or ancient plant pollen and spores within the Hakatai Shale (Williams, 1997). The results of this latest study supports the belief that pollen and spores occur within the Hakatai Shale and that they were deposited contemporaneously with the strata.

Hakatai Shale Comparisons with Other Fossiliferous Precambrian Strata

Uniformitarians view the Hakatai Shale as being deposited during the Proterozoic. It is age dated at approximately 1.25 Ga. Comparison of this Precambrian section to those of similar age found across other sections of the globe suggests that it is *not* out of the question to expect or find fossilized plant materials within the Hakatai Shale (Figure 2). Modern pollen and spores, however, are not expected in strata of this extreme age. In fact it is somewhat surprising that ancient fossilized plant material has

³These models place a Flood/pre-Flood boundary at the base of the Paleozoic, strongly implying the absence of fossils in older rocks formed during the creation Week—see Froede and Reed, 1999.

not been identified at an earlier date by uniformitarians for this stratigraphic unit (although it should be noted that Elston [1989, p. 264] hinted at the possibility of stromatolites being present within the Hakatai Shale, and Horodyski [in Link et al., 1993, p. 561] referenced a wide variety of fossils within various Precambrian strata of the Grand Canyon). However, the confirmation of ancient fossilized plant material per se in the Hakatai Shale would not contradict the uniformitarian model, as far older Precambrian strata have been found to contain plant fossils (Figure 2).

Implications For the Young-Earth Flood Model

The Precambrian Hakatai Shale has been examined four times for the presence of plant fossils. Ancient and modern forms were found in three of those investigations. However, some creationists still reject the presence of any fossilized plant material within the Hakatai Shale as it disagrees with their model (see Austin, 1994, p. 58, Figure 4.1; Austin and Wise, 1994, p. 40, Figure 1). According to Austin and Wise, the majority of the Precambrian strata represent Creation Week deposits and should not contain plant fossils since they formed before plants were created. They suggest that plant fossils would only occur in abundance within Flood deposits (i.e., above their Precambrian / Cambrian–pre-Flood / Flood boundary). By implication their model would need to explain the evidence of plant fossils within Precambrian strata from areas both in and outside of the Grand Canyon (see Appendix). This point is important because Austin and Wise have stated that they support the general framework of the global uniformitarian timescale while denying the old age of the earth (Austin 1994, p. 58, Figure 4.1; Austin and Wise, 1994, p. 40, Figure 1; Snelling et al., 1996). In order to defend their pre-Flood/Flood boundary being globally chronostratigraphically equivalent to that of the Precam-

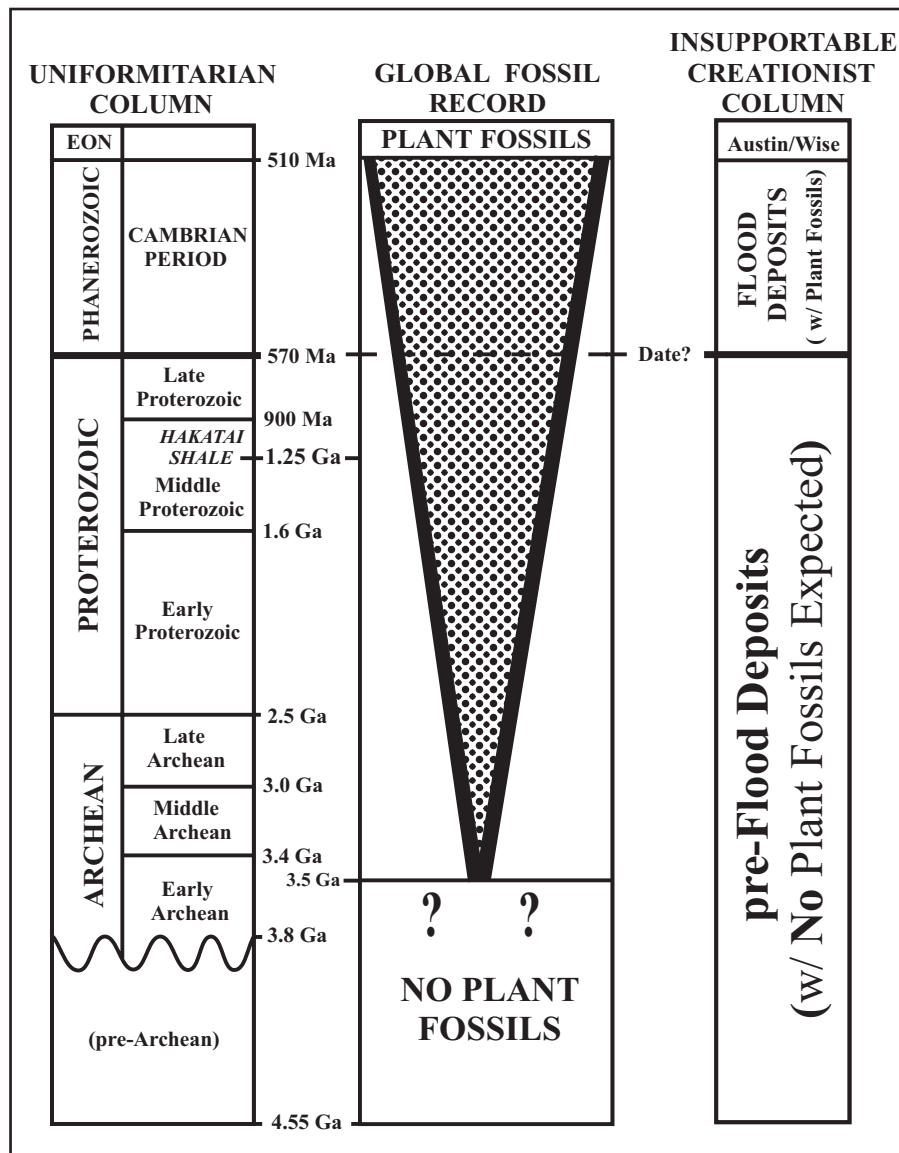


Figure 2. Within the global uniformitarian stratigraphic column the Precambrian/Cambrian boundary is located at 570 million years ago. One group of creationists has proposed that this boundary marks the end of the Antediluvian deposits and the beginning of the Flood deposits, and they use the lack of fossils and/or the transition to more advanced life forms to define this boundary (Austin, 1994; Austin and Wise, 1994; Baumgardner 1990; Wise, 1992). However, evidence of fossilized plants extend much deeper within the global uniformitarian stratigraphic column (modified from Schopf, 1994, Figure 1, and Schopf and Walter, 1983, Figure 1). Notice that the occurrence of plant fossils extends to 3.5 billion years ago—the lowest point where they have been identified and dated by uniformitarians. Fossilized plant material within the Precambrian is in violation of the Austin/Wise model.

brian/Cambrian boundary they should undertake palynological studies to prove that fossilized plants do *not* exist within *any* Precambrian strata. Their model of the stratigraphic column in the Grand Canyon remains questionable if they continue to deny the presence of Precambrian plant fossils.

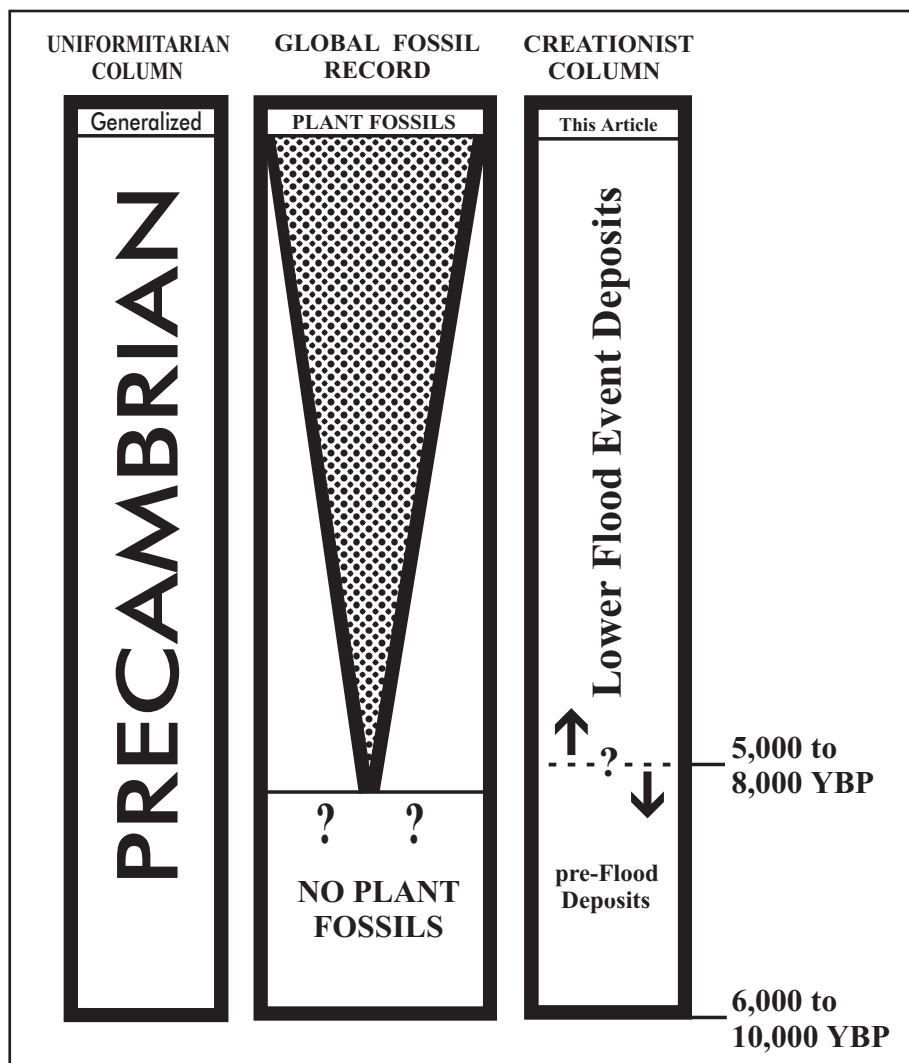


Figure 3. Recently, several creationists have advanced a different interpretation which proposes that Precambrian plant fossils represent Flood deposits (Froede, Howe, Reed, and Meyer, 1998; Snelling, 1991; Woodmorappe, 1983). These plant fossils have nothing to do with evolution or time, rather they reflect Antediluvian sediments and organic material buried in the global Flood. The exact location of the pre-Flood/Flood boundary would be determined at the specific outcrop based on changing energy levels and not on paleontology.

The identification of plant fossils within Precambrian shales has been documented. In fact, several uniformitarian geologists have commented that:

...in the light of results summarized here [for the Grand Canyon] together with important discoveries recently reported from other Precambrian shales, it seems reasonable to conclude that shaley facies represent a promising, but as yet largely untapped, source of new evidence on the diversity, evolution, and biostratigraphic usefulness of the Precambrian biota (Bloeser, Schopf, Horodyski, and Breed, 1977, p. 679).

I urge creationists to undertake studies to find fossilized plant materials in all Precambrian strata in an effort to help delineate the impact which the Flood had on the Earth's stratigraphic record.

Conclusion

A variety of Precambrian plant fossils have been documented in rocks as ancient as the Archean (Figure 2). Presently, any specifics about the kind of plants from which these fossilized remains were derived cannot be ascertained. Each new discovery of ancient fossilized plant material pushes back the timing of evolution of life on this planet. This creates difficulties for evolutionary models of life's origin and early history. Young-earth creationists hopefully will keep abreast of this interesting and relevant work. In addition to highlighting weaknesses in the evolutionary model, it helps us to define and refine our own framework of Flood-dominated stratigraphy.

It is important to note that proving the existence of generic plant material in the Hakatai Shale within the Grand Canyon will *not* affect the uniformitarian model of Earth history; it would only add a new location where Proterozoic plant material has been found. It is the evolutionary stage of Burdick's discovery that contradicts the global uniformitarian column. With time new "older" Archean outcrops containing plant fossils may be

found. The problem which uniformitarian geologists and paleontologists must address remains that of explaining life's point of origin and rapid dispersion across the planet.

The Austin/Wise stratigraphic model for the Grand Canyon appears questionable as it denies the known presence of Precambrian plant life found both within the canyon and globally. Further clarification is required in order to reconcile these conflicts in their model. The presence of plant fossils within the Hakatai Shale, documented on three occasions, also casts doubt on their approach to defining the strata within the Grand Canyon.

Hopefully these issues will be addressed in the near future.

Young-earth creationists should consider the paleontological potential of all sedimentary and metasedimentary Precambrian strata. Finding fossilized plant life within these “ancient” rock layers might be expected within the young-earth Flood model. Several creationists have proposed that some Precambrian strata were deposited during the global Flood of Genesis (Figure 3).

Creationists should take an active part in paleontological studies locating “ancient” Precambrian fossils across the earth. By doing so we accomplish two objectives: 1) We extend the depth of strata likely affected by the Flood, and 2) we push evolutionists to explain how life arose “fully-formed” across the earth so rapidly, and so very long ago. We need to aggressively pursue paleontological studies if we wish to demonstrate the weaknesses of evolution and uniformitarian geology in explaining the stratigraphic record. This is what the global uniformitarian stratigraphic column is based on (evolutionary biology/paleontology and *not* radiometric dating!) and this is where we need to focus our efforts (Froede, 1994, 1997). Precambrian plant fossils provide excellent evidence of Flood deposition within the young-earth Flood model.

Appendix

The controversy over the paleontology and stratigraphy of the Hakatai Shale (or any other Precambrian strata) raises a larger question than the mere presence or absence of fossilized plant material in the Precambrian. Rather, the core issue is whether or not young-earth creationists should use the global uniformitarian column to define biblical history. Austin and Wise follow the general framework of the global uniformitarian column (Austin, 1994, p. 58, Figure 4.1; Austin and Wise, 1994, p. 40, Figure 1; Snelling et al., 1996, p. 333, Figure 1). They have also proposed that the pre-Flood/Flood boundary should occur at the uniformitarian Precambrian/Cambrian boundary (Figure 2). This is based on their definition of the Paleontological Discontinuity criteria:

The slow deposition in the pre-Flood world would have made fossilization of plant, animal and fungal remains unlikely. Also, it is very likely that the initial erosion of the Flood destroyed or reworked virtually all of the fossils which were present in pre-Flood sediments. Consequently, below the pre-Flood/Flood boundary, sediments capable of preserving fossils might, at best, contain only traces

of the most abundant and easily fossilized life forms—bacterial, algal, and protist fossils—and *probably in very low abundance*. Plant, animal and fungal fossils might be expected to be found in high abundance only above the pre-Flood/Flood boundary. (Austin and Wise, 1994, p. 40) (*Italics mine*)

This statement is inconsistent, however, when dealing with the evidence of plant fossils in the uniformitarian Precambrian strata, and runs counter to what Schopf (1994, p. 194) has stated about the presence of plant fossils found within the Precambrian, Proterozoic Eon:

Stromatolites are virtually ubiquitous in Proterozoic carbonate terranes, represented by hundreds of taxonomic occurrences reported from a large number of Proterozoic basins. ...literally hundreds of microfossiliferous formations and nearly 3,000 occurrences of bona fide microfossils have been discovered in Proterozoic-age strata...

These creationists appear to have overlooked the record of plant fossils taken directly from the Precambrian strata within the Grand Canyon! They do not believe that plant fossils are abundant within the Precambrian strata of the Grand Canyon, and yet uniformitarians have documented them in several places and in abundance (see Bloeser, Schopf, Horodyski, and Breed, 1977; Elston, 1989; Elston and McKee, 1982; Ford, 1990; Horodyski, 1993; Knauth, 1994; Link et al., 1993; Nations and Stump, 1996; Schopf, Ford, and Breed, 1973). Since the Austin/Wise stratigraphic model for the Grand Canyon is inconsistent with the physical evidence, perhaps they should reexamine the role of the global uniformitarian column in their model. The global uniformitarian stratigraphic column is not required within the young-earth Flood model (Froede and Reed, 1999). I recommend that the use of the global uniformitarian column to define Flood geology in the Grand Canyon (or anywhere else) be rejected.

Acknowledgments

I thank Dr. George F. Howe and Dr. Emmett L. Williams for sharing their experiences with me regarding the controversy surrounding the presence of pollen and spore material within the Hakatai Shale. Both gentlemen kindly provided me with review and comment on various drafts of this document. Additionally, all of the peer-review comments were of great help to me in further clarifying this article. However, any mistakes which remain are my own. I thank my wife for allowing me the time to write for the *Creation Research Society Quarterly*. Glory to God in the highest (Pr 3:5-6).

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Photo Essay

Willow Mountain: An Intrusive Columnar Rhyolite

Willow Mountain presents a challenge to the uniformitarian concept of igneous rock formation. It is located approximately three miles north of Study Butte, Texas (north of the western portion of Big Bend National Park), and is located within the Christmas Mountains. Rising 1000 feet above the surrounding topography, the columnar jointing of the mountain is easily observed from Texas Highway 118, and with the correct angle of sunlight it is a beautiful and perplexing sight (Figure 1). While basalt commonly occurs in a columnar form, a massive outcropping of rhyolite in this form is unique.

Willow Mountain is identified as a quartz syenite and is believed to be associated with widespread intrusive volcanic activity which occurred across this section of west

Texas during the late Eocene to early Oligocene (42 to 34 Ma) [Barker, Henry, and Price, 1986; Carman and Cameron, 1986; Henry and McDowell, 1986]. The composition of the volcanic rocks intruded during this purported span of many millions of years range from rhyolitic to ultramafic.

Most interesting to us is that intrusive types of volcanics, commonly referred to in the geologic literature as *granites* and *diorites*, are usually referred to in this section of west Texas by their extrusive counterparts, i.e., *rhyolites* and *basalts*, respectively. This is because these intrusive volcanic rocks have the same crystal form as their extruded equivalent. This would suggest that while they were emplaced below the earth's former sur-



Figure 1. Willow Mountain's western face (as seen from Texas Highway 118), rises 1000 feet above the surrounding surface and exposes approximately three-quarters of a mile of columnar quartz syenite. Although it is identified as an intrusive volcanic rock (i.e., a micro-granite), its crystal form is identical to that of a rhyolite (an extrusive quartz-rich volcanic rock). The rapid means by which this intrusive rock formed and cooled in the subsurface suggests that it occurred during the Flood. At some later period Floodwater eroded away the thin overburden exposing it largely as it exists today.

face *they cooled very rapidly*. No uniformitarian explanation has been proposed to address how intrusive volcanic rocks have the same crystal form as their extrusive equivalent.

We suggest that “intrusives” like the Willow Mountain rhyolite (actually it has been referred to as a “micro-granite,” due to its extremely small crystal grain size) reflect conditions associated with the Flood. We propose that these molten rocks were intruded into overlying water-saturated marine sediments while Floodwater still covered this area. These igneous rocks rapidly cooled. The movement of Floodwater eroded away the thin overburden and exposed these extrusive-like “intrusive” volcanics at the Earth’s surface. Later, the withdrawal of Floodwater served to expose these rhyolites and basalts to subaerial conditions. The wet weather conditions associated with the single post-Flood ice age (Oard, 1990), contributed additional erosion, albeit minor in comparison to that experienced by the earlier period of raging Floodwater. Today these “intrusives” stand hundreds of feet high above the surrounding area, and provide evidence of what were high-energy conditions associated with the global Flood of Genesis.

Acknowledgements

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Craniodental variability in the domestic dog (*Canis familiaris*) and its Implications for the Variability in Primates

Celedonio Garcia-Pozuelo-Ramos*

Abstract

The domestic dog (*Canis familiaris*) constitutes a species that has attained considerable variability in historic times. The crania and dentition of a sample of the domestic dog *Canis familiaris* have been statistically analyzed with methods that have been employed to determine variability in other species. The results point to a degree of variation in the dog crania and dentition that may be a useful tool for creationists in determining the boundaries of the holobaramins (created kinds).

The results obtained from dog crania do not support the division of *Homo erectus* into two, or

more, different species, but are compatible with the hypothesis that they are all part of one species.

Variability in the cranium and dentition of this living monobaramin (*Canis familiaris*) suggest that *H. erectus*, archaic *H. sapiens* fossils of diverse origin, and *H. sapiens sapiens* should be lumped into one kind (holobaramin¹).

The degree of morphological variability in domestic dogs is an important tool for assessing the variability of extinct kinds, and the limits of morphological variability within living beings.

Introduction

The domestic dog has been used by creationists as an example of a creature showing great variation in a short time. This study quantifies the variability of cranial and dental traits of *Canis familiaris*. Although the data obtained are limited, I will utilize them to study the limits of holobaramins¹ of primates, with special attention to the holobaramin that includes human beings—both current and fossil. In this report it is largely cranial traits that have been examined, although some dental measurements have been utilized as well.

The variability has been analyzed by the coefficient of variation, with the range expressed as a percentage of the average, and the index of the minimum and maximum values. Whenever possible, an F-test was used to compare standard deviations.

Using this method the results support a degree of variation in *Canis familiaris* that is equivalent to (or greater than) the variation found in the mix of various near spe-

cies of genus *Canis*. When the data from several *H. erectus* fossils from both Asiatic and African regions are mixed, their cranial variability is less than that which we find in the domestic dog, and this variability does not generally exceed, the variability (CV) which is considered the usual maximum for a single mammal species. Using the same methodology and standards, a mix of the data of *H. erectus*, archaic *H. sapiens*, and *H. sapiens sapiens* specimens shows that all these species should be lumped into one holobaramin. This work is the continuation and complement of my previously published article (García-Pozuelo-Ramos 1998).

¹In this paper I frequently use the words *holobaramin* and *monobaramin*. They are defined according to ReMine (1990): a holobaramin is "A complete set of organisms related by common descent. A group containing all and only those organisms related by common descent." A monobaramin is "A group containing only organisms related by common descent, but not necessarily all of them."

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Materials and Methods

My data include measurements taken from my own set of dog crania and data from authors cited in the text. The dimensions measured were chosen because of their relevance and ease of handling, and are described in Table I and Figure 1. The data for *H. erectus*, archaic *H. sapiens*, and *H. sapiens sapiens* come from several sources. The fossils studied are given in Table II with the number of teeth or skulls analyzed for each case. The craniometric points are as listed in Figure 2.

I used the coefficient of variation, CV^2 . The range is expressed as a percentage of the average— $R\%$; and the index between the maximum and minimum value is $I_{\max/\min}$. These statistical tools are frequently used in paleontology to determine if different species were included in one fossil sample (e.g. Gingerich, 1974; Cope and Lacy, 1992; Martin and Andrews, 1993; Teaford, Walker, and Mugaisi, 1993; Thomson, 1996). For an additional discussion on these statistical tools, see García-Pozuelo-Ramos (1998).

The criteria used in this study to determine whether the variability in the domestic dog exceeds the variability of the species taxon are based on the work of Martin and Andrews (1993) as well as Thomson (1996), who use mixes of species similar to the one being studied; and Simpson, Roe, and Lewontin (1960) who gave a value of 10 for the CV as the maximum value of variability belonging to a single species. I use a CV limit of 10 as well as the intrinsic variation (the variance or standard deviation of the logarithm of the measurements as in Lewontin, 1966) because it is invariant under a multiplicative change. This compares the variability among different beings like canids and primates in a more effective manner. The intrinsic variation allows a demonstration of similarities even when there is a reduced number of data, as it is usually the case

Table I. Description of the skull measurements taken from the domestic dog sample. The lettered distances here are shown in Figure 1.

- (a'): Condylbasal length.
- (b'): Maximum skull width across the zygomatic arches.
- (c'): Skull breadth across the mastoid process.
- (d'): Postorbital process width.
- (e'): Interorbital breadth.
- (f'): Minimum width of cranium at postorbital constriction.
- (g'): Cranial vault width to parietal-temporal suture.
- (i'): Face length.
- (j'): Length of auditory bulla from the carotid channel to the farthest back area.
- (k'): Basicranial axis length.
- (l'): Alar caudal foramen to alar rostral foramen arch length.

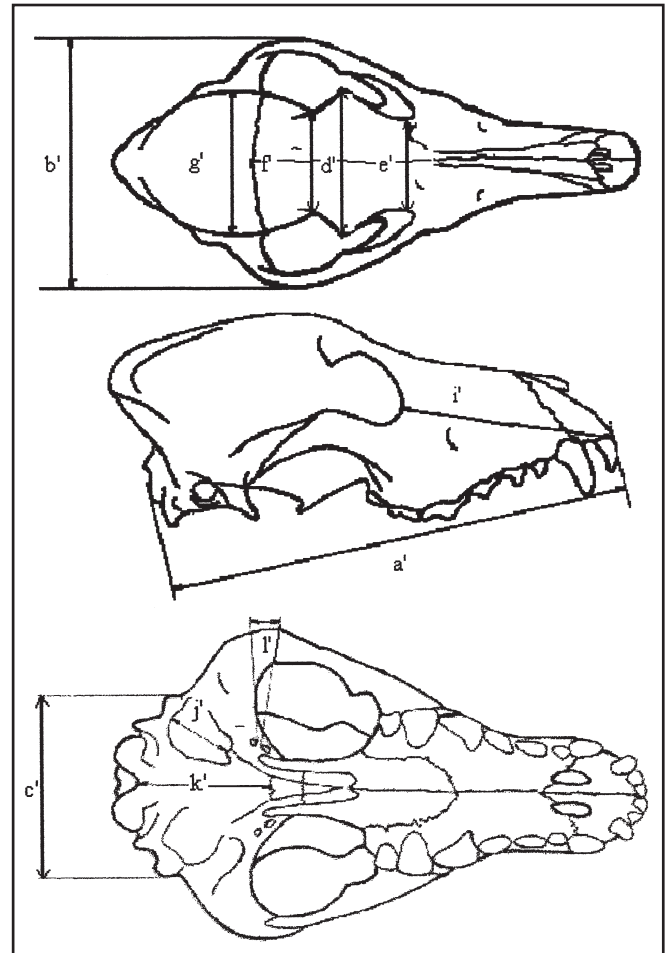


Figure 1. Cranial measurements taken on domestic dog skulls. The lettered measurements shown here are named in Table I.

with fossils (Lewontin, 1966). An additional advantage of the intrinsic variation over the CV is that all the usual statistical tests can be performed (Lewontin, 1966). When it has been possible, I have carried out the F-test in order to compare the significance of the differences between different intrinsic variations of humans and dogs. The utilization of F-test to determine the significance of the differences in intrinsic variation of several samples has been demonstrated by Uchida (1996). No matter which method is used, however, one can never say with absolute certainty that a particular sample is composed of just one species (Martin and Andrews, 1993). The data can demon-

²CV is the standard deviation expressed in percent to the arithmetic mean of the given population. The Coefficient of Variation is used to compare the variation of a measurement (for example, the length of legs) in different populations or species, independently of the magnitude of their measurement (for example, to compare the length of the legs of elephants with the length of legs of horses).

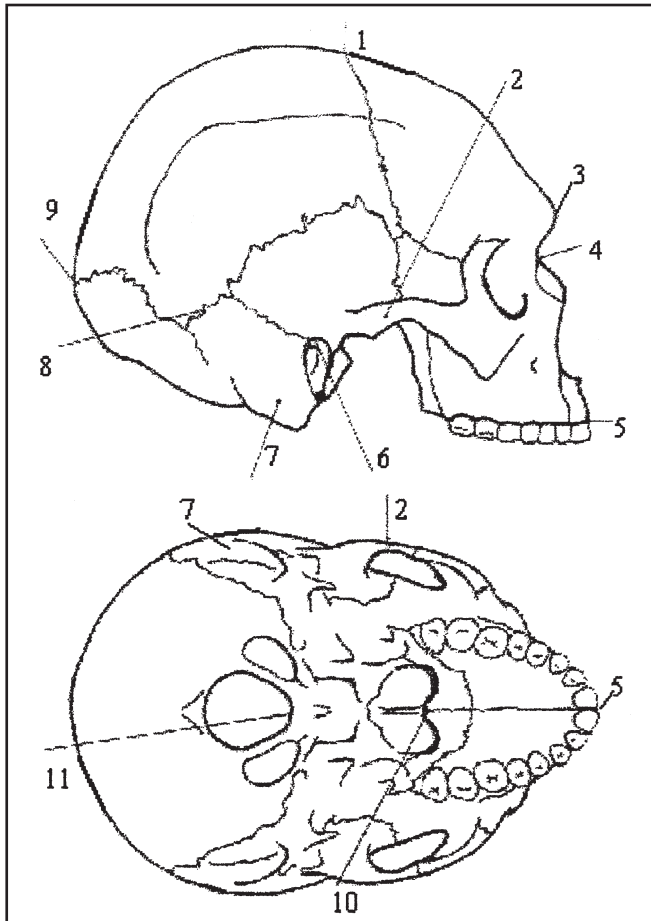


Figure 2. Cranial landmarks on skulls of *Homo sapiens*. (1) Bregma. (2) Zygomatic arch. (3) Glabella. (4) Nasion. (5) Prosthion. (6) Auricular. (7) Mastoidal process. (8) Asterion. (9) Lambda. (10) Staphylion. (11) Basion.

strate the presence of more than one species with some degree of certainty.

Results and Discussion

Comparison of the coefficient of variation between measurements from skulls of different canids shows that the CV values for the domestic dog (*Canis familiaris*) generously exceed the CV values of different species and mixes of canis, called Mix1 and and Mix2 (Table III and Figure 3). The width of the neurocranium (g'), however, is an exception in that this width is similar in the dog and the other canid species analyzed. The g' value for domestic dog is less than 10 and is less than the g' value for Mix1 and Mix2 (Table III and Figure 3).

Morey (1992) has studied a sample of 65 dogs from several different archeological sites. I have compared the sample of dogs studied by Morey (1992) with my sample of 43 domestic dogs in three measurements — a' (length of cranium), g' (cranium width), and i' (length of face).

Table II. List of teeth and skulls utilized in mix of *H. sapiens sapiens*, archaic *H. sapiens* and *H. erectus*. The numbers in parentheses following each type of specimen refer to origin of data.

Teeth

Homo sapiens sapiens: KS 81001 B,C,D,E,H (1); KP 79501 (1); Krm 13400, 14696, 16424 (2); 262587, 304095, 320916, 339064 (3).

Archaic *Homo sapiens*: Xujiayao (1); Changyang (1); PA 74, 874, 875 (1); Ehringsdorf (3); Le Moustier (3); Spy 1, 2 (3); La Quina H5 (3); Krapina (3); L.H.18 (4); Dmanisi (5); Thomas Quarry 1 (5); Mauer (5).

Homo erectus: Chenjiawo (1); PA 637, 836, 838, 839 (1); *H. erectus pekinensis* (1); KNM-ER 820, 922, 3733 (6); KNM-WT 15000 (6); Sangiran 4, 5, 17 (6); Tighenif 1, 2, 3 (6); Trinil 4 (6).

Skulls

Homo sapiens sapiens: Liujiang (1); Zhoukoudian 101, 102, 103 (1); Cohuna (7); Kow Swamp 1, 5, 14 (7) Cos-sack (8); 792 (9); 279540 (10); 23, 1303, 1417, 1420, 219263 (11); 228017 (12); 7539-10, 242869, 283619, 378403 (13); 3780, 3786, 3811, 3829, 3839, 4040, 4042, 4071, 4080 (14).

Archaic *Homo sapiens*: Dali (1); Jinniushan (1); Rhodesia (3); Neander (3); Spy 1, 2 (3); Gibraltar (3); Monte Circeo (3); Petralona (3); Cr 4, 5, 6 (15); Ndutu (16); Steinheim (16); La Ferrassie 1 (17); La Chapelle aux Saints (17); La Quina (17); Le Moustier (17); Danakil (18).

Homo erectus: Gongwangling (1); Hexian (1); *H. erectus pekinensis* II, III, V, X, XI, XII (1); KNM-ER 3733, 3883 (6); OH 9(6); Sangiran 2, 4, 10, 12, 17 (6); Trinil 2 (6).

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- (1) Wu, and Poirier (1995).
- (2) Rightmire, and Deacon (1991).
- (3) Hrdlicka (1930).
- (4) Day et al. (1980).
- (5) Gabunia, and Vekua (1995).
- (6) Wood (1991).
- (7) Thorne, and Wolpoff (1981).
- (8) Freedman, and Lofgren (1979).
- (9) Burkitt, and Hunte (1922).
- (10) Hrdlicka (1924).
- (11) Hrdlicka (1928).
- (12) Hrdlicka (1927).
- (13) Hrdlicka (1944).
- (14) Shapiro (1929).
- (15) Arsuaga et al. (1997).
- (16) Clarke (1990).
- (17) Heim (1974).
- (18) Abate (1998).

The three measurements show a greater CV value in my sample, especially in the length of the cranium (a'), and the length of the face (i') (Table III and Figure 4). These data suggest that within historical times the morphological diversification of the domestic dog has increased.

In the order Primates, the mix of seven species of guenons (genus *Cercopithecus*) manifests a variability CV below 10 except in basion-prosthion length (16 of Ta-

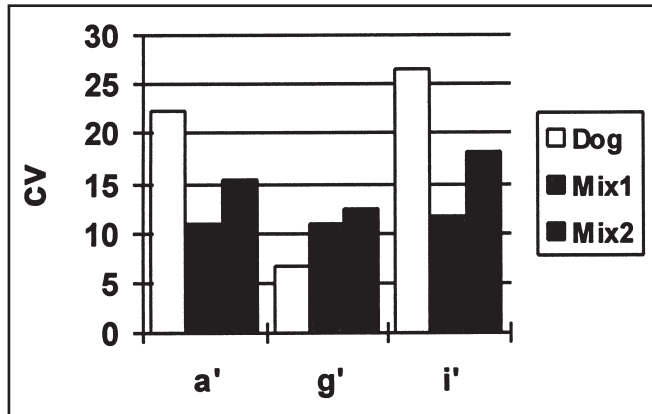


Figure 3. Comparison of the coefficient of variation between cranial dimensions of domestic dog and Mix1 (*C. lupus* and *C. latrans*), and Mix2 *C. lupus*, *C. latrans*, and *C. aureus*). The lettered items are listed in Table I and illustrated in Figure 1.

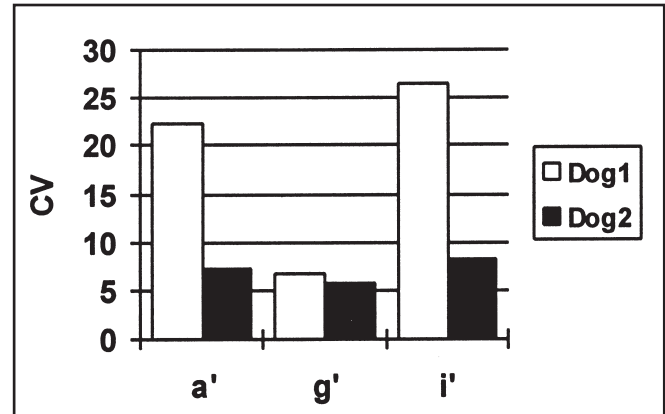


Figure 4. Comparison of the coefficient of variation between cranial dimensions of domestic dog, Dog1: author's collection, and Dog2: archaeological collection after Morey (1992). The lettered items are listed in Table I and illustrated in Figure 1.

ble IV) and staphylion-basion length (26 of Table IV). The three measurements that have been possible to compare between the *Cercopithecus* mix and *Canis familiaris* (postorbital constriction—6 of Table IV and f' of Table VI; interior biorbital breadth—19 of Table IV and e' of Table VI; and bizygomatic breadth—20 of Table IV and b' of Table III) show the greater variability in the domestic dog. Hence, *Cercopithecus* represents one morphologically coherent group, just as has been suggested by some authors (Hartwig-Scherer, 1993; García-Pozuelo-Ramos, 1997; Robinson and Cavanaugh, 1998).

In the case of the mix of data of three pongids—*Gorilla gorilla* (the gorilla), *Pan troglodytes* (the chimpanzee), and *Pongo pygmaeus* (the orangutan)—the postorbital constriction is less variable than in the dog. The

Table III. Comparison of the coefficient of variation between measurements from skull of different canids and mixes.

Canids	a'	b'	c'	e'	g'	i'
Dog1	22.2(43)	15.8(40)	18.8(41)	20.5(41)	6.8(42)	26.5(43)
Dog2 (1)*	7.3	-	-	-	5.6	8.2
Canis lupus(1)*	5.2	-	-	-	3.8	5.5
Canis latrans(1)*	4.4	-	-	-	3.9	5.5
Canis aureus(1)*	7.0	-	-	-	4.9	8.2
Mix1(1)*	10.9	-	-	-	10.8	11.6
Mix2(1)*	15.3	-	-	-	12.4	18.0
Vulpes vulpes(2)*	4.6	5.2	6.0	8.0	-	-
Lycaon pictus(3)*	-	-	-	-	6.1	3.4

The numbers in parentheses behind the CV values for Dog1 correspond to the number of specimens used in this study. The numbers in parentheses with an asterisk (standing after each category) correspond to the references for the original data in which (1)* is Morey, 1992; (2)* is Huson, and Page, 1979; and (3)* is Girman et al., 1993. Mix1 included *C. lupus* (the gray wolf), and *C. latrans* (the coyote). Mix2 contained *C. lupus*, *C. latrans*, and *C. aureus* (the golden jackal). Dog1 is the author's collection of dog skulls, and Dog2 is the archaeological collection of dog skulls in Morey (1992). Key letters in Table IX.

Table IV. Coefficient of variation, index between the maximum and minimum value and range, expressed as a percentage of average in measurements from skull in mix of *Cercopithecus* genus (guenons).

Mix of <i>Cercopithecus</i>	3	6	7	8	10	16	19	20	26	40
CV	8.5	4.1	7.1	8.5	6.3	12.1	6.8	9.7	13.4	7.3
Imax/min	1.7	1.2	1.4	1.6	1.4	1.6	1.4	1.5	1.7	1.4
R%	60.7	20.0	29.4	46.7	32.0	47.5	30.8	41.5	54.9	34.4

3: Basion-nasion length. 6: Postorbital constriction. 7: Biauricular breadth. 8: Anterior basicranial breadth. 10: Basion-bregma chord. 16: Basion-prosthion length. 19: Interior biorbital breadth. 20: Bizygomatic breadth. 26: Staphylion-basion length. 40: Maxilar breadth. This mix included *C. aethiops*, *C. ascanius*, *C. cephus*, *C. l'hoesti*, *C. mitis*, *C. mona*, and *C. neglectus*. Key numbers, and data after Verheyen (1962).

Table V. Coefficient of variation in measurements from skull of pongids.

Pongids	1	2	3	5	13	20
<i>G. gorilla</i> (the gorilla) (61)	6.7	6.6	6.5	6.2	8.9	11.0
<i>P. troglodytes</i> (the chimpanzee) (60)	3.5	3.4	5.0	5.0	7.4	5.7
<i>P. pygmaeus</i> (the orangutan) (53)	5.6	7.5	6.3	6.6	10.2	13.9
Mix of the three (174)	10.1	6.9	10.2	7.0	9.2	15.4

1: Maximum length. 2: Maximum breadth. 3: Basion-bregma length. 5: Post-orbital constriction. 13: Palatal breadth. 20: Bizygomatic breadth. Key numbers and data after O'Higgins, Moore, Johnson, and McAndrew (1990). The numbers in parentheses after each category at the left are the number of specimens analyzed.

variability of maximum breadth and bizygomatic breadth (2 and 20 in Table V) in a mix of pongids is similar to the variability of cranial vault width and bizygomatic breadth (g' and b' in Table III) in domestic dog (Dog1 in Table III). We cannot compare the palatal breadth of the mix of pongids with my sample of dogs, but their CV is less than 10. Only one of the six measurements (the basion-bregma length) in great apes has a CV value slightly greater than 10 (Tables III, V, VI, and Figure 2). These results support the idea suggested by some authors that all the pongids belong to the same holobaramin (García-Pozuelo-Ramos, 1997).

The mix of *H. erectus* I have studied exposes a CV in cranial traits below 10, except in the biasterionic breadth (Table VII and Figure 2). Hence, the cranial variability in *H. erectus* specimens is smaller than what is considered the limit of the species. The CV of dental measurements leads to the same conclusion (García-Pozuelo-Ramos, 1998). Kramer (1993) has also found that the variability of certain cranial measurements of *H. erectus* does not justify the division of this taxon into several species, as was proposed by other researchers (e.g. Jacob, 1976; Alexeev, 1986; Wood, 1992).

When we compare the CV for cranial variability in modern man with values for a mix of *H. erectus*, archaic *H. sapiens*, and *H. sapiens sapiens* (modern man), the mix is more variable (Tables VIII and IX). In the case of the basion-bregma length (Figure 2), the CV values in

the mix of *Homo* is greater than in the mix of pongids (Tables V and IX).

Dental variability (CV, $I^{\max}/_{\min}$, and R%) in mix of *Homo* is lower than such variability in the domestic dog (Table IX, García-Pozuelo-Ramos, 1998). The F-test analysis demonstrates that differences between the intrinsic variability of dental measurements in the mix of *Homo* and domestic dog are significant (see Table X).

The cranial measurements that can be compared between the dog and the mix of *Homo* are few in this study. The

variability (CV, $I^{\max}/_{\min}$, and R%) of the cranial greatest length is greater in the domestic dog than in the mix of *Homo* (Tables III and IX). The F-test analysis shows that the difference between intrinsic variability in *Homo* and *Canis familiaris* is significant for cranial greatest length (Table X). Four of the seven cranial measurements analyzed in the mix of *Homo* have a CV value of less than 10. Three of these cases are greater than CV value 10, and one of these is biasterionic breadth (Figure 2). There is no measurement of biasterionic breadth for the domestic dog in this study. However, I have compared it with cranial vault width (g' of Table I). In the dog the CV value is less than that of the mix of *Homo*. That difference is significant according to the F-test (Table X). According to these data the cranio-dental variability of the mix of *Homo* would be, at most, similar to such variability in *Canis familiaris*, when these data are taken together.

Dental variability is greater in *Canis familiaris* than in the mix of *Homo* (Table IX, and García-Pozuelo-Ramos, 1998) but it is more difficult to compare the variability between these two. In the mix of *Homo* four out of seven measurements are not greater than CV of value 10. In the case of the dog, fourteen measurements of the cranium generously exceed CV of 10. Only one, g' (cranial vault width to parietal-temporal suture, Table I and Figure 1), has a CV value less than 10 which was also less than that seen in canids mix1 and mix2 and it was close to the CV of other species of canids (Table III).

Table VI. Coefficient of variation, index between the maximum and minimum value and range, expressed as a percentage of average in measurements from skull of dog.

Dog1	d'	f'	h'	j'	k'	l'	m'	n'	o'
CV	20.1(41)	10.6(42)	21.1(39)	17.3(43)	19.7(41)	25.9(43)	22.6(40)	29.0(39)	25.6(40)
$I^{\max}/_{\min}$	2.2	1.7	2.4	1.8	2.0	3.1	2.1	3.3	2.4
R%	78.0	57.3	82.8	56.5	65.3	109.4	73.5	109.3	83.2

The numbers in parentheses correspond to the number of specimens measurements for each lettered data item. This table is complementary to Table III. The lettered measurements are described in Table I and illustrated in Figure 1.

Table VII. Coefficient of variation in measurements from skull of *H. erectus*.

	8	9	12	14	25	31
CV	7.5(13)	4.0(13)	4.3(13)	10.2(14)	8.7(14)	8.0(11)

8: Minimum frontal breadth. 9: Maximum parietal breadth. 12: Supramastoid breadth. 14: Biasterionic breadth. 25: Bregma-lambda length. 31: Lambda-asterion length. The numbers in parentheses correspond to the number of specimens used in this study. Key numbers and data after Wood (1991).

Table VIII. Coefficient of variation in cranial dimensions of *Homo sapiens sapiens*.

	AUB	BNL	XCB	ZYB	WCB	ASB	BPL	DKB	BBH
CV	4.4	4.3	3.8	4.8	5.4	4.5	5.3	9.7	4.2

AUB: Biauricular breadth. BNL: Basion-nasion length. XCB: Maximum cranial breadth. ZYB: Bizygomatic breadth. WCB: Minimum cranial breadth. ASB: Biasterionic breadth. BPL: Basion - prosthion length. DKB: Interorbital breadth. BBH: Basion-bregma length. Key letters, and data after Howells (1989).

Table IX. Coefficient of variation, index between the maximum and minimum value and range, expressed as a percentage of the average in measurements from skull in mix of *Homo* genus.

	1	2	3	4	5	6	7
CV	8.8(19)	7.8(19)	8.4(28)	8.1(29)	10.1(30)	10.7(30)	6.7(58)
$I_{\max/\min}$	1.3	1.3	1.4	1.4	1.6	1.6	1.4
R%	29.8	23.6	34.1	31.0	45.1	47.9	30.1
	8	9	10	11	12	13	
CV	11.5(23)	6.0(18)	13.7(15)	9.4(47)	9.2(12)	11.8(14)	
$I_{\max/\min}$	1.5	1.3	1.6	1.5	1.3	1.5	
R%	40.4	26.3	48.3	39.0	27.5	40.1	

1: M¹length. 2: M¹width. 3: M₁length. 4: M₁width. 5: M₂length. 6: M₂width. 7: Cranial greatest length (glabella ad maximum). 8: Basion-bregma length. 9: Basion-nasion length. 10: Bregma-lambda chord. 11: Minimum frontal breadth. 12: Biauricular breadth. 13: Biasterionic breadth. The mix is composed of *Homo erectus*, archaic *H. sapiens*, and *Homo sapiens sapiens*. The list of skulls studied is found in Table VI. The numbers in parentheses correspond to the specimens used in this study.

The variability of the basicranial axis length, k' (Table VI and Figure 1) measured from the midventral side of the foramen magnum to the basisphenoid-presphenoid suture has special significance because of the stability of the base of the cranium (Enlow, 1992). The variability of this feature (CV) is much higher than 10. It appears that not only dogs, but all canids belong to one holobaramin (Crompton, 1993). Hence, I believe that the mix of *Homo* may constitute a single holobaramin.

Under stressful conditions of domestication, the fox (*Vulpes vulpes*) increases its variability. A great part of this enhanced variability is in the same direction as that

of the dog (Belyaev and Borodin, 1982). In approximately 20 years time, the wild fox altered its behavior becoming a domestic animal. It changed a few aspects of its morphology, there were hormonal changes, and it even underwent changes of the karyotype (Belyaev, 1979). Parsons (1986) has suggested that the explosions of variability concentrate in periods of environmental stress. Cases of environmental stress could have been frequent in nature on a worldwide scale after the Fall and again as a result of the Flood. But what is it that unleashes a process of variation under conditions of stress? Crossing-over, (i.e., genetic recombination) is more frequent and mutations are more common. Mobile genetic elements increase their mobility, passing from one place to another in the genome which produces alterations of genetic function (Belyaev and Borodin, 1982; Parsons, 1986). Molecular details of these processes have been seen in recent investigations. Heat-shock proteins are produced under high temperatures stress conditions. One of these proteins (Hsp90) under normal conditions involving no stress, masked certain genetic determinants in *Drosophila*. These genetic determinants were noted under stress conditions as Hsp90 changed its function and take on stress-protective functions (Rutherford and Lindquist, 1998). These genetic determinants produced morphological variants which were heritable. To demonstrate that stress played an important role in

the diversification of baramins after the Fall and after the Flood would be more difficult. Currently, however, there is a theoretical possibility of checking this. Under environmental stress, a fluctuating asymmetry is produced, that is, an alteration of the organismal morphological symmetry produced by a developmental instability (Parsons, 1992). Study of fluctuating asymmetry can reveal whether or not stress was a cause for the increase in variability in living beings after the Fall and after the Flood. The great number of fossil specimens required to make this research possible, however, would present a problem.

Conclusion

Study of the cranial metric variability in a sample of *Canis familiaris* (domestic dog) makes four things clear. (1) Metric variability in the skull of *Canis familiaris* corresponds to the variability expected in a combination of more than one species of wild dogs. (2) Cranial metric variability of archaeological specimens of *Canis familiaris* is smaller than that found in living *Canis familiaris*. This demonstrates an increase of the variability of this species in historical times. (3) Cranial metric variability of *H. erectus* skulls of diverse origin confirms the interpretation that they all belong to a single species. (4) Cranial and dental metric variability in a sample of domestic dogs is close to one represented by a population composed of a mixture of data representing *H. erectus*, fossil *H. sapiens*, and *H. sapiens sapiens*. This information suggests that *H. erectus*, fossil *H. sapiens*, and *H. sapiens sapiens* should be lumped into one holobaramin.

Although more research on other hominids is necessary, these data support the creation idea that human beings were produced by the Creator as a separate holobaramin, distinct from and unrelated to other primate or pongid holobaramins.

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Table X. F-tests for dogs and for the genus *Homo*.

	M1L	M1W	M1L	M2L	SL	SW
M1L	3.88/1.42 +					
M1W		4.85/1.19 +				
M1L			4.15/1.36 +			
M2L				6.51/1.94 +		
SL					10.42/0.85 +	
SW						0.88/2.56 +

SL: skull length. SW: skull width. The number to the left of the slash corresponds to intrinsic variation $\times 10^3$, for dogs. The number to the right corresponds to the intrinsic variation $\times 10^3$ for the *Homo* mix described in the caption of Table IX. The plus sign (+) indicates a statistically significant difference between the standard deviations of the two samples ($P < 0.05$).

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Personalities in Creationism: John Woodmorappe

John Woodmorappe was born in the United States to Polish immigrant parents who lost everything in World War II. Thus his family experienced the difficulty of adapting to a new language and culture under trying circumstances. Life has been a challenge to John since he is afflicted with Tourette Syndrome, a misunderstood neurological disorder, that causes him to have spells of torso rocking and finger movement. Since he was a toddler, Woodmorappe has had an insatiable curiosity in scientific matters. At the age of 10 he could identify many different kinds of trees in his neighborhood even pronouncing their Latin names, which caused his young friends to observe that he sounded like a priest. Occasionally an 80-year-old retired botanist would visit him and they would go on walks together to discuss and examine different trees. When he was in junior high, his superior science projects were entered in annual state fairs. Later he attended one of the most academically-demanding high schools in the United States.

Woodmorappe was not raised as a Bible believer, therefore nothing in his background prompted him to question the philosophical conclusions of conventional science. He was quite comfortable while attending a Jesuit school, which was liberal theologically as well as politically, where he was taught that the Genesis account of creation was a myth and that organic evolution was a proven fact of science. He took an advanced biology course in his sophomore year and later studied ecology where he was taught all of the horror stories of radical environmentalists as fact.

Having learned that DDT and other organic chlorocarbons accumulate in the atmosphere without decomposing, Woodmorappe wrote a paper for one of his instructors in which he suggested a solution to the problem. He postulated that possibly scientists could breed bacteria and subject them to radiogenic mutations for several generations in progressively greater concentrations of DDT. Hopefully a strain of bacteria would be developed that would consume DDT when released into the atmosphere. His teacher told John that his proposal probably would not be feasible unless millions of years were available to obtain a suitably mutated strain of bac-



teria. This answer planted the first seed of doubt toward organic evolution in his mind because it showed that the notion of natural selection culminating in unlimited variation is a highly theoretical rather than a factual concept.

A member of Campus Crusade for Christ (CCC) witnessed to John when he was a college freshman. Woodmorappe accepted Christ as his personal Savior and attended meetings of CCC. During one of these sessions, he asked some Bible-science questions and a CCC member loaned him a copy of *The Genesis Flood*. Reading the book challenged John's

intellect and after much more study, he decided to major in both geology and biology in college because of the pivotal role of these two disciplines in the study of origins. Actually geology "is in Woodmorappe's blood" as his grandfather had been a geologist who had owned an oil well in Boryslaw (now in western Ukraine). John has earned a B. A. in biology and a B. A. and M. A. in geology.

In the late 1970s and early 1980s, he wrote a series of articles for the *Quarterly* of which several were collected in an excellent monograph, *Studies in Flood Geology* (now in its second edition). He has written for *Ex Nihilo Technical Journal*, spoken at all of the International Conferences on Creationism and is the author of two other monographs, *Noah's Ark: A Feasibility Study* and *The Mythology of Modern Dating Methods*. John is a dedicated, productive creationist and is one of our most reliable peer reviewers for *Quarterly* articles in his fields. He is in earnest in his field work and research from the creationist perspective and a deadly opponent of evolutionism. Woodmorappe continually exposes the pseudoscholarship of naturalists. His extensive geological field work has taken him to many places in the United States (17 states) and Canada (2 provinces) from Alabama to Alberta and from Montana to New York.

When not involved in his professional and creationist activities, John enjoys swimming, rollerblading, ice skating and bicycling as well as being an inveterate cat lover. It is a pleasure to honor John Woodmorappe in this issue of the *Quarterly*.

Emmett L. Williams

Information Theory, Consequence Operators, and the Origin of Life

Robert A. Herrmann*

Abstract

In this article, the Gitt (1997) concept of information as it is represented by a mental-like sequence of activities is compared with the mental activity represented by consequence operators. It is shown how consequence operators model mathematically these Gitt notions and how a specific ultralogic and four ultrawords yield an identical foundation for Gitt's information theory scenario for the origin of life. Consequence operator theory, as a model for Gitt information theory, is used to establish that, relative to this model and without external modification to the processes, it is not possible, using fixed pragmatic information, to increase or decrease the complexity of a biological entity by selecting from two distinct independently produced biological entities as these entities

are characterized at the apobetic level. This signifies that if random *mutations* are *random* alterations in the characteristics of a biological entity that are, necessarily, not dependent upon the original biological characteristics, then this model would tend to disallow random mutations as a viable source for biological alterations. On the other hand, for fixed pragmatic information, an increase or decrease in complexity by selecting from two distinct apobetic level biological entities is possible if a very special dependency exists between their characteristics. Further, complexity can also be increased by applying the semantic level consequence operator to an increased portion of the information contained within the genetic code in the DNA, information that exists originally.

Introduction

Information theory as introduced by Shannon (Shannon and Weaver, 1964) is often understood to be a statistical approach to the formation of a language from strings of symbols. However, many researchers (Gitt, 1997; Steinbuch, 1968; von Weizsäcker, 1974) state that this approach to information theory does not capture its actual essence. Indeed, relative to the statistical approach Weaver (Gitt, 1997, p. 45) is quoted as writing: "Two messages, one which is heavily loaded with meaning and the other which is pure nonsense, can be exactly equivalent . . . as regards information." Rather than being defined in terms of statistics and combinatorial mathematics, can the actual *mental activity* nature of information be discussed successfully?

Werner Gitt (1997) has presented to the scientific community a collection of "Theorems" that appear to capture the actual mental activity associated information. Gitt uses a five level approach, where the informa-

tion content of the statistical level is extended significantly. This approach is utilized to model the origin of life question as well as to model a series of scriptural statements. Gitt's thesis is that it is mental-like behavior that is the true essence of information theory. Is this Gitt approach equivalent to another approach the foundations of which have been extensively investigated previously?

In a series of articles (Herrmann, 1982, 1984, 1985, 1986a, 1986b, 1988, 1994a), a newly devised method to model mathematically the origin of and the time development for a *natural system* is discussed in a nontechnical yet detailed manner. (Note: Most italicized terms are either specifically defined within the body of this article or in the glossary.) This model shows that it is rational to assume that the most basic behavior that can be associated with the development of a natural system is a behavior that is being mirrored by processes that resemble those associated with an infinitely powerful mental activity. Further, this modeling process, when interpreted linguistically, is shown to correspond to numerous scriptural statements. Hence, this correspondence verifies the scientific rationality of these scriptural statements.

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The Herrmann modeling process is chosen so that it is compatible with all known forms of scientific deduction. Consequently, the results are all relative to the most basic foundation for the origin and development of a natural system and are not concerned with a particular deductive pattern that one might associate with a particular theory. It was assumed that the reader of these past articles could, using the discussed methods, investigate various well-known scientific *inner-logics* that are associated with various theories and, without difficulty, correlate these inner-logics to the *ultralogics* discussed in these articles. Unfortunately, this assumption has not been fully realized. Consequently, within this article, a specific and somewhat complex illustration is given relative to “information theory” as this theory is presented by Gitt (1997) and as Gitt information theory relates to the origin and existence of biological life. This illustration serves as a prototype for all discussions relative to a specific concept that requires some form of logical deduction or similar mental activity, and that is relative to a specific natural system.

A few technical aspects will be recalled; but, the actual mathematical structure with its in-depth construction is rather technical in character and will not be discussed, in detail, within this article. However, partial or full discussions can be found in Herrmann (1993, 1994b, 1999). Although a few formal definitions will be given, in most cases, what is presented here are notions that are intuitively rather than formally defined. As discussed in Herrmann (1994c), it is not difficult to show that all scientific communication can be represented by finite strings of symbols taken from a finite alphabet $\mathcal{A}$. Using modern digitizing techniques and electronics, such finite strings of symbols also include visual and audio impressions. The set of all such nonempty finite strings of symbols is called a language $\mathcal{L}$. (Note: This is not a language as described by Gitt.) Each nonempty finite string of symbols is called a *word* or *readable sentence*. Among the collection of all words, there are specific ones that correspond to meaningful strings of symbols that appear in a *discipline dictionary*. This discipline dictionary corresponds to Gitt’s *language elements*. Further, there are readable sentences that are constructed from members of the discipline dictionary by means of a set of formalized or formalizable rules. (Note: The rules themselves are also readable sentences.) These rules form the *syntax* for a language. For the case of digitized visual and audio impressions, this syntax is the construction of the electronic instrumentation and required software that will translate a specific collection of strings of symbols into the actual electronically presented impressions; i.e. computer or TV screens, and speakers. These syntactically constructed strings of symbols are also members of $\mathcal{L}$ and form what is termed as a *meaningful set of readable sentences* or *mean-*

ingful words, $\mathcal{L}_M$, and various nonempty subsets of $\mathcal{L}_M$ correspond to Gitt’s second level of information (1997, p. 57), the *syntax level*.

Equivalence Classes

Prior to discussing the mathematical entity that gives a rather general model for many types of human mental processes, one technical aspect for such modeling needs to be explored. This aspect was assumed to be self-evident in some of the previous Herrmann articles written on this subject. However, this “self-evidence” will now be further detailed. Different natural languages use different discipline dictionaries as well as different syntactic rules. In formal logic, the same symbols and same syntactic rules yield different strings of symbols that are said to be “logically equivalent.” Throughout various deductive arguments logically equivalent strings of symbols can be substituted, one for another, and the logical argument remains valid. This type of equivalence is defined in a strict and not controversial manner. Types of equivalence are necessary when natural or native language descriptions are used. However, a definition as to the equivalence of different native language strings of symbols is necessarily more intuitive in character.

First note that to comprehend properly a set of symbol strings that contains more than one string of symbols it is usually required that the strings be presented in a specific order. When necessary, the use of a spacing and punctuation symbols would allow any finite set of such symbol strings to be considered as a set that contains but one string of symbols. However, even under a single symbol string notion, various types of equivalence are required for natural language descriptions. Intuitively, this equivalence is captured within the statement that “two strings of symbols are *saying the same thing* or have the *same relative meaning*.” It is necessary that a form of mental activity and general consensus be considered in order to come to this conclusion. Whatever technique is used for this purpose, such a concept appears to have universal acceptance or else it would not be possible to “translate” efficiently from one native language to another and ever hope to achieve the same intended results being communicated by two different strings of symbols. Of course, the same idea of equivalent symbol strings would hold within a specific meaningful language as well. The equivalence of two different strings of symbols probably depends upon the term “thing” presented above. But, in any case, such an equivalence would need to be accepted by the vast majority. In some cases, “testing” can be used to determine whether different symbol strings yield equivalent mental results; that they are, indeed, “saying the same thing.”

The set of all “equivalent” strings of symbols taken from $\mathcal{L}_M$ and that have been adjudged to be “saying the same thing” is called an *equivalence class*. Distinct equivalence classes are disjoint, that is they have no members in common, and every member of $\mathcal{L}_M$ is contained in some equivalence class. The self-evident notion previously made but not explicitly stated is that the actual set $\mathcal{L}_M$ that determines the domain and codomain for our consequence operators is a set composed of one and only one member, a *representative*, from each of these equivalence classes. In all that follows in this article, the exact same symbol string representation for an equivalence class will be used. This procedure is tacitly assumed.

Consequence Operators

Although our next object of significance is defined on the set of all subsets of $\mathcal{L}$, its application is usually restricted to the set of all subsets of some nonempty $\mathcal{L}_1 \subset \mathcal{L}_M$ (Herrmann, 1993, pp. 1 and 24). Using a weak set-theory, Tarski (1930) models a fundamental essence for mental activity and uses this model to investigate deductive logic. It was discovered in 1970 (Wójcicki, 1970), that a slight generalization of the Tarski ideas leads to significant additional algebraic properties. A *consequence operator* is a function Cn , in the general sense, that is applied to each $A \subset \mathcal{L}_1$ and gives $Cn(A) \subset \mathcal{L}_1$ and which satisfies three axioms. (1) $A \subset Cn(A)$, (2) $Cn(Cn(A)) = Cn(A)$, (3) and if $A, B \subset \mathcal{L}_1$, $A \subset B$, then $Cn(A) \subset Cn(B)$. Each of these axioms will be discussed in order to show how they model the most basic aspects of mental activity.

For axiom (1), suppose that A is a set of meaningful sentences upon which some form of mental activity is performed. The result $Cn(A)$ represents all of those meaningful sentences that are obtained when that mental activity is performed on A . In order to perform the mental activity on A , the members of A must be mentally recognized. This is the first and absolutely necessary form of mental activity needed prior to application of Cn .

To codify this requirement within these axioms, it is required that the mental activity being performed allows $A \subset Cn(A)$. This process is necessary in almost all formal deduction and constitutes the process of stating an hypothesis as part of a deductive pattern. Indeed, if $A = Cn(A)$, then one would conclude that Cn yields no “new” deductive statements from A or, except for the recognition process, no “other meaningful” mental activity relative to $\mathcal{L}_1$ has occurred. It is also clear how to determine which strings of symbols are produced by this “other meaningful” mental activity that is distinct from the recognition requirement. These are those strings of symbols in $Cn(A)$ and not in A , i.e. members of $Cn(A) - A$.

Axiom (2) is called the idempotent axiom; and it is a symbolic representation for the concept that $Cn(A)$ should contain *all* members of $\mathcal{L}_1$ that are obtain from this specific mental activity, and simply applying Cn again will not alter the statement that *all* such members are obtained from the original application of Cn . Indeed, if $Cn(A)$ is a form of human deduction, then $Cn(A)$ is the *theory* obtained from the hypotheses A . The same form of human deduction Cn applied to a theory will not produce any new deductive results. Note that this aspect is dependent upon the Cn being considered. Different consequence operators (mental activities) applied to A can yield significantly different results, however.

Axiom (3) represents what the brain does sequentially prior to any additional mental activity. By way of illustration, suppose that $A, B \subset \mathcal{L}_1$, $A \subset B$, and A, B are sets of written strings of symbols. The mental activity represented by Cn is considered as fixed. From the axiom (2) notion, $Cn(A)$ represents all the symbol strings this mental activity is able to express. Since $A \subset B$, then by this fixed mental activity applied to B , you can still restrict your activity, first, to A and obtain $Cn(A)$. Continued application to $Cn(A)$ will not yield any new results. But, next, you could get new results by applying the mental activity to the set $B - A$ and adjoin these results to $Cn(A)$. This is the exact approach when B is considered as a set of hypotheses to which scientific logic is applied. This type of sequential approach is codified by requiring $Cn(A) \subset Cn(B)$. Whether or not this might reduce the original $Cn(A)$ so that axiom (3) would not hold would depend upon another mental process, not considered as an aspect of this generalized consequence operator, that is performed after the $Cn(A)$ and $Cn(B)$ are obtained.

Although it may seem rather trivial, one of the more significant consequence operators is the *identity* operator, I . As the name indicates, I is defined on $\mathcal{L}$ [resp. $\mathcal{L}_1$] as follows: for each $A \subset \mathcal{L}$ [resp. $\mathcal{L}_1$], $I(A) = A$. This operator can be used to model cases where mental activity yields no “new” results and to construct consequence operators.

The Syntax Level

Relative to the origin and development of life, Gitt begins his information scheme not at this level of information but, rather, at the semantic level. Considering the equivalence class concept, this level corresponds to nonempty subsets of $\mathcal{L}_M$. The mental activity that produces this syntax level from $\mathcal{L}$ or even from the set of all language elements, does not appear to be a consequence operator. Under the most general possibility, suppose Sy is an operator that takes every subset of $\mathcal{L}$ and yields subsets of $\mathcal{L}$, which would be the first requirement for Sy to

be a consequence operator. It seems reasonable to require that this operator should yield $Sy(\mathcal{L}) \subset \mathcal{L}_M$. However, unless $\mathcal{L} = \mathcal{L}_M$, which undoubtedly is not the case, then this reasonable requirement is contradicted by axiom 1. This does not mean that this possibility cannot be mathematically modeled, however.

There are operators that do model mathematically, in a general way, a mental process that would yield this required result and correspond to Sy . One of these is a mathematical finite or general selection operator (Herrmann, 1993, p. 100). The other is the deductive operator (Herrmann, 1993, p. 7). Although these do model, to some extent, certain very general mental activities, they are not consequence operators. Since the application of consequence operator theory to Gitt information theory is the purpose for the investigation presented here, the first application will assume that the sets $\mathcal{L}_1, \mathcal{L}_M$ have been previously obtained by means of mental-like activity modeled by one of these or possibly some other similar mathematical operator.

The Semantic Level

The consequence operators discussed in Herrmann (1982, 1984, 1985, 1986a, 1986b, 1993, 1994a) are of a very special type and apply only to meaningful sets of readable sentences and yield only distinct meaningful results. One obvious aspect of this approach, however, was not required by these special consequence operators, but in a more general setting the idea of "content" (Herrmann, 1994c) was introduced. When restricted to human thought, a syntactically correct string of symbols can invoke a vast array of additional thoughts within the mind of an individual who perceives this symbol string. Due to differing education and training, these additional thoughts and images can differ from one individual to another. The term *content* has been used to express all of the effects a particular string of symbols has upon the mind of an individual who recognizes the string as a meaningful string of symbols. For this discussion, the content is restricted to those effects that can be represented by means of meaningful strings of symbols and is extended to include the general concept of mental activity. Any differences in content can be considered as the outcomes of different consequence operators. On the other hand, two distinct meaningful strings of symbols can produce the exact same content for a fixed consequence operator. Although the idea of content may be somewhat broad in character, the above restriction to effects that are expressible by meaningful strings of symbols corresponds to Gitt's third level of information, the *semantic level*. Hence, consider a fixed "semantics" generating consequence operator Sm de-

fined on $\mathcal{L}_1$. Since Sm is a consequence operator, for a specific $y \in \mathcal{L}_1$, the set of symbol strings $Sm(y) \subset \mathcal{L}_1$ is a complete semantic description obtainable from Sm and the language $\mathcal{L}_1$. This, of course, does not preclude a different semantic description using a different Sm or a different $\mathcal{L}_1$. From the above remarks, it is certainly possible that for two distinct $A, B \subset \mathcal{L}_1$, $Sm(A) = Sm(B)$. Hence, assume that Sm and the next two consequence operators are many-to-one operators; i. e. a specific value might be generated by more than one distinct member of $\mathcal{L}_1$.

Thus far, the term *information* has not been defined. Gitt (1997, p. 124) states that a general definition would be difficult to achieve. However, in accordance with the above, an analytical definition is possible for fixed Sm and $\mathcal{L}_1$. The consequence operator Sm can be viewed as a functional collection Q of ordered pairs. The semantic "information" is actually being displayed by this set Q . Thus *semantic information*, in this sense, is encoded by Sm and its corresponding Q . It is not a numerical measure but rather a set-theoretic concept. Indeed, using different semantic consequence operators Sm_1, Sm_2 one can investigate, as in Herrmann (1987), different strengths of semantic information. However, this additional investigation is not the purpose for this present article and will not be presented in any detail.

The Pragmatic Level

It is certainly possible that the semantic consequence operator is actually the identity operator. In this case, the actual mental activity Sm represents would be minimal. But, in many cases, the semantics includes strings of symbols which would require some sort of *action* to be undertaken; actions that, for a natural system, yield the objects and processes from which a natural system will be constructed. It is at this stage that more mental activity would ensue. The results of such mental activity Gitt calls the fourth level or *pragmatic level* of information.

The results of these actions can also be described in terms of meaningful strings of symbols as previously defined. Denote the corresponding consequence operator by P . Hence, the composition $P(Sm(A))$ yields the descriptive content of these actions. The actual new results of the actions are found in $P(Sm(A)) - Sm(A)$. Of course, Sm and P should be defined, at the least, on subsets of $\mathcal{L}_1$. Suppose that for a particular application of such operators, their axiom 1, 2, 3 behavior only holds for a special set $\mathcal{B}$ of subsets of $\mathcal{L}_1$. This is where the identity consequence operator might be used to extend, if necessary, the Sm and P to the entire set of all subsets of $\mathcal{L}_1$. For example, suppose that $\mathcal{L}_1$ is composed of the 26 alphabet symbols $\{a, b, \dots, z\}$ each of which represents a

meaningful string of symbols. Let $\beta = \{\{a\}, \{a,b\}\} \cup \mathcal{D}$, where $\mathcal{D} = \{A \mid a \in A, A \subset \mathcal{L}_1\}$. Then $\mathcal{Q} = \{(\{a\}, \{a,b\})\} \cup \{(A, A \cup \{a,b\}) \mid A \in \mathcal{D}\}$ satisfies consequence operator axioms 1, 2, and 3. Now if $y \subset \mathcal{L}_1$ and $y \neq B$, for any $B \in \beta$, then adjoin to $\mathcal{Q}$ the (y,y) . It follows that extended $\mathcal{Q}$ represents a consequence operator on $\mathcal{L}_1$. Such consequence operators have a specific application to the concept of adjoining or removing a specific characterization from the description for a biological entity. Once again, the Gitt information associated with this level is encoded by $\mathcal{Q}$.

The Apobetic Level

Once actions have actually been taken as they are encoded by $P(Sm(A))$, that is the pieces of the “puzzle,” so to speak, collectively exist, then to what plan or purpose does the $P(Sm(A))$ correspond? Assuming that such a purpose is representable by characterizing and meaningful strings of symbols from $\mathcal{L}_1$, then to recognize that $P(Sm(A))$ is not just composed of a set of disjoint descriptive statements but that these statements characterize a specific physical entity, plan, or purpose; yet another descriptive collection from $\mathcal{L}_1$ is obtained by means of another level of mental activity. For example, to recognize that $P(Sm(A))$ produces a specific natural system that can be described by a sequence of symbol strings is such a mental activity. For a natural system, intuitively, the mental activity is a *combining together* of the necessary pieces obtained from the pragmatic level in order to produce a complete and identifiable natural system. Gitt calls this fifth level, a teleological information level, the *apobetic level* and it is modeled by a consequence operator T . Relative to a natural system, the result $T(P(Sm(A)))$ is always assumed to be a complete and consistent characterizing subset of $\mathcal{L}_1$. The term *complete* means that $T(P(Sm(A)))$ is maximal with respect to $\mathcal{L}_1$; i.e. $T(P(Sm(A)))$ contains only characterizing statements and if $x \in \mathcal{L}_1 - T(P(Sm(A)))$, then x is not a characteristic of the particular natural system being considered.

Following the application of the Sm, P, T consequence operators, a final mental-like operator, a *realism relation*, such as the one similar to that found in Herrmann (1993, p. 56) needs to be applied. For a given consequence operator Cn , this operator selects from the set of all subsets of $Cn(X)$ those collections of characteristics that can actually characterize an objectively real entity. However, due to axiom 1, this realism relation need only be applied after the application of the last consequence operator in a sequence of such operators, in this case after T , in order to identify the specific characterizing collections. The realism relation represents yet another necessary information level. It is tacitly assumed that this operator is applied.

Thus using the above notation and beginning at the syntactical level Gitt's entire sequence that represents the *internal transfer of information* with respect to a specific $A \subset \mathcal{L}_1$ is captured by the sequence Sm, P, T of consequence operators with the final result described by $T(P(Sm(A)))$. One fact about such a sequence of consequence operators emerges from the theory of consequence operators. In Herrmann (1987, p. 4), the composition considered as a single operator of the Example 2.8 defined C' and Sm consequence operators is not itself a consequence operator. Thus, except under very special circumstances, the composition $(TPSm)$ cannot be considered as a single consequence operator. This implies a significant conclusion that the natural world mental activities modeled by Sm, P, T are usually *ordered* mental activities that are probably not representable by a single consequence operator. Except under very special circumstances, they need to be applied in the specific order indicated.

External Transmission of Information and Gitt's Theorems

There is considerable interest in the external transmission of Gitt information. This can be readily modeled by two sets of meaningful sentences A and A' and two sets of consequence operators defined on $\mathcal{L}_1$, the *sender* operators T, P, Sm and the *recipient* operators T', P', Sm' . A correspondence E between the sender and recipient is necessary and this would amount to another relation, not a consequence operator, such that $E(A) = A', E(Sm(A)) = Sm'(A'), E(P(Sm(A))) = P'(Sm'(A'))$ and $E(T(P(Sm(A)))) = T'(P'(Sm'(A')))$. Of course, it is possible that the sender and recipient are identical entities. In which case, E is but an identity. Further, the E correspondence indicates such things as whether the purpose intended by the sender is achieved by the recipient, for if this is the case, then $E(T(P(Sm(A)))) = T(P(Sm(A)))$. It is self-evident that many other aspects of the external transmission of Gitt information can be characterized by means of E and, further, all of the appropriate general results that have been established about consequence operators would hold for the ones used to model the Gitt concept of information. Recall that this mathematical model begins with the semantic level and not the statistical level that is the domain of information theory as originally envisioned by Shannon and Weaver (1964).

Some of the “Theorems” stated by Gitt (1997) are not inductively deduced by any strong logical argument nor are they obtained from a preponderance of empirical evidence. They are, more probably, axioms for his information theory concepts. However, many other Gitt theorems can be deduced directly from the above simple

mathematical model. The following examples are deductive results that correspond to some of Gitt's (1997) theorems. Theorem 7 (p. 65) states that the allocation of meanings to the set of available symbols is a mental process depending upon convention. This is but the consequence operators Sm and Sm' . Theorem 9 (p. 65) states that if the information is to be understood, the particular code must be known to both the sender and the recipient. This is but the fact that the $\mathcal{A}$ and $\mathcal{L}_1$ are the same for sender and recipient. Theorem 14 (p. 70) states that any entity, to be accepted as information, must entail semantics; it must be meaningful. Again this is Sm and Sm' applied to members of $\mathcal{L}_1$. Theorem 15 (p. 70) states that when its progress along the *chain of transmission events is traced backwards, every piece of information leads to a mental source, the mind of the sender*. Of course, this is but the inverse of E and its relation to the operators T , P , Sm . Theorem 16 (p. 71) states that if a chain of symbols comprises only a statistical sequence of characters, it does not represent information. This result is established since the consequence operators are defined first on the syntactical level since an appropriate logical operator that can be defined on the statistics level and that produces the syntax level is not a consequence operator. Further, Gitt's theorems 17, 19 - 22, 24 are established immediately and without difficulty. Gitt's other theorems can be established if one includes certain of his stated theorems as non-logical physical axioms, where the phrase *physical axiom* is used to differentiate inductive from deductive results.

Is Gitt information as presented within strings of symbols an actual and necessary requirement in order for the material universe to function? Gitt states (p. 29) that "The laws of nature are equally valid for living beings and for inanimate matter." His basic Theorem 1 (p. 47) is that "*The fundamental quantity information is a non-material (mental) entity*. It is not a property of matter, so that purely material processes are fundamentally precluded as sources of information." Then we have Theorem 23 (p. 79) "*There is no known natural law through which matter can give rise to information, neither is a physical process or material phenomenon known that can do this*." There is the claim that all of the stated theorems are obtained by inductive logic using empirical evidence and as such are natural laws. This cannot be the case, however, with theorem 23 since the phrase natural law is part of the theorem statement itself and this theorem would be better classified as a statement within the philosophy of "information science." Further, Theorem 13 states that "Any piece of information has been transmitted by somebody and is meant for somebody. A sender and recipient is always involved whenever and wherever information is concerned." Under Gitt's definition of natu-

ral law, Theorem 13 would need to be applicable to inanimate matter. But it is only applicable to "somebody." It appears likely that, at present, the only *direct* evidence that something like Gitt information is being used and transmitted is evidence relative to certain biological entities that exhibit mental activity and not evidence relative to purely inanimate material objects.

Most certainly one of the foremost advances in human intellectual development is the construction of various types of alphabets and written languages. Although actual neural processes are not being considered, some sort of material processes are taking place when an actual mental process is performed upon a set of symbol strings as an input and a set of such symbol strings is written down as an output. All of modern humankind's actual knowledge of natural law and the scientific descriptions for natural system behavior require a coded or symbolic information theory. The basic definition of the concept termed *natural laws* as these laws are applied today seems to require strings of symbols in order for various *relationships* that appear to exist between discipline dictionary named entities to be represented and comprehended by biological life-forms. There is always the possibility that there are relationships that exist between physical entities that cannot be expressed by any form of humanly comprehensible language.

Thus far, there is no evidence that the actual symbol strings that specify these relationships have been produced within the material world without the aid of a biological life-form. One might conclude that the behavior of a universe as a natural system would continue even if no intelligent life-forms exist. However, it is not the purpose of this article to discuss what might be a satisfactory definition of natural law. But, from the view point of how natural law is expressed today, information theory would only represent a *model* that mirrors certain aspects of natural system behavior that we seem unable to comprehend without its use. Indeed, if the genetic code and information theory is accepted as a reasonable explanation for how life could have come about from fundamental elements and fundamental natural law, then the genetic code and information theory still remains but a model for what could be natural processes that we can only comprehend through application of coding and information theory. This acceptance need not eliminate a search for other specific and fully materialistic processes that would achieve the same goal. On the other hand, nothing in this paper is intended to denigrate information theory or to imply that it is not significant to linguistics, to communication, to mental activity investigations, and as a model for natural system behavior. Those who specialize in information theory have and will continue to contribute significantly to scientific advances.

Nobel Laureate Louis deBroglie wrote:

[T]he structure of the material universe has something in common with the laws that govern the workings of the human mind. (March and Freeman, 1963, p. 143)

This stated and rather obvious fact refers to human comprehension of natural system behavior. In order for us to comprehend and predict natural system behavior, human mental activity is used. General patterns associated with such mental activity would need to mirror the perceived general patterns associated with natural system behavior in order for us to predict by such mental activity specific natural system behavior. Being able to predict natural system behavior is the major application of natural law. Thus every reasonable prediction made and that is verified yields evidence that patterns of mental activity mirror patterns associated with natural system behavior whether the system be animate or inanimate. However, this still only implies that, in general, patterns associated with “information” are, at present, but models that can be an aid to comprehension and prediction.

An Application of Information as an Analog Model

First, one needs to define a mental process as modeled by consequence operators, say, as a *non-material process*. Relative to the actual physical world Yockey (1981, p. 26) reminds us that “Nothing which even vaguely resembles a code [alphabet] exists in the physico-chemical world.” Assuming that the material universe of fundamental elements and natural laws has no actual symbolic code as a basic constituent, then, as with the case of ultralogics, it is, at the least, *rational to assume* that the processes and concepts associated with an information theory *analog model* is a required condition for our universe to exist and function. Although we may only be able to comprehend certain physical processes by means of information theory as an analog model this does not alter the statement that its application to the non-mental material world is an assumption that may never be fully established.

As stated previously, the Sm, P, T sequence of Gitt information consequence operators, from the natural world viewpoint, most probably are applied sequentially and taken as a composition they do not, in general, correspond to a single consequence operator. Each of these operators is a restriction to the natural world of three ultralogics $*Sm, *P, *T$, which are direct extensions of Sm, P, T to the nonstandard physical world as it is described in the Herrmann references. However, the sequential application of these three ultralogics must still hold if it holds for Sm, P, T . But, as will be shown, this is not the case if a special ultralogic and ultrawords

(Herrmann, 1994a,b) are applied, where this ultralogic and ultrawords behave as an underlying control. In Gitt (1997, fig. 26, p. 137) relative to a scriptural interpretation, the A corresponds to a portion of the information contained in the genetic code in the DNA; $Sm(A)$ is a description for the reading of the code, the meaning of the information in A , the rules, the instructions; $P(Sm(A))$ is a description for the actual protein synthesis in living cells, the construction of entire organisms, the realization of all biological functions; and the $T(P(Sm(A)))$ is a description that would define a particular life-form by means of a complete description of its characteristics or as an integrated time ordered sequence of descriptions. (Note: The actual statements given in Gitt’s figure 26 have been slightly extended.) From the viewpoint of models, these particular consequence operators and their corresponding ultralogics answer affirmatively the following question posed by one of the worlds foremost scientists. Hermann Weyl is credited with writing:

Is it conceivable that immaterial factors having the nature of images, ideas, “building plans” also intervene in the evolution of the world as a whole?

Unfortunately, there is a fundamental error displayed in Gitt’s figure 26 (p. 137). The figure indicates that the source (the Creator) of the information necessary for the generation of “life” is not within the scientific boundary. This, of course, is contradicted by a scriptural interpretation for the ultralogic and ultraword notion. Not only are $*Sm, *P, *T$ ultralogics that yield the appropriate results, but using Theorems 7.3.1 and 7.3.4 for developmental paradigms, or as they are applied to general paradigms (Herrmann, 1993, p. 92) in the appropriate cases, for any $A \subset \mathcal{L}_1$ there exist four ultrawords w_{Sm}, w_P, w_T, w' and the single ultralogic $*S$ such that, when $*S$ is restricted to natural world symbol strings $\mathcal{L}_1$, we have (1) $*S(w_{Sm}) = Sm(A)$, (2) $*S(w_P) = P(Sm(A))$, (3) $*S(w_T) = T(P(Sm(A)))$, and $w_{Sm}, w_P, w_T \in *S(w')$. This illustrates the behavior of the ultralogic $*S$ as being fundamental in character, and how it exercises an additional control over the results of all other ultralogics that are extensions of specific natural world inner-logics such as Sm, P, T . In each case, these ultralogics behave, at the least, in the same manner as a consequence operator would behave; but, they can be classified in many ways as infinitely more powerful than natural world or standard consequence operators. Hence, there is a scientific description for the behavior of the Creator source and the natural world results generated by this source cannot be differentiated, by natural means, from the Sm, P, T . The scriptural statements that Gitt uses to identify the “sender” as the Creator are the exact type of statements mentioned in Herrmann (1984) where ultralogics and ultrawords are used as a model for God’s creative and sustaining processes. This application should help to clarify the relation between in-

formation theory as presented by Gitt and previous work in the area of ultralogics and ultrawords.

Our final illustrations will indicate how Gitt information as encoded within consequence operators might apply to other aspects of genetic coding. Suppose that “complexity” is measured by the T description for the characteristics associated with a biological entity. Suppose that you are given $P(Sm(A))$ and two distinct consequence operators T_i, T_0 . Then stating that $T_0(P(Sm(A)))$ is *as or more complex* than $T_i(P(Sm(A)))$ means that (I) $T_i(P(Sm(A))) \subset T_0(P(Sm(A)))$. Further, one could also write that $T_i(P(Sm(A)))$ is *as or less complex* than $T_0(P(Sm(A)))$. Notice that complexity in this case is a direct relative measure of T_i compared with another T_0 . There are consequence operators that satisfy (I) for any $B \subset \mathcal{L}_1$. However, in general, can complexity be increased or decreased, at the T information level, by requiring the characterizing description to be obtained by choosing from two independent distinct characterizing descriptions $T_1(P(Sm(A))), T_2(P(Sm(A)))$? Suppose T_1, T_2 are two distinct apobetic consequence operators applied to the same $P(Sm(A))$, but the results are distinctly different, one from another, at least with respect to one characterizing statement. The previous question is equivalent to the next question. Can it be assumed that (II) $T_0(X) = T_1(X) \cup T_2(X)$ defines a single apobetic consequence operator T_0 on nonempty $\mathcal{L}_1 \subset \mathcal{L}_M$ where $P(Sm(A)) \subset \mathcal{L}_1$ and the T_1, T_2 are independent? The term *independent* means that there is no relationship, accept for a set-theoretic identity relationship, between the T_1, T_2 that is expressible in terms of the set-theoretic operators used to obtain the theory of consequence operators. For example, suppose that such a consequence operator T_0 exists. Then a characteristic $X \in T_0(P(Sm(A)))$ is either a member of $T_1(P(Sm(A)))$ or a member of $T_2(P(Sm(A)))$ and a characteristic Y in $T_1(P(Sm(A)))$ or in $T_2(P(Sm(A)))$ is a characteristic in $T_0(P(Sm(A)))$ and no other characteristics exist in $T_0(P(Sm(A)))$. This implies that T_0 is a result that is as or more complex than the result obtained from T_1 or from T_2 or from both. Further, $T_0(P(Sm(A)))$ determines no other characteristics. Notice that if (II) holds, then (I) holds for each $i = 1, 2$.

In the appendix (with expanded proof) is a result that shows that (II) does not define a consequence operator if selection from two independent sets of characteristics is required. In particular, it is shown that if T_0 is a consequence operator defined on $\mathcal{L}_1$, then for each $X \subset \mathcal{L}_1$, $T_1(T_2(X)) = T_2(T_1(X))$; i.e. the composition of T_1, T_2 is a consequence operator and composition is a commutative process. This commutative requirement is a very special relationship that must exist between T_1 and T_2 and shows that no such consequence operator exists if independence is required. On the other hand, if (III) $T_1(T_2(X)) =$

$T_2(T_1(X))$ for each $X \subset \mathcal{L}_1$, then the composition T_1T_2 is a consequence operator and (IV) $T_1(X) \cup T_2(X) \subset T_1(T_2(X))$ for each $X \subset \mathcal{L}_1$. Thus far, other than T_0 being a consequence operator, it has not been determined whether (III) is sufficient in order to replace in (IV) $\subset$ with $=$. If (III) is not sufficient for this purpose, then this is a rather interesting result since the required consequence operator composed of the composition of T_1, T_2 that is needed to yield the right hand side of (II), at the least, would also be capable of yielding $T_1(X) \cup T_2(X)$ possibility adjoined with other characteristics neither in $T_1(X)$ nor in $T_2(X)$. The following simple example shows that T_0 as defined need not be a consequence operator. Let $\mathcal{L}_1 = \{a, b, c\}$. In binary pair form, let $T_1 = \{(\emptyset, \{a\}), (\{b\}, \{a, b, c\}), (\{a, b\}, \{a, b, c\}), (\{b, c\}, \{a, b, c\}), (\{a, b, c\}, \{a, b, c\}), (\{a\}, \{a\}), (\{c\}, \{a, c\}), (\{a, c\}, \{a, c\})\}$ and $T_2 = \{(\emptyset, \{b\}), (\{a\}, \{a, b\}), (\{b\}, \{b\}), (\{c\}, \{b, c\}), (\{a, b\}, \{a, b\}), (\{a, c\}, \{a, b, c\}), (\{b, c\}, \{b, c\}), (\{a, b, c\}, \{a, b, c\})\}$. The relations T_1, T_2 represent consequence operators. But, $T_0(\emptyset) = \{a, b\}$ and $T_0(\{a, b\}) = \{a, b, c\}$. Hence, axiom (2) does not hold. Also notice that $T_1(T_2(\emptyset)) = T_1(\{b\}) = \{a, b, c\}$, but $T_2(T_1(\emptyset)) = T_2(\{a\}) = \{a, b\}$. On the other hand, for the above $\mathcal{L}_1$, if $T_1(\{a\}) = \{a, b\}$ and $T_2(\{a\}) = \{a, c\}$ and T_1, T_2 are extended as defined in the above section “The Pragmatic Level,” then T_0 is a consequence operator.

There are other rather obvious ways to increase [resp. decrease] complexity. For example, relative to (I), there are consequence operators T_1, T_2 such that (V) for each $B \subset \mathcal{L}_1$, $T_2(B) \subset T_1(B)$. If $B = P(Sm(A))$, then this clearly yields the same or an increase [resp. decrease] in complexity. But, Theorem 2 in the appendix shows that if (V) holds, then we again have the same dependency statement that $T_1T_2 = T_2T_1$. On the other hand, a more direct way to give a possible increase in complexity is to let $A, B \subset \mathcal{L}_1$, $A \subset B$ and A and B are considered portions of the information in the genetic code in DNA. Then $T(P(Sm(A))) \subset T(P(Sm(B)))$. For biological entities, this can be interpreted as predicting, what is rather obvious, that a possible greater complexity can be obtained from a fixed T by applying Sm to an increased portion of the information contained within the genetic code in the DNA, information that exists originally. However, in this case, to have a possible increase in complexity it is necessary that $P(Sm(A)) \neq P(Sm(B))$. Recall that, as in all previous cases, it is always assumed that $T(P(Sm(A)))$ and $T(P(Sm(B)))$ are complete and consistent descriptions. Note that the technical results in this section also apply to the P and Sm operators. Scripturally, the special relationship between these consequence operators, with their encoded information, that is required to increase or decrease complexity gives further meaning to such statements as Hebrews 1:3.

In the above applications, it is assumed that consequence operators yield an ideal model for Gitt information theory. This model would need to be modified if modifications to the Gitt information or the information processes occurred. However, using Gitt's Theorem 1 (Gitt, 1997, p. 47), it is rational to assume that such modifications could only be produced through applications of additional mental activity. It is self-evident, that if consequence operators are used as a mathematical model for Gitt's concept of information and such an information scheme is accepted by the scientific community, then such results as presented here would most certainly require a rejection of the basic mechanisms that evolutionist claim yield a diversity of life-forms.

Conclusions

In this paper, there is developed a reasonable relation between consequence operators and information theory as presented by Gitt (1997). Although certain aspects of Gitt's theory may not be formulated in an acceptable manner, when re-formated, many of the theorems used for Gitt's theory are shown to be but deductive conclusions obtainable from the theory of consequence operators. It has also been shown that, relative to a scriptural interpretation of this Gitt information scheme, the source of life producing biological information corresponds to the scientifically describable concepts of ultralogics and ultrawords.

It is clear, however, that Gitt information theory, if it is accepted as a basic model for certain biological processes, may have a very profound effect upon those processes that evolutionists claim lead not only to "life" but also to the diversity of life-forms. If random *mutations* are random alterations in the characteristics of a biological entity that are, necessarily, not dependent upon the original biological characteristics, then this model would tend to disallow random mutations as a viable source of new evolutionary Gitt information. Mathematicians have produced an extensive theory of consequence operators and, hence, the mathematical model presented in this paper could be a very useful and additional tool in analyzing such claimed evolutionary processes.

Glossary

Analog model: In this paper, this is a theory that mimics a physical scenario—physical processes, physical characteristics, or natural system behavior—by application of objects or processes distinctly different from those discussed within the physical scenario.

Content: All of the effects a particular string of symbols has upon the mind of an individual who recognizes the string as meaningful.

Discipline dictionary: A collection of terms and phrases that has meaning for individuals who are associated with a specific discipline.

Equivalence class: Although this can be formally defined, for this paper, it is the collection of all meaningful strings of symbols that are adjudged to be "saying the same thing" or as having the "same relative meaning."

Independent consequence operators: This means that there is no relationship, except for an identity relationship, between the consequence operators that is expressible in terms of the set-theoretic operators used to obtain the theory of consequence operators.

Inner-logics: The mental-like patterns that model behavior of or predict behavior for a specific natural system contained within our universe.

Internal transfer of information: This is information that is transferred between the Gitt information levels.

Model: A collection of statements that uses entities that need not correspond to the actual objects under consideration. The relationships that exist between specific entities within the statements are used to describe relationships that exist between the actual objects under consideration. It is these relations that mirror the behavior of the actual objects being discussed.

Natural system: A set or arrangement of physical entities within our universe that are so related as to form an identifiable whole.

Physical axiom: A statement using terms denoting assumed physical entities that is obtained by induction using empirical evidence.

Readable sentence: Another name for a word.

Representative: A single member of an equivalence class.

Ultralogics: An object that behaves like a mental process but is infinitely more powerful than any such process that models behavior that occurs within our universe.

Word: A nonempty finite string of symbols. Such a string can also correspond to visual and audio impressions.

Appendix

Theorem 1. *Let $\mathcal{C}$ be the set of all consequence operators defined on $\mathcal{L}_1$. Let $C_1, C_2 \in \mathcal{C}$ and, for each $X \subset \mathcal{L}_1$, let $C_0(X) = C_1(X) \cup C_2(X)$. If $C_0 \in \mathcal{C}$, then for each $X \subset \mathcal{L}_1$, $C_1(C_2(X)) = C_2(C_1(X))$.*

Proof. First notice that C_0 is a mapping on the power set of $\mathcal{L}_1$ into the power set of $\mathcal{L}_1$ and satisfies axioms 1 and 3 for consequence operators. Two auxiliary results need to be established using our three axioms.

Suppose that $X, Y \subset \mathcal{L}_1$ and $C \in \mathcal{C}$. From axiom 1, we have that $X \cup Y \subset X \cup C(Y) \subset C(X) \cup C(Y)$. Application of axiom 3, yields that (1) $C(X \cup Y) \subset C(X \cup C(Y)) \subset C(C(X) \cup C(Y))$. Since $X \subset X \cup Y$ and $Y \subset X \cup Y$, axiom 3 yields that $C(X) \subset C(X \cup Y)$, $C(Y) \subset C(X \cup Y)$. Consequently, $C(X) \cup C(Y) \subset C(X \cup Y)$. Applying axiom 2, it follows that (2) $C(C(X) \cup C(Y)) \subset C(C(X \cup Y)) = C(X \cup Y)$. It follows from (1) and (2) that (3) $C(X \cup Y) = C(X \cup C(Y)) = C(C(X) \cup C(Y))$.

For a given $C \in \mathcal{C}$, a $Y \subset \mathcal{L}_1$ is called a C -system if and only if $C(Y) \subset Y$, which is equivalent to $C(Y) = Y$. Note that for any consequence operator $C \in \mathcal{C}$, $\mathcal{L}_1$ is a C -system. Let $S(C)$ be the nonempty set of all C -systems for a given $C \in \mathcal{C}$. Suppose that (4) $\emptyset \neq \mathcal{A} \subset S(C)$ and (5) $X = \bigcap \{Y \mid Y \in \mathcal{A}\}$. Let arbitrary $Y \in S(C)$. Then $C(Y) \subset Y$. But fixed $X \subset Y$ implies that $C(X) \subset C(Y)$, which implies that $C(X) \subset \bigcap \{C(Y) \mid Y \in S(C)\} = \bigcap \{Y \mid Y \in S(C)\} = X$ since Y is arbitrary. Hence (6) $X \in S(C)$.

For each $C_1, C_2 \in \mathcal{C}$ define $C_1 \leq C_2$ if and only if for each $X \in \mathcal{L}_1$, $C_1(X) \subset C_2(X)$. The binary relation $\leq$ is a partial order on $\mathcal{C}$. The algebra $\langle \mathcal{C}, \leq \rangle$, along with other objects and relations is shown by Wójcicki (1970) to be a complete lattice. Our interest is in the structure of the least upper bound (the supremum) $C_1 \vee C_2$ for any $C_1, C_2 \in \mathcal{C}$. As shown by Wójcicki (1970, p. 276) for any $X \subset \mathcal{L}_1$, $(C_1 \vee C_2)(X) = Y_X = \bigcap \{Y \subset \mathcal{L}_1 \mid X \subset Y = C_1(Y) = C_2(Y)\}$. Thus the Y_X is by (6) a C_1 -system and C_2 -system. Indeed, intuitively the smallest (with respect to $\subset$) such common C -system. Now $X \subset Y_X$ implies that $X \subset C_1(X) \subset C_1(Y_X) = Y_X$ and $X \subset C_2(X) \subset C_2(Y_X) = Y_X$. Consequently, $C_1(X) \cup C_2(X) \subset Y_X$. Further, $C_1(X) \subset C_1(X) \cup C_2(X)$, $C_2(X) \subset C_1(X) \cup C_2(X)$. Define for each $X \subset \mathcal{L}_1$, $C_0(X) = C_1(X) \cup C_2(X)$ and assume that $C_0 \in \mathcal{C}$. First notice that $C_1 \leq C_0$, $C_2 \leq C_0$ and $C_0 \leq C_1 \vee C_2$. Thus $C_0 = C_1 \vee C_2$. This implies that for arbitrary $X \subset \mathcal{L}_1$, $C_1(X) \cup C_2(X) = Y_X = C_1(Y_X) = C_2(Y_X)$ by (6). Therefore, $C_1(C_1(X) \cup C_2(X)) = C_1(Y_X) = C_2(Y_X) = C_2(C_1(X) \cup C_2(X))$. From (3), $C_1(X \cup C_2(X)) = C_2(X \cup C_1(X))$. But, axiom 1 yields that $C_1(C_2(X)) = C_2(C_1(X))$ and the result follows.

Theorem 2. Let $\mathcal{C}$ be the set of all consequence operators defined on $\mathcal{L}_1$. Let $C_1, C_2 \in \mathcal{C}$. Then $C_2 \leq C_1$ if and only if $C_1 C_2 = C_2 C_1 = C_1$.

Proof. As shown in Herrmann (1987, p. 7), $C_2 \leq C_1$ if and only if the composition $C_1 C_2 = C_1$. Assume that $C_2 \leq C_1$. Then for arbitrary $X \subset \mathcal{L}_1$, $C_1(C_2(X)) = C_1(X) \subset C_2(C_1(X)) \subset C_1(C_1(X)) = C_1(X)$ implies $C_1(C_2(X)) = C_2(C_1(X)) = C_1(X)$. The converse is obvious and this completes the proof.

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Photo Essay

Fluted vase or sensory appendage?

The scarab beetle pictured in these scanning electron micrographs is a member of the Family Scarabaeidae in the Order Coleoptera. It has chewing mouth-parts (protected and not shown) and well-developed antennae that are folded into slots built into its exoskeleton (Figure 1). In addition, a pair of hard, opaque, waterproof wings (called elytra) which cover and protect the thin flight wings and the body characterizes the scarabs. Many of them have brilliant colors and patterns, but most are dull. They range in size from less than 1/32 in. (1 mm) to more than 6 in. (15 cm) in length. One of the most famous of the scarabs is the dung beetle, with many different species, which according to some is responsible for most of the earth moving on the planet.

The closer one looks at the surface features of living creatures, the more intricacy and detail becomes apparent to the observer. Notice for example, as a small portion of the scarab body near the antenna and the compound eye is enlarged (Figure 2), what appeared to be white hair-like structures in Figure 1 now takes on more of a three-dimensional appearance. The compound detail of the eye becomes apparent, as does the ribbed nature of those objects we once thought were merely spines. It is now clear that there are indeed spines on our subject, but they are much different from the fluted structures we are studying. These structures are tapered at the end where they appear to be embedded into pores on the exoskeleton. In Figure 3, the dramatic detail of these fluted vases now becomes clear. They have fluted ridges which terminate in an open mouth surrounded by spines and they are hollow. It appears that they serve some sensory function, perhaps communicating temperature and humidity changes or the proximity of a food source to the organism. If one were to study only a single magnification of an object, an erroneous assumption about what we are observing could easily be made.

What is abundantly clear from the world of the electron microscope is that there is order and complexity at all levels of magnification, from 100X to 10,000X—an order that speaks of an ordering intelligence. I postulate that this Intelligence is God.

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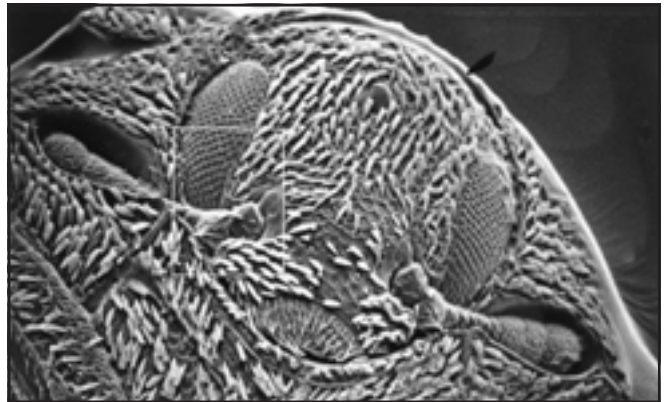


Figure 1. Scarab beetle *Plecocoma* sp., ventral view.

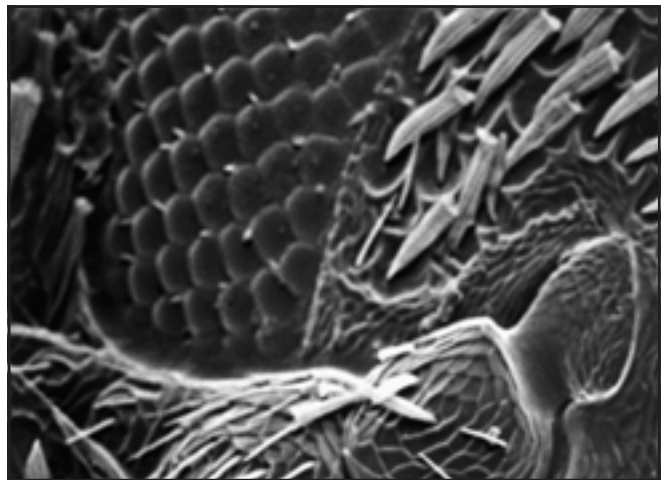


Figure 2. Beetle antenna ball joint/edge of eye.

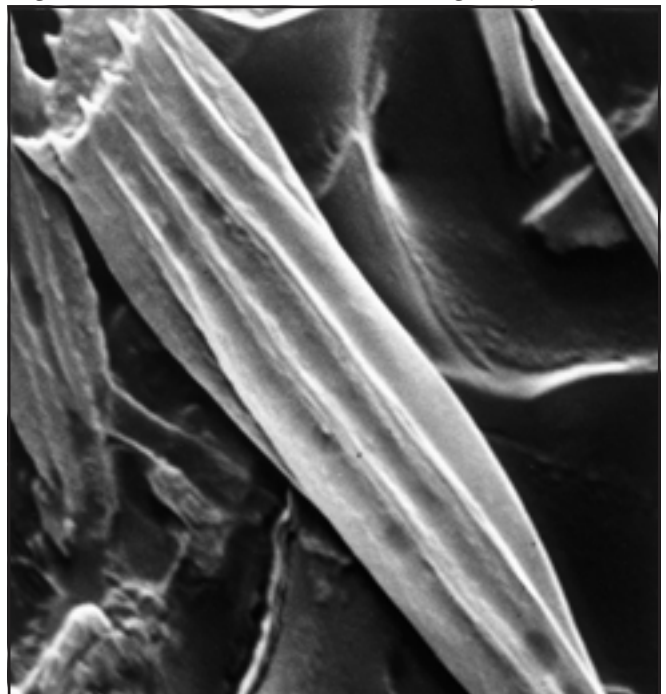


Figure 3. Single fluted structure.

How Gradual Evolution Is Disproved In the Textbooks

Randall Hedtke*

Abstract

Jevons' Rule states that a single absolute conflict between fact and a hypothesis is fatal to that hypothesis. Darwin's theory of gradual evolution cannot logically be sustained because it is a theory which is in direct conflict with paleontological facts and is thus falsified by Jevons' Rule. This conflict between Darwin's theory and paleontology was known from the time Darwin's book was published, but reliable investigative procedures were not allowed to stand in the way of the materialists' determination to establish an explanation for the origin of life. Thus began a policy of suppression, calculated ignorance, and deliberate closed-mindedness regarding unfavorable evi-

dence on the part of macroevolutionists in science education. Today the teaching of evolution is doctrinal rather than genuinely theoretical; it is a curriculum deliberately tailored to indoctrinate rather than educate and a curriculum whose palpable intellectual duplicity must be exposed.

When the gradualists' theory of macroevolution is analyzed in the context of paleontological facts, it is disproved by the obvious lack of intermediate fossil forms. Darwin foresaw this problem as did the theistic evolutionist, St. George Mivart, whose ideas are explored here. Mivart formulated an early version of the punctuated equilibrium model, a version predicated on Divine miracles.

Introduction

Darwin believed that all life forms are related and have descended from a common ancestry by a gradual natural process which came to be called evolution. Today, however, it is a common practice to distinguish between two types of evolutionary change. The first is sometimes labeled microevolution and involves minor changes, which can be observed or easily inferred from scientific evidence. The second usage, macroevolution, designates the belief that the major adaptive forms such as fish, amphibians, reptiles, etc. are all related. The word "evolution" as used in this paper, is referring to the concept of macroevolution. Like all other theories, macroevolution exists to be overthrown if possible and no amount of belief in it, as a doctrine, should prevent declaring it disproved. All of the pertinent evidence necessary to disprove evolution is in place. Although all explanations for the origin of life incorporate a religious element, the validity or invalidity of evolution is first and foremost an issue of good science versus bad science.

The Untestable and Inconclusive Evidence for Evolution

Humanism is a materialistic belief which requires a materialistic explanation for origins. Darwin's religious orientation also provided the motivation for presenting his theory in a dogmatic rather than scientifically objective way. He tailored his theory to make it more convincing in terms of his personal belief system. The legacy of Darwin is that today religious humanism stands in the way of objectively looking at evolution theory.

Evolution by means of gradual change has dual roles as both scientific theory and religious doctrine. In his autobiography, Charles Darwin described his humanistic religious belief:

A man who has no assured and no present belief in the existence of a personal God or a future existence with retribution and rewards, can have for his rule of life, as far as I can see, only to follow those impulses and instincts which are the strongest or which seem to him the best ones. A dog acts in this manner, but he does so blindly. A man on the other hand, looks forwards and backwards, and compares his various feelings, desires, and recollections. He then finds, in accordance with the verdict of the wisest men, that the highest satisfaction is derived from following certain impulses, namely the social instincts. If he acts for the good of others he will re-

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ceive the approbation of his fellow men and gain the love of those with whom he lives; and this latter gain undoubtedly is the highest pleasure on this earth. By degrees it will be more intolerable to him to obey his sensuous passions rather than his highest impulses, which when rendered habitual may be almost called instincts. His reason may occasionally tell him to act in opposition to the opinion of others, whose approbation he will then not receive; but he will still have the solid satisfaction of knowing that he has followed his innermost judge or conscience (Himmelfarb, 1959, pp. 318–319).

Darwin's belief seems to be the forerunner of the humanistic doctrine expounded in the *Humanist Manifesto*:

Religious humanists regard the universe as self-existing and not created. Humanism believes that man is part of nature and that he emerged as the result of a continuous process (Kurtz, 1984, p. 8).

We find insufficient evidence for belief in the existence of a supernatural; it is either meaningless or irrelevant to the question of the survival and fulfillment of the human race. As non-theists we begin with humans not God, nature not deity (Kurtz, 1984, p. 16).

In order to expose the fact that evolution by means of natural selection is disproved in the textbooks, one must not become beguiled by evolution's doctrinal aspects. Evolution must be held strictly accountable as a scientific theory. To do that, we need apply only one simple rule of logic, which is taken from W. Stanley Jevons (1958, p. 516): "A single absolute conflict between fact and hypothesis is fatal to the hypothesis". Jevons is merely stating an obvious elementary rule of logic that is applied in every walk of life. One can hardly get through the day without consciously or subconsciously using Jevons' Rule. It applies equally well to theories.

In evaluating the body of evolutionary evidence in the textbooks, we find that two categories exist, the untestable, inconclusive evidence and the testable, conclusive evidence. Within the inconclusive category we have the fossil evidence for alleged human evolution, alleged vestigial organs, comparative anatomy, comparative embryology, and geographic distribution. These are the same inconclusive evidences that Darwin employed in writing the *Origin of Species*. These cannot be interpreted conclusively because no empirical test is possible to prove the evolutionary interpretations. Such evidence is open to counterinduction or alternative points of view. The counterinductive interpretations are also inconclusive. The process of entertaining alternative interpretations has the effect of removing the entire body of inconclusive evidence from the arena of dogma and

putting it into the realm of scientific objectivity where it belongs.

Therefore, the first step in our criticism of customary concepts and customary reactions is to step outside the circle and either to invent a new conceptual system, for example, a new theory that clashes with the most carefully established observational results and confounds the most plausible theoretical principles, or to import such a system from outside science, from religion, from theology, from the ideas of incompetents, or the ramblings of mad men. This step is, again, counterinductive. Counterinduction is thus both a fact—science could not exist without it—and a legitimate and much needed move in the game of science (Feyerabend, 1975, p. 68).

Considering Darwin's underlying religiosity and the fact that evolution is a doctrine of certain religions, the dogmatic treatment of this inconclusive evidence in the public school textbooks constitutes a possible violation of the First Amendment Establishment Clause of the United States Constitution. That clause states that "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof." We can demonstrate how an alternative explanation is possible with the evidence for alleged human evolution. In the textbooks, fossil specimens are interpreted in terms of an *a priori* belief in evolution. Regarding the origin of humans, an alternative point of view is that fossil specimens are remains of extinct races of human beings or extinct species of primates having nothing to do with evolution. Extinction we know is a fact in the natural scheme of things. In addition, many of the specimens were discovered on continents that presently host populations of primates. Experts will argue the ancestry of a fossil specimen endlessly because there is no empirical test to prove ancestry.

Counterinduction can apply to all the untestable, inconclusive evidence. With little effort it is possible and useful to formulate legitimate, nonevolutionary explanations for any of evolution's untestable evidences. Evolution theorists have not received any special dispensation in the United States Constitution allowing only their biased interpretations to be taught. Darwin knew that his evidence was vulnerable to counterinduction which is probably why, in the Introduction to the *Origin*, he begged the public's indulgence to postpone publishing "conclusions directly opposite."

For I am well aware that scarcely a single point is discussed in this volume on which facts cannot be adduced, often apparently leading to conclusions directly opposite to those at which I have arrived. A fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of

each question; and this cannot possibly be here done (Darwin, 1909, p. 20).

Darwin regarded the *Origin* as a mere abstract of a complete account which he assured the public he would provide in the future. Originally he wrote that in “two or three more years” he would finish the complete account. But in the final edition of the *Origin* he changed his mind.

My work is now nearly finished; but as it will take me many more years to complete it, and as my health is far from strong, I have been urged to publish this Abstract (Peckham, 1959, p. 71).

Presumably a completely developed version of his theory would have included counterinduction, but Darwin’s postponement in presenting alternative views turned out to be permanent and persists to this day. It is still the practice of most evolutionists to ignore alternative views. Why was it “impossible” for Darwin to include counterinduction? He may have known that evolution was more of a religious doctrine than a scientific theory, and perhaps he was reticent to present any religious views except his own. It is scientifically archaic, however, to consider only certain prejudicial interpretations of data.

The Testable or Conclusive Evidence

Evolution by means of natural selection contains a prediction that would ultimately determine its validity. The testable prediction was that abundant transitional fossils would be discovered and that the alleged transitional fossils would reveal a gradual evolutionary change from simple to complex in both the plant and animal kingdoms. But that is not what the real fossil record tells us.

One class of facts, however, namely, the sudden appearance of new and distinct forms of life in our geological formations supports at first sight the belief in abrupt development. But the value of this evidence depends entirely on the perfection of the geological record in relation to periods remote in the history of the world. If the record is as fragmentary as many geologists strenuously assert, there is nothing strange in new forms appearing as if suddenly developed (Darwin, 1909, p. 249).

In the following statement Darwin substantiated his position on the lack of intermediate links:

Why then are not every geological formation and every stratum full of such intermediate links? Geology assuredly does not reveal any such finely graduated organic chain; and this, perhaps, is the most obvious and serious objection which can be urged against the theory. The explanation lies, as I believe, in the extreme imperfection of the geological record (Darwin, 1909, p. 320).

In other words, Darwin’s theory was founded, not on the real fossil record that he and the scientific establishment recognized, but on a mythical, or idealized fossil record with abundant transitional fossils that he believed would be forthcoming. Since Darwin formulated his theory, testing of the prediction has been going on for about 150 years. In all of this time, only one or two questionable transitional fossils have been discovered, e.g. *Archaeopteryx* as a transition between reptile and bird. It is now an embarrassment for proponents of evolution to insist, as Darwin did, that numerous intermediate fossils will be forthcoming. The time has arrived when it must be declared that the test is finished and it has negated the gradual evolutionary theory. Many contemporary evolutionists have spoken of the overthrow of gradualism; two sample quotes are given here.

The absence of fossil evidence for intermediary stages between major transitions in organic design, indeed our inability, even in our imagination, to construct functional intermediates in many cases, has been a persistent and nagging problem for gradualistic accounts of evolution (Gould, 1980, p. 127).

We now have a quarter of a million fossil species but the situation hasn’t changed much. The record of evolution is still surprisingly jerky and, ironically, we have even fewer examples of evolutionary transition than we had in Darwin’s time. By this I mean that some of the classic cases of Darwinian change in the fossil record, such as the evolution of the horse in North America, have had to be discarded or modified as a result of more detailed information—what appeared to be a nice simple progression when relatively few data were available now appears to be much more complex and much less gradualistic (Raup, 1979, p. 25).

Consequently, gradualistic evolution by means of natural selection is disproved. Even Darwin hinted at such paleontological disproof:

The abrupt manner in which whole groups of species suddenly appear in certain formations, has been urged by several paleontologists—for instance, by Agassiz, Pictet, and Sedgwick—as a fatal objection to the belief in the transmutation of species (Darwin, 1909, p. 348).

Regarding these paleontological problems, Gould used a quote from Darwin:

The geological record is extremely imperfect and this fact will to a large extent explain why we do not find interminable varieties, connecting together all the extinct and existing forms of life by the finest graduated steps. He who rejects these views on the nature of the geological record, will rightly reject my whole theory (Gould, 1977, p. 14).

He would rightly reject it because a single absolute conflict between fact and hypothesis is fatal to the hypothesis (Jevons' Rule). Darwin well understood that ultimately his theory would be accountable to such logic. The following epitomizes the relationship between the fossil record and Darwinism:

The extreme rarity of transitional forms in the fossil record persists as the trade secret of paleontology. The evolutionary trees that adorn our textbooks have data only at the tips and nodes of their branches; the rest is inference, however reasonable, not the evidence of fossils. Yet Darwin was so wedded to gradualism that he wagered his entire theory on a denial of this literal record (Gould, 1977, p. 14).

Darwin wagered a prediction and lost. The mythical fossil record that he and generations of evolutionists after him have believed in has not become a reality. The consensus opinion against Darwin's prediction, however, is currently being censored from school textbooks. Despite such censorship, one can say that gradual evolution is disproved in these same textbooks and that there is in them that which confirms the consensus rejection of gradualism.

In textbooks there is a brief statement about the punctuated equilibrium theory which has become an accepted part of the evolutionary apologetic:

Evidence from the fossil record has led some scientists to propose that speciation need not occur gradually but can occur in spurts. According to the theory of punctuated equilibrium, all populations of a species may exist for a relatively long time at or close to genetic equilibrium. Then the equilibrium may be interrupted by a brief period of rapid genetic change in which speciation occurs (Towle, 1993, p. 249).

This statement seems innocuous at first until one realizes that it was formulated to take into account the absence of numerous intermediate fossils predicted by gradual evolution. Its significance becomes striking because it means that we have two opposing theories in the textbooks: one gradual and one abrupt. Both rely on the same fossil record which, of course, cannot support two opposing interpretations! The punctuated equilibrium theory is not a formal declaration by the evolutionists that gradual evolution is disproved, but it is nevertheless an indirect statement to that effect.

Now that the mythical fossil record had been openly rejected by the realists, the gradualists must prove that the mythical fossil record upon which evolution is founded is real. It is not the skeptics' responsibility to try to prove that abundant transitional fossils do not exist.

Instead, it is the gradualists' responsibility to prove that they do. This is the way matters should have played out from the very beginning.

A Mechanic's Obedience to Jevons' Rule

An auto mechanic must abide unquestioningly by Jevons' Rule; it would be both impractical and ludicrous not to. Let us say the mechanic has been hired to start an automobile engine. He initially hypothesizes that the problem is with the battery or its electrical connections. When those potential problems are eliminated, the mechanic unhesitatingly abandons his hypothesis and formulates a new one.

The same principle applies to evolution theory regarding the fossil record except for the element of practicality. The real fossil record conflicts with the theory of gradual evolution, but because of evolution's religious and philosophical underpinning, evolution theorists are guided by metaphysical considerations rather than by scientific facts. It is nonetheless ludicrous for evolution theorists to be recalcitrant in obeying Jevons' Rule; they should reject gradualism.

The leadership of the National Association of Biology Teachers (NABT, 1996) has refused to acknowledge the obvious absence of transitional fossils. It published a directive for teachers in every public school district on how to teach evolution. Two of their tenets read as follows: "Nothing in biology makes sense except in the light of evolution," (p. 61) and "Specific textbook chapters on evolution should be included in biology curricula, and evolution should be a recurrent theme throughout biology textbooks and courses" (p. 62). Could a purely secular theory inspire that much evangelistic zeal?

In that same document the NABT actually encourages biology instructors to teach a falsehood. "The fossil record, which includes abundant transitional forms in diverse taxonomic groups, establishes extensive and comprehensive evidence for organic evolution (p. 61)." There is, in fact, an absence of transitional fossils, such that Jevons' Rule takes effect and Darwinian gradualistic evolution should be presented as a falsified hypothesis.

On p. 61 the NABT states: "The model of punctuated equilibrium provides another account of the tempo of speciation in the fossil record of many lineages; it does not refute or overturn evolutionary theory, but adds to its scientific richness." "Scientific richness" should read "confusion". The NABT's endorsement of punctuated equilibrium is tantamount to admitting that they agree with paleontology, which has exposed the fact about abundant transitional fossils as being untrue.

How Mivart Descended Gradualism in 1872

Many people believe natural selection is the mechanism for gradualism and that gradual evolution is occurring in the environment. They reason that because the mechanism sounds reasonable, gradual evolution must be true regardless of the fossil record. This is rather like having the tail wag the dog. The correct reasoning is that the fossil record disproves gradual evolution, consequently the mechanism cannot be true. In fact the efficacy of natural selection to cause macroevolutionary changes was discredited in 1872 when Darwin conceded to the problem concerning how an organ might have even got started from rudimentary beginnings, a problem posed by St. George Mivart:

It was inevitable that a great crowd of half-educated men and shallow thinkers should accept with eagerness the theory of "Natural Selection". We refer to its remarkable simplicity, and the ready way in which phenomena the most complex appear explicable by a cause for the comprehension of which laborious and persevering efforts are not required, but which may be represented by the simple phrase "survival of the fittest". With nothing more than this, can, on the Darwinian theory, all the more intricate facts of distribution and affinity, form and color, be accounted for; as well as the most complex instincts and the most admirable adjustments, such as those of human eye and ear (Mivart, 1871, p. 23).

Mivart regarded natural selection as incapable of producing new kinds or adaptive features. His criticism of natural selection was as follows:

Natural selection utterly fails to account for the conservation and development of the minute rudimentary beginnings, the slight and infinitesimal commencement of structures, however useful those structures may afterward become (Mivart, 1871, p. 35).

In other words, natural selection cannot play a role in the minute beginnings of useful structures before they have a use. Should minute, indefinite, and fortuitous variations somehow be preserved in one direction, they would merely result in an incipient, functionless organ on which natural selection is incompetent to act, since the incipient organ could not have conferred an advantage in survival or reproduction.

That such variations should come into existence and be somehow preserved in one direction is the miraculous part of Darwinian evolution and thus not scientifically accountable. All explanations for the origin of life, whether theological or scientific, ultimately rely on miracles. Mivart continued with his opposition to Darwin's touting natural selection as a mechanism for major changes:

The author of this book can say that, although by no means disposed originally to dissent from the theory of "Natural Selection", if only its difficulties could be solved, he has found each successive year that deeper consideration and more careful examination have more and more brought home to him the inadequacy of Mr. Darwin's theory to account for the preservation and intensification of incipient, specific and generic characters. That minute, fortuitous, and indefinite variations could have brought about such special forms and modifications as have been enumerated in this chapter, seems to contradict not imagination, but reason.

In spite of all the resources of a fertile imagination, the Darwinian, pure and simple, is reduced to the assertion of a paradox as great as any he opposes. In the place of mere assertion of our ignorance as to the way these phenomena have been produced, he brings forward, as their explanation, a cause which it is contended in this work is demonstrably insufficient.

Of course in this matter, as elsewhere throughout Nature, we have to do with the operation of fixed and constant natural laws, and the knowledge of these may before long be obtained by human patience or human genius; but there is, it is believed, already enough evidence to show that these as yet unknown natural laws or law will never be resolved into the action of "Natural Selection", but will constitute or exemplify a mode and condition or organic action of which the Darwinian theory takes no account whatsoever (Mivart, 1871, pp. 74–75).

Darwin's Response to Mivart

In the final edition of the *Origin* (1872), Darwin included a section for a response to Mivart in which he did not deny the validity of Mivart's incipency criticism.

I have now considered enough, perhaps more than enough of the cases selected with care by a skilful naturalist, to prove that natural selection is incompetent to account for the incipient stages of useful structures; and I have shown, as I hope, that there is no great difficulty on this head. A good opportunity has thus been afforded for enlarging a little on gradations of structure, often associated with changed functions—an important subject, which was not treated at sufficient length in the former editions of this work (Darwin, 1909, pp. 243–244).

Darwin surrendered further with this admission: "Even if the fitting variation did arise, it does not follow that natural selection would be able to act on them, and produce a structure which apparently would be beneficial

to the species" (Darwin, 1909, p. 222). The significance of Darwin's concession to the validity of the incipency problem is profound. It means, since natural selection cannot account for the beginning stages of an organ, it cannot account for the present existence of complete, functional organs and organisms. It is for this reason some people will perform mental contortions in order not to interpret Darwin literally. What was Darwin's alternative? Could he disagree with Mivart and insist that natural selection can account for incipient organs? Of course not; the superficial logic of natural selection would be shattered. The phrase "survival of the fittest" would no longer have application and it would mean that incipient organs, with no survival value in the beginning, could make an organism more fit for survival in the end. It would be illogical to the Darwinian concept to have useless organs mysteriously maintained and preserved by natural selection. Instead, Darwin's strategy was to concede to Mivart's criticism by giving natural selection only a secondary role, and advancing other methods by which evolutionary changes can be accomplished. This is seen in the latter part of the first quote in which Darwin stated: "I have shown, as I hope, that there is no great difficulty on this head." When Darwin responded thus to Mivart, he was not trying to defend his natural selection view against incipency, since it is obviously indefensible. Instead he took Mivart to task for not informing his readers of alternative methods of evolution:

When discussing special cases, Mr. Mivart passes over effects of use and disuse of parts, which I have always maintained to be highly important... He likewise often assumes that I attribute nothing to variations, independent of natural selection... (Darwin, 1909, pp. 218–219).

Darwin formulated a new version of natural selection in an attempt to circumvent the incipency problem. Other methods of evolution and this new version of natural selection together overcome (in Darwin's mind) the difficulties confronting his theory which is why he asserted that: "...there is no great difficulty on this head."

Darwin attempted to salvage evolution by natural selection by appealing to variations independent of natural selection which simply means that favorable variations will accumulate into new kinds by themselves. But there is no naturalistic mechanism for such to occur. It was a scenario that the naturalistic evolutionary establishment would not have embraced. Use and disuse of parts is Jean Lamarck's (1774–1829) theory that the mere *need* for a new organ or body part would enable an organism to acquire it out of necessity, but Lamarck's theory has been refuted by modern genetics.

Darwin's new natural selection mechanism promoted the idea that useful gradations are always added, which is to say, that every evolutionary step must be useful. Since

Darwin could not overcome the incipency problem, he simply eliminated incipency! "Gradations of structure, with each stage beneficial to changing species, will be found only under certain peculiar conditions" (Darwin, 1909, p. 223). The air bladder in fishes, for example, would have become lungs in mammals by means of natural selection acting on alleged gradations that were always useful. It was proposed that every evolutionary stage from air bladder to lungs had been beneficial to the intermediate organisms. There is one very serious drawback, as Darwin admitted: "It is therefore impossible to conjecture by what serviceable gradation the one could have been converted into the other; but it by no means follows from this that such gradations have not existed" (Darwin, 1909, p. 237). This Darwinian statement demonstrated that the "always useful gradations" are not only beyond science; they are even beyond imagination!

In effect, Darwin was saying that in order for natural selection to work, one must always have useful gradations which natural selection will then make useful for survival. This makes natural selection redundant as a creative mechanism, because if the variations were already useful, how could natural selection make them useful later? It is no wonder that evolutionary scientists did not adopt Darwin's new natural selection mechanism. Their strategy instead has been to sweep the whole incipency problem under the rug; it is simply omitted from typical introductory biology textbooks. Darwin's belief in "serviceable gradations" again directs us back to the fossil record. These serviceable gradations must have been evident in nothing other than the elusive intermediate fossils!

The History of Punctuated Equilibrium

Few people realize that the punctuated equilibrium scenario was originally proposed by St. George Mivart under the name of "derivative creation." Although a contemporary of Darwin, Mivart stuck with the real fossil record rather than the mythical one and, "...he utilized the gaps in the palaeontological record...to support his view that evolution occurs through saltations (jumps) independent of the operation of natural selection" (Gruber, 1960, p. 54).

In his book, *On the Genesis of Species*, Mivart described his own theory of origins, which overcomes the problems in Darwinian gradualism by means of natural selection. Mivart's theory of evolution centered on a belief in a Divine Being.

Organic Nature speaks clearly to many minds of the action of an intelligence resulting, on the whole and in the main, in order, harmony, and beauty, yet of an intelligence the ways of which are not such as ours" (Mivart 1871, p. 253).

Mivart's aim was,

...to support the doctrine that these species have been evolved by ordinary natural laws (for the most part unknown) controlled by the subordinate action of "Natural Selection," and at the same time to remind some that there is and can be absolutely nothing in physical science which forbids them to regard those natural laws as acting with the Divine concurrence and in obedience to a creative fiat originally imposed on the primeval Cosmos, "in the beginning," by its Creator, its upholder, and its Lord. (Mivart, 1871, p. 255).

Consequently,

...an internal law presides over the actions of every part of every individual, and of every organism as a unit, and of the entire organic world as a whole. That by such a force, from time to time, new species are manifested by ordinary generation... That these "jumps" are considerable in comparison with the minute variations of "Natural Selection"—are in fact sensible steps, such as discriminate species from species. That the latent tendency which exists to these sudden evolutions is determined to action by the stimulus of external conditions. (Mivart, 1871, p. 255).

Therefore, according to Mivart, natural laws that were preordained by God induced the abrupt appearance of new species derived from antecedent species. The subordinate role of natural selection is to eliminate the antecedent species. The function of natural selection is thus relegated to an eliminating and stabilizing, not a creating, mechanism.

"Natural Selection" removes the antecedent species rapidly when the new one evolved is more in harmony with surrounding conditions. By some such conception as this, the difficulties here enumerated, which beset the theory of "Natural Selection" pure and simple, are to be got over. Thus, for example, the difficulties as to the origins and first beginnings of certain structures are completely got over (Mivart, 1871, p. 255–256).

Mivart's sudden appearance explanation for origins, like the punctuated equilibrium model, overcomes unresolved difficulties facing Darwinian gradualism, particularly incipency and the obviously abrupt appearance of species in the fossil record. But Mivart's derivative creation theory had a feature that made it unacceptable to the prevailing naturalistic mindset of the Darwinists. It did not have an on-going naturalistic mechanism, being instead a teleological explanation for the origin of life. Teleology means that natural phenomena are determined not only by mechanical causes but by an overall design or purpose in nature. Mivart's theory called for a Divine Being and we know from Darwin's

humanistic belief that the religious imperative of his theory was to deny the activity of a personal God. Any kind of abrupt explanation for the origin of life immediately implies miracles and miracles imply a creator. It is for that reason Darwin was absolutely opposed to Mivart's theory:

He who believes that some ancient form was transformed suddenly through an internal force or tendency into, for instance, one furnished with wings, will be almost compelled to assume... that many individuals varied simultaneously. He will further be compelled to believe that many structures beautifully adapted to all the other parts of the same creature and to the surrounding conditions, have been suddenly produced; and of such complex and wonderful co-adaptation, he will not be able to assign a shadow of an explanation. To admit all this is, as it seems to me, to enter into the realms of miracle, and to leave those of Science (Darwin, 1909, p. 250).

Mivart's derivative creation theory is really a version of theistic evolution. Darwin's opposition to Mivart's theory tells us in no uncertain terms that any theistic evolutionist who thinks he shares common ground with orthodox, atheistic, evolutionists is sadly mistaken. Teleology is still the forbidden element in the theorizing of orthodox evolutionists.

Mivart's reward for betraying evolutionary orthodoxy was ostracism:

Until the day of his death, Mivart was haunted by the hostility, latent and overt, of the small circle which had surrounded Darwin. The continuing, if not growing antipathy toward Mivart as both a man and scientist, expressed by those who were becoming the leaders of post-Darwinian science, virtually excluded him from the mainstream of science for which Darwinism was the source. This antipathy, gradually established the caricature of Mivart as a dogmatic and biased opponent of Darwinism, led for all practical purposes to the negation of his more pregnant observations. As an apostate he was forgotten, relegated to the ash heap upon which lay the remains of all whose who, for one reason or another, selfish or unselfish, good or bad, sought to check the wholesale acceptance of all things Darwinian (Gruber, 1960, p. 80).

Where was the tolerance and the fabled scientific objectivity and open-mindedness? And that was not the full extent of Mivart's tribulation. To add insult to injury, Mivart, a prominent Catholic layman, was excommunicated by Cardinal Vaughn for trying to advance an explanation for origins other than special creation (Gruber, 1960, pp. 209–210). We must give Mivart credit for having the courage to stand up to the Darwinian juggernaut

and point out the incipency problem. We must also applaud him for having the mental fortitude to base his origins theory on the real fossil record while others were committed to gradualism based on a mythical fossil record. Mivart's analysis was, in fact, a declaration that Darwinian gradual evolution was already disproved. It was because of this declaration and his teleology that he was ostracized and his work suppressed. His one fault seems to have been that he insisted on his theory being accepted because it overcame incipency and accounted for the gaps in the fossil record. In actuality it merely proved to be a superior theory to Darwinian gradualism in agreeing with the facts, but it, like Darwinian gradualism, remained a tentative explanation and could not be empirically supported.

About 120 years passed before orthodox evolutionists have again confronted the issue of the absence of abundant intermediate fossils with the formulation of the punctuated equilibrium theory. Orthodox evolutionists finally had to admit that the mythical fossil record is indeed a figment of their imaginations and could no longer be perpetuated in the real world. So why are not the formulators of punctuated equilibrium, Eldridge and Gould, ostracized? Why was their punctuated equilibrium theory accepted when Mivart's was not? It is obvious that Darwin's objection to Mivart's theory applies as well to their punctuated equilibrium view. Both theories are based upon the abrupt appearance of organisms. The answer is that the punctuated equilibrium model of Gould and Eldridge is not teleological; its miracles are not called such and they do not demand a Miracle Maker. The punctuated equilibrium view fulfills the orthodox evolutionists' religious imperative to exclude God from the process of origins. To the evolutionist, the question of whether or not there was a Miracle Maker behind the obvious "miracles" is an issue for religion to discuss, not science.

The Need for Academic Honesty in School Curricula

The general taxpayers and scientists should be in favor of an open presentation of the scientific origins data and an honest evolutionary curriculum. Such a curriculum should correct the work of Darwin who was dedicated to a form of religious indoctrination rather than to scientific open-mindedness. By his own admission he knew that his data were subject to "conclusions directly opposite".

What would constitute an enlightened and academically honest origins curriculum? First and foremost it would incorporate counterinduction (alternative expla-

nations) in keeping with scientific objectivity. It should also include all of the pertinent information unfavorable to evolution that is presently censored. It should detail the "incipency problem" and Darwin's response to it. It ought to inform students of Darwin's new concept of natural selection that required gradations that were always useful. Students should be informed that in every field of investigation the real data are the only data scientists consider reliable. They must learn how evolutionary investigators have promoted a mythical fossil record rather than the real one. When the real fossil evidence is analyzed, Jevons' Rule applies and gradual evolution stands disproved. Students should be allowed to decide for themselves whether or not to apply Jevons' Rule. In an academically honest origins curriculum, discussions of the punctuated equilibrium model ought to include Mivart's pioneering "derivative creation" theory, which, like the punctuated equilibrium view, was formulated to take into account the absence of abundant intermediate fossils. Students should learn that both theories are similar in that neither is scientifically accountable and that the fundamental difference is the teleology of Mivart's theory versus the materialism of Gould's and Eldridge's view. Mivart's derivative creation requires a Miracle Maker while the miracles of Gould's punctuated equilibrium theory supposedly occur "naturally". They should see that the difference between Gould and Mivart is in the metaphysics, not the science.

An academically honest origins curriculum would enable students to have a well-rounded education on the subject of origins. In a scientifically based curriculum there should be discussion of whether or not any explanation for the origin of life can be empirically proved. Indeed, some explanations for the origin of life may be disproved but can any be empirically proved? Without exception all so-called scientific explanations for the origin of life begin with a modicum of scientific accountability and ultimately veer off into the domains of speculation, imagination, myth, miracle, and wishful thinking. It is socially divisive and reflects a lack of scientific integrity for scientists to promote one particular explanation for the origin of life under the name of "science" when no explanation can be empirically verified.

The scientific establishment should stop theorizing about origins unless it becomes socially neutral by including all other theories of origins. All explanations for origins share the common feature of relying on miracles that are scientifically unaccountable and all have religious underpinnings. There really is no scientific, social, or other basis for excluding any particular explanation for the origin of life in a science curriculum.

Doctrine versus True Science in Teaching Evolution

Two versions of evolution exist, the doctrinal and the truly scientific. The educational world promotes only the doctrinal version. Scientific information unfavorable to evolution has been systematically omitted because doctrinal evolutionists are religiously motivated.

No one can claim to be an authority on evolution if they are unaware of information that is unfavorable to their theory. No other investigative body would consider forsaking real evidence for imaginary evidence; only doctrinal evolutionists have this distinction. They formulated a theory that was unavoidably destined to self-destruct in the face of Jevons' Rule.

Because doctrinal evolutionists are unwilling to include unfavorable information about evolution in the curriculum, they automatically forfeit their claim of authority on the subject. The open-minded and truly scientific evolutionists and others willing to deal with evolution in a truly scientific framework need to claim that authority.

The doctrinal version of evolution as presently taught in public schools should be rejected not on constitutional grounds alone but because it is also self-serving, prejudicial, and religiously dogmatic. Students are not able to make an educated judgment concerning evolution when the unfavorable information is withheld and only favorable information is presented. This is the grand strategy that has shaped the evolution curriculum and it is time for a change.

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On the 200th anniversary of the death of the first President of the United States

Of all the dispositions and habits, which lead to political prosperity, Religion and Morality are indispensable supports. In vain would that man claim the tribute of Patriotism who should labor to subvert these great pillars of human happiness, these firmest props of the duties of Men and Citizens. The mere Politician, equally with the pious man, ought to respect and to cherish them. A volume could not trace all their connections with private and public felicity.

Let it simply be asked where is the security for property, for reputation, for life, if the sense of religious obligation desert the oaths which are the instruments of investigation in Courts of Justice? And let us with caution indulge the supposition that morality can be maintained without religion.

Whatever may be conceded to the influence of refined education on minds of peculiar structure—reason and experience both forbid us to expect that national morality can prevail in exclusion of religious principle.

George Washington, from his Farewell Address

The Piltdown Hoax's Influence on Evolution's Acceptance

Jerry Bergman*

Abstract

The Piltdown hoax history and its importance in convincing the world of evolution is reviewed. Compelling evidence existed from the beginning that the find was a hoax or, at the very least, did not provide support for human evolution. Yet, the Piltdown was touted for decades as one of the most important evidences of human evolution by textbooks, articles and major first class museums

such as the American Museum of Natural History in New York. The hoax is an excellent illustration of the difficulties inherent in drawing conclusions about evolution from the fossil record. It was concluded that the hoax served to convince many people of the validity of Darwinism and its final definitive exposure probably did little to alter the views of most Darwinists.

Introduction

Of the many fossil forgeries used to try to prove Darwinism, the most well known was the Piltdown hoax. For close to forty years, *Eoanthropus dawsoni*, a.k.a. Piltdown man (Figure 1) was taught as fact in textbooks throughout the world and was exhibit one for evolution in major museums the world over (Blinderman, 1986, p. 238). Its importance was explained by Walsh:

The Piltdown hoax—though that is much too mild a word for an event never intended as a light-hearted prank—during the four decades that passed before it was exposed, *played a pivotal role in one of the most critical scientific pursuits of modern times*, the theory of human evolution. Appearing on the scene just as the fossil record of man had slowly begun to accumulate ... It created, as one scientist recently expressed it, what was easily the most troubled chapter in human paleontology, with the fraudulent bones receiving nearly as much attention *as all the legitimate specimens in the fossil record put together*. Young scientists and old alike wasted untold thousands of hours on the Piltdown phenomenon. The laborious study, and the writing and publishing of the several hundred research reports and papers worldwide, the sheer, enormous amount of space in books and articles given to sober discussion of its every smallest aspect, make a picture sad to contemplate (Walsh, 1996, p. xvi emphasis mine).

Many famous scientists were involved in the hoax including Dr. Arthur Smith Woodward, Director of the Natural History Museum of London, and Sir Arthur Keith (1866–1955), Professor of Anatomy at the London Hospital Medical School and later Conservator of the Museum of the Royal College of Surgeons. The Piltdown bone fragments were accepted by many well respected scientists as important proof of evolution for almost half of a century. Furthermore, Piltdown man absorbed the professional attention of many fine scientists [and] ... led millions of people astray for forty years (Gould, 1983, p. 225).

Although several other putative finds existed that were used to prove human evolution, the Piltdown fossils had a major impact in proving the theory of evolution and were used as proof of evolution in textbooks for decades (Baitsell, 1929). It was no minor find, but of central importance to evolution: As Christ was to Christianity, and the atomic theory was to chemistry, Piltdown man was to human evolution. Piltdown even made the careers of some of the most eminent 20th century scientists. When Arthur Smith Woodward retired he found his days were as busy as they were during

his forty crowded years at the Natural History Museum in London. Still youthful at sixty ... he was to remain active in paleontology for almost another two decades ... The ultimate honor came ... in the spring of 1924: conferral of a knighthood. Woodward's eminence had been fairly won ... by sheer brilliance and unflagging energy he had worked his way upward at the museum, at thirty-seven becoming keeper (director) of its world-famed geology department. Along the way his many out-

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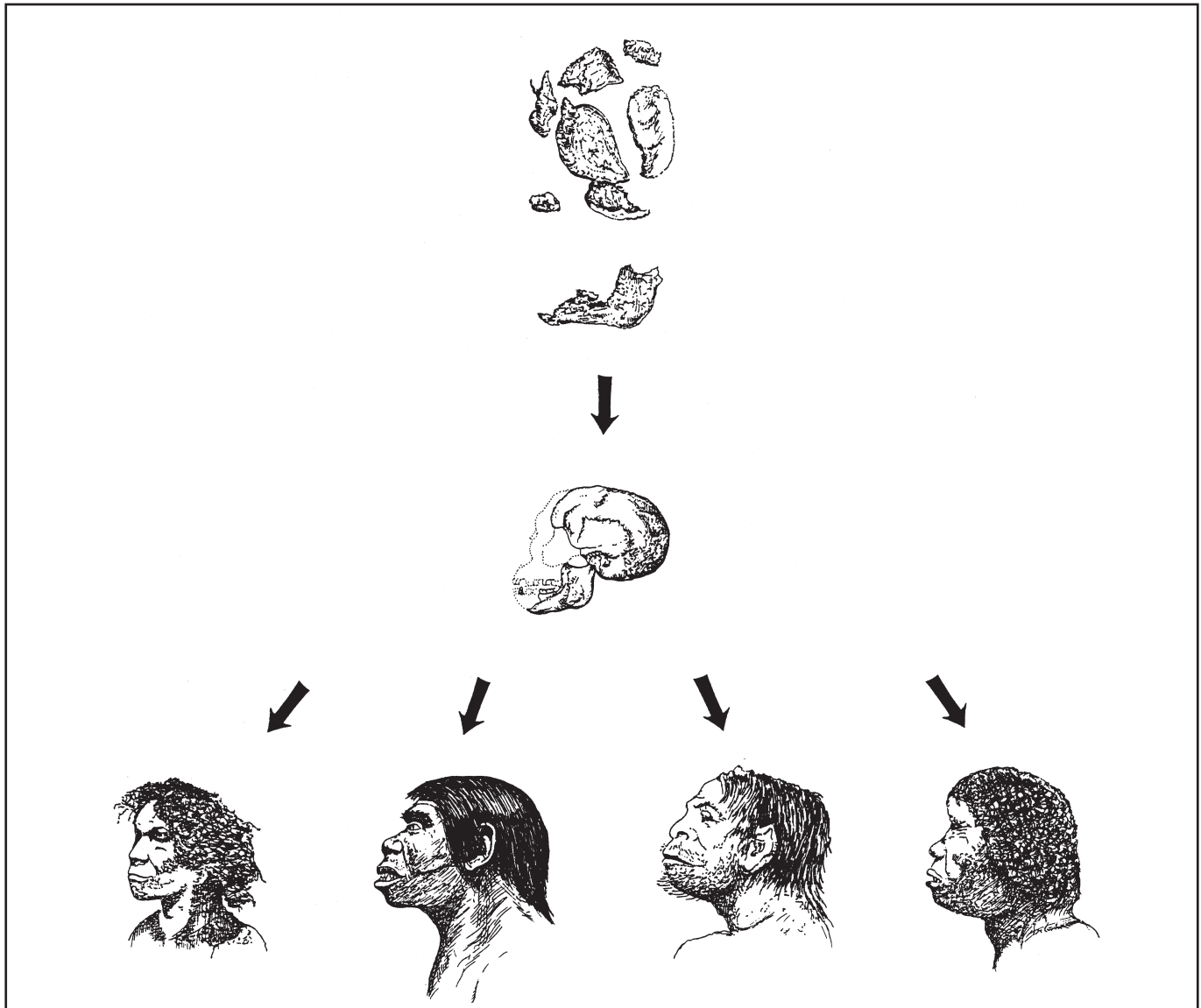


Figure 1. Adapted from Blinderman (1986), Winslow and Meyer (1983), and Walsh (1996) by artist Richard Geer. From the bone fragments and a human jaw shown above the reconstruction shown in the middle was produced (the solid lines represent then actual skull parts, the dotted lines the missing parts). From the skull reconstruction was then produced by four artists the illustrations shown, each which was represented as an accurate depiction of the Piltown man head.

standing achievements in paleontology... had been fully recognized. A fellow of the Royal Society before he was forty, by the time of his retirement he had been president at different times of three prominent scientific bodies. A recipient of the Gold Medal of England's Royal Society, he had also been awarded the Lyell Medal, the Linnean Medal, the Wollaston Prize, the Prix Cuvier of the French Academy, and the Thompson Medal of the American Museum. Aside from his half dozen technical books, the total of his scientific writings exceeded a remarkable four hundred papers. *Capping all was the association that had brought*

him fame and secured his place at the pinnacle of his profession, the central role he took in the drama of Piltown Man. Hailed by most as evolution's first true missing link, that sensational find since its arresting debut in 1912 had usurped a large portion of his time at the museum, and through his twenty-year retirement it continued to rivet his attention ... To a reporter from a London paper who interviewed him on the day he quit the museum for good, Woodward readily admitted that the Piltown discovery had been the most important thing that ever happened in my life (Walsh, 1996, pp. 3–4 emphasis mine).

History of the Piltdown Discovery

The story began with Charles Dawson, a geologist awarded the coveted fellowship of the London Geological Society at the young age of 21 (Youngson, 1998, p. 53). Dawson claimed that he noticed several small pieces of brown flint when workers were digging gravel from a shallow pit to repair a road near the village of Piltdown in Sussex country, England. Dawson claimed that the flint indicated the site might contain humanoid fossils and so asked the workers to contact him if they found any bones.

He later claimed that the men did find some "old bones" in 1908 and four years later, on December 18, 1912, Dawson and Woodward introduced to the world—to a packed and excited audience at the Geological Society of London—Piltdown man, the most important archaeological discovery of all time (Youngson, 1998, p. 54; Millar, 1972). The find not only fulfilled Charles Darwin's predictions but was the ideal missing link (Millar, 1972, p. 9). The evidence consisted of skull fragments, a jawbone, and a single tooth found in a shallow gravel. The Piltdown brain capacity was at first estimated to be about halfway between that of humans and apes, but later more evaluations indicated that its brain size was closer to about 1,400 cubic centimeters, close to modern Piltdown residents.

Later named *Eoanthropus dawsoni* by Woodward in honor of Dawson, the skull was pieced together from fragments that had been putatively deposited during the Pleistocene era, roughly around the last ice age. Further finds, including a lower canine tooth uncovered in 1913 and cranial fragments at a second site called Piltdown II allegedly found two miles away found in 1915, dispelled much of the doubt about the validity of the original finds (Gould, 1979, p. 87; Lubenow, 1992, p. 41). The bones, teeth, and antlers of a variety of extinct and non-extinct animals including mastodons were also allegedly found nearby Piltdown's grave as were crudely flaked flint stones called coliths (Winslow and Meyer, 1983, p. 34).

Many scientists—and much of the world—were elated at the discovery. Now many evolutionists felt that for the first time they finally had solid empirical evidence of human evolution. Piltdown bridged the gap between humans and lower primates, and was judged by many of the world's leading paleontologists as neither a monkey nor a human but an ape-man link. Piltdown soon became the basis for many beliefs about the so-called "missing links" discovered since then. The find was soon widely regarded as the earliest known human fossil, older than anything the French or Germans or anyone else had yet found (Winslow and Meyer, 1983, p. 33). A close associate of Dawson, Sir Arthur Smith Woodward, who was then head of the geology department at the British Museum,

was so enthusiastic about the find that he widely publicized it at every opportunity. The importance of the find is clear in a contemporary account:

A GREAT company assembled in the rooms of the Geological Society of London on the evening of December 18th, 1912, to receive the first authentic account of the discovery at Piltdown . . . It was quite plain to all assembled that the skull thus reconstructed by Dr. Smith Woodward was a strange blend of man and ape. At last, it seemed, the missing form—the link which early followers of Darwin had searched for—had really been discovered. No one had ever suspected that a secret of this kind lay hid away in the Weald of Sussex (Keith, 1915, p. 306; emphasis in original).

With the support of many well-known eminent scientists, many of the experts of the day were easily convinced that an important and unique find had been made. Jesuit Priest Pierre Teilhard de Chardin helped Dawson with the digs which improved Dawson's credibility even more. Professor de Chardin, who was then teaching at a seminary in Hasting, soon uncovered another part of the missing link, this time a canine tooth. With the church on his side and further discoveries to come, major challenges to Piltdown Man appeared unlikely.

The importance of Piltdown in convincing the populace of the validity of evolution cannot be overestimated. The other fossil finds of the time included a jawbone found near Heidelberg, Germany (Heidelberg man) and a skullcap, thighbone and three teeth discovered in Java (Java man). These were then the only known fossil evidence of the putative modern human ancestors and for years both remained the subject of intense scientific controversy (Larson, 1997, pp. 11–12). Neanderthals contributed little to the story of human evolution because they came from a later era, were fully human and died out (Larson, 1997, p. 12). This left Piltdown as one of the most important missing links between man and the higher apes (Lawson, 1997, p. 12).

One day after the Piltdown find was announced to the world a headline in the *New York Times* stated that the "Piltdown Bones Probably Those of a Direct Ancestor of Modern Man" (Dec. 19, 1912, p. 6). The very next day the *Times* (Dec 20, 1912 section c, p 1) followed up with an interview of Woodward who stated, "Hitherto the nearest approach to a species from which we might have been said to descend that had been discovered was the cave-man," and that "the authorities constantly asserted that we did not spring direct from the cave-man. Where, then, was the missing link in the chain of our evolution? . . . the answer lies in the Piltdown skull, for we came directly from a species almost entirely ape." Many American and European newspapers carried similar claims.

The *New York Times* in its next Sunday edition concluded its coverage of the Piltdown discovery with a page-one summary of the find and its meaning for evolution. The banner headline proclaimed “Darwin Theory Is Proved True” and added the subheadline that the skull was thought to be a woman’s. Another subtitle added “English Scientists Say the Skull Found in Sussex Establishes Human Descent from Apes.” This article printed Keith’s conclusion that the discovery is what anthropologists have been seeking for forty years because it provided proof of a stage in the evolution of man which we have only imagined since Darwin propounded the theory. He adds that

there is no doubt at all that this is the most important discovery concerning ancient man ever made in England. It is one of the three most important discoveries of ... [fossil man] ever made in the world. The other two were the discovery of the individual known as Pithecanthropus, made in Java in 1892 by Prof. Eugene Dubois. The other, which equals it in instructiveness and importance, is the skull discovered at Heidelberg six years ago (Quoted in The New York Times, Dec. 22, 1912, p. C1 emphasis mine).

Note how extremely confident the scientists were in their assessments:

It is, therefore, generally agreed that the skull belonged to a race of men who lacked the power of speech. A prominent anthropologist ... said that the evidence on that point was convincing, the speech centres in the brain being so feebly developed that brain power was practically nonexistent (New York Times, Dec. 22, 1912, p. C1).

The renown of Piltdown man soon rapidly spread throughout the world. Replicas of the famous skull made from the original (which was regarded as priceless and kept safe locked away in the British Museum protected from vandals and skeptical investigators alike) soon found their way into many state museums and college science classrooms (Johnson, 1991, p. 186). In a set of glass cases in the Hall of the Age of Man display at the American Museum of Natural History, for years Professor Henry Osborn exhibited his best case for human evolution. In case No. 2 he mounted a bust of the Piltdown man conceived by Professor J. H. McGregor. Described as a restoration of a missing link, to the uninitiated it was half-ape, half-human which was designed to impress the high school students and their teachers, visiting the Museum in ever increasing numbers, with the conclusion that human evolution is true (McCann, 1922, p. 1).

Lubenow concludes that one reason why the Piltdown hoax was so successful was because it conformed to what certain evolutionists were expecting to find, namely a big-brained human ancestor. “Sir Grafton Elliott Smith

had successfully predicted that a fossil very similar to Piltdown would be found.” This successful prediction is one reason why he was one of the suspects of the hoax (1992, p. 43). The eminent Sir Arthur Keith even wrote a 520 page scholarly book on the human fossil record, much of which discussed Piltdown man in enormous detail, including extensive discussions of its biology, life habits and even its death. A sample section follows:

Early in the summer of 1912, when Dr. Smith Woodward commenced his examination of the Piltdown fragments, he realized that the peculiar and characteristic features of this ancient form of man were centered in the region of the chin. Such features had never been found or seen in any mandible or skull to which the term human could be applied . . . It is the lower or muscular part which principally concerns us. There is no projection of the anterior surface at the lower border of the symphysis to represent a chin in the chimpanzee; the anterior or labial surface of the jaw slopes downwards and backwards to a chinless lower border. On the hinder surface of the symphyseal region—the surface directed towards the tongue—there is seen a deep pit, almost large enough to take the tip of the little finger . . . Such is the conformation of the symphyseal or chin region of the lower jaw in apes . . . When a corresponding section is made of the symphyseal region of a human lower jaw, a very different conformation is seen (Keith, 1915, pp. 322-323, spelling modernized).

Reading this work is enormously enlightening about the wild speculations involved in establishing evolution theory. The Nature Conservancy even spent much taxpayer money to designate the Piltdown site as a national monument. Nor were a few loners only involved in accepting the fraud. Gould admitted that the three leading lights of British anthropology and paleontology—Arthur Smith Woodward, Grafton Elliot Smith, and Arthur Keith—had staked their careers on the reality of Piltdown (Gould, 1979, p. 90). So important was the find that Millar claims were it not for his premature death, Dawson would been knighted by the British crown for it (1972, p. 9). Fix claims that for many Piltdown Man was the most important evidence of human evolution (1984, p. 12).

To most creationists and a few critical scientists including Franz Weidenreich, though, the skull and jaw fit did not seem right. The jaw was too much like an ape and the cranium was far too much like an Anglo-Saxon human cranium. Although other persons also eventually came to believe the two did not belong together, evidently most scientists did accept the Piltdown hoax. According to Lubenow

evolutionists now like to boast that not everyone accepted Piltdown. Technically they are correct.

There were a few, such as Weidenreich and Hrdlicka, who did not accept Piltdown. But the vast majority of paleoanthropologists worldwide did accept Piltdown as legitimate, especially after the confirming discoveries at Piltdown II (1992, p. 41).

Finally, in 1949 British geologist Kenneth Oakley, who was evidently convinced of the validity of the Piltdown find, read a 1892 paper by the French scientist Carnot. Carnot demonstrated that the fluorine content of bone generally *increases with age*. One can therefore obtain an estimate of the age of previously living bone by ascertaining the fluorine content. Dr. Oakley decided he would test the famous Piltdown skull using this new knowledge to prove *once and for all* that the finding was genuine (Walsh, 1996). Oakley found the fluorine content showed that the Piltdown man had made a monkey out of almost everyone involved in propagating Piltdown. According to this technique, Piltdown man was closer to 10,000 years old and not up to 500,000 years old as was originally claimed. (Modern radiocarbon dating indicates it is only 520 to 720 years old—see Lubenow, 1992, p. 42). This finding raised serious questions about the Piltdown find which led to its eventual exposure (Gee, 1996).

The events leading up to this retesting as told by Walsh are a very revealing part of the story. After Woodward published a book on fossil man, a renewed zest about human evolution resulted. The book, although very technical, served to help trigger

a lively renewal of interest in the original Piltdown discoveries, and a call soon went up to do something about preserving the site of the excavations. Under government auspices, after some final excavations, the small plot of ground was bricked in, with the precise spot of the discoveries being kept open and protected behind thick glass. Piltdown had become a major event in the unfolding of man's remote past, it was declared, and the ground that had yielded the fossils would have great historical value for unborn generations. When in the spring of 1950 the almost forty-year-old site was thrown open for public viewing, it quickly become a focal point for tourists and school outings. It was in this same year that the first puzzled suspicions, ironically *triggered by a wish to obtain the clinching evidence for authenticity*, began to stir. Late in 1949 the bones were taken from the vault of the Natural History Museum and submitted to a test that had been only recently perfected. The new procedure, it was thought, would settle the vexed question of the jaw-cranium association (Walsh, 1996, pp. 9–10 emphasis mine).

The skull is now known to be from a modern human, and the jaw was from a juvenile female orangutan (Winslow and Meyer, 1983, p. 33). The first rigorous discussion

of the hoax was published in a 1953 British Museum bulletin by Dr. Oakley and two scientific collaborators in a paper titled "The Solution of the Piltdown Problem." The paper concluded that the canine tooth had been filed down to articulate better with the skull and it was stained to appear more primitive, and also was impregnated with grains of sand so as to "imitate" fossilization. Joseph Weiner is credited for finally bring the forgery to light (Spencer, 1990, p. xiii).

In light of this background, a 1948 account is enormously revealing about the tendency to reach broad sweeping conclusions from a minuscule amount of data:

... Piltdown man, long considered one of mankind's oldest ancestors, is a mere anthropological infant, not more than 10,000 years old, Dr. K.P. Oakley of the British Museum disclosed to the British Association for the Advancement of Science Previously considered to be between 100,000 and 500,000 years old, the jawbone and skull are now proved by analysis of their fluorine content to be definitely of the last interglacial period. Fossil animal bones of known geological age, dating from the Pleistocene or glacial period, unearthed nearby the human bones at Piltdown, England, had the same content of the chemical fluorine picked up from the ground water of the locality (Davis, 1949, p.185).

The Piltdown exposure was first covered in *The Times* of London (Nov. 23, 1953) and the *Manchester Guardian* of November 26, 1953, which called the hoaxer extraordinarily skillful. It soon became obvious that the hoaxer was actually extraordinarily sloppy, almost beyond belief (Millar, 1972, p. 228). The scientific world was stunned by the Piltdown exposure partly because one of the most important star evidences for evolution was now lost. One major question remaining was: Who was the culprit? Blame fell first on the putative discoverer, Charles Dawson, but his role was difficult to investigate for he had by then been dead for 37 years. Dawson, an amateur anthropologist with limited experience had putatively made some significant fossil discoveries, and was a member of the prestigious Geological Society (Lubenow, 1992, p. 40). Nonetheless, many authorities still conclude he was the most likely candidate (Walsh, 1996).

Also accused was Father de Chardin who was well known for his religion of evolution and his research into the putative evolutionary origins of humans. Harvard professor Stephen Jay Gould concluded de Chardin, Dawson and possibly others were all involved (1979, 1983). Millar concluded that Sir Grafton Elliot Smith of the British Museum was the hoaxer (1972). Even Sir Arthur Conan Doyle was once a suspect (Winslow and Meyer, 1983). Most early investigators of the various distinguished paleontologists and archeologists who originally took part in the investigations of Piltdown were

either perpetrators or the victims of a carefully planned hoax.

Since then a number of other possibilities have surfaced, but *none* of them has produced conclusive evidence. The latest is Martin A.C. Hinton who was a Curator of Zoology at the British Museum in from 1936 to 1945 (Menon, 1997). A trunk that belonged to him was found to contain bones and teeth artificially stained in a way very similar to the Piltdown hoax bones (Gee, 1996, pp. 261–262). This and other evidence have caused some persons that were close to the case to conclude that the evidence for “Hinton having been the sole hoaxer is now conclusive” (Gee, 1996, p. 262). To others, though, the case still remains a mystery, an unsolved hoax. Nonetheless, the significance of the hoax by far is its importance in understanding both the mind set and the paucity of evidence the true believers in evolution actually had.

Piltdown, Creationists and the Scopes Trial

Creationists especially were critical of the find, often by noting the disagreement that existed among evolutionists themselves about the validity of many of the various interpretations that soon surfaced about the find. Typical of the many creationists critiques was the following by Price:

Considering the fact that these fragments were not all found together or at one time, some of them having been found in the autumn and the rest in the spring of the next year, the various fragments being scattered over an area of several yards, the difficulty of being sure of the real form and size of this skull will be appreciated. As for the geological age of these remains, Keith calls them Pliocene, while Smith Woodward thinks them Pleistocene. Keith thinks the skull is that of a woman (1923, p. 299).

Assuming much of the information presented in the media about Piltdown was true, Price elsewhere stated he believed that Piltdown Man may be a degenerate human offshoot (1924, p. 110). William J. Bryan argued that the Piltdown man did not prove man’s relationship to the anthropoid ape (quoted in Larson, 1997, p. 8). Plaster casts of Piltdown man soon even appeared as evidence for the defense in Scopes’ legal challenge to Tennessee’s anti-evolution law.

Some creationists such as John Roach Straton openly denounced Piltdown as a fraud (Larson, 1997, p. 32). At about this time creationist Harry Rimmer asserted that the Piltdown hominid consisted mostly of plaster of Paris and imagination (1995, p. 427). William Bell Riley referred to it as imaginatively created (quoted in Trollinger, 1995, p. 101). Unfortunately, evidently no creationists then had carefully analyzed the find and provided a de-

tailed review of it. One reason was because few people had access to the original bones which were carefully guarded by the British Museum.

Probably the most extensive early discussion of the Piltdown man problem by creationists was by Catholic biologist George O’Toole (1929) and Catholic author Alfred McCann (1922). McCann does an excellent job evaluating the evidence, albeit in journalistic prose, showing that the obviously poorly executed hoax was accepted only because of the powerful desire of evolutionists to find support for human evolution. McCann traced the Piltdown discovery from its beginning to about 1920. He confidently concluded that Piltdown was clearly a discredited hoax and that the skull-cap was human, the jaw was the jaw of an ape, and the pair were deliberately designed to look like a man half way along his journey from simian to the human stage (McCann, 1922, p. 1). Professor O’Toole correctly concluded twenty years before it was finally recognized by the scientific world that

Eoanthropus Dawsoni is an invention, not a discovery, an artistic creation, not a specimen. Anyone can combine a simian mandible with a human cranium, and, if the discovery of a connecting link entails no more than this, then there is no reason why evidence of human evolution should not be turned out wholesale (1929, p. 323).

O’Toole also concluded Dr. Woodward’s major error was in his

failure to discern the obvious disproportion between the mismated cranium and mandible. As a matter of fact, the mandible is older than the skull and belongs to a fossil ape, whereas the cranium is more recent and is conspicuously human. Woodward, however, was blissfully unconscious of this misalliance. What there is of the lower jaw, he assures us, shows the same mineralized condition as the skull and corresponds sufficiently well in size to be referred to the same individual without hesitation (1929, p. 322).

Extreme Confidence of Many Leading Scientists in the Find

Many of the leading paleontologists expressed extreme confidence in the importance of the Piltdown find for evolution. William J. Bryans nemesis, Henry Fairfield Osborn, even included several chapters devoted largely to Piltdown Man in his major 1928 book on human evolution. The high level of confidence Osborn had in his conclusion is clear from his forceful prose:

There has been on the part of anthropologists no conspiracy or hasty acceptance of any of these fossil men. The Neanderthal Stone Age man discovered

in 1848, the Trinil ape-man of Java discovered in 1891, the Piltdown Dawn Man discovered in 1911, have had in turn a hard struggle for scientific recognition, lasting thirty-nine years in the case of the Neanderthal man, more than thirty years in the case of the Trinil ape-man (*fide* Dubois), and no less than ten years in the case of the Dawn Man of Piltdown (Osborn, 1927, p. 48).

Osborn added that Arthur Smith Woodward had finally established

... beyond question the authenticity of the Dawn Man of Piltdown. The confirmation of the reality of the Piltdown man as a veritable dawn man must be followed by renewed and determined effort to fix more precisely his *geologic antiquity*, about which there has also been a great difference of opinion and on which the discovery of Foxhall man, described above, may have some bearing (Osborn, 1927, p. 48).

Sir Author Keith even stated of those who concluded that the jaw was that of an ape and the skull was that of a human was a mistake that could never have been made if those concerned had studied the comparative anatomy of anthropoid apes (1927, p. 204). A common conclusion was that the jaw and cranium *must* belong together because the chances of the two being found together accidentally was infinitely small (Gates, 1948, p. 239). The extreme confidence of the genuineness of the Piltdown find is commonly found in many pre-1950 works on evolution. One scientist in a summary of the current state of support for Piltdown concluded that if the second fossil lower jaw found at Piltdown belongs with the first

Piltdown skull, as nearly all authorities now believe, it affords a clear case of an ape-like canine belonging in a human jaw; only it should be noted that the Piltdown canine is much more like the lower canines of certain female gorillas, which have not attained the tusk-like stature of male canines. The human canines may indeed be most reasonably regarded as reduced and infantilized or feminized derivatives of a primitive anthropoid type, and the process of reduction and infantilization may well have taken place during the millions of years of the Lower Pliocene epoch, at a period when the fossil record of human remains so far discovered is still blank. The great mass of collateral evidence for the derivation of man from primitive anthropoids with well developed but not greatly enlarged canines, has been reviewed lately with great thoroughness by Remane, who finds no justification for the view that man has avoided the primitive anthropoid stage and has been derived from wholly unknown forms with the canine tips not projecting much beyond the level of the premolars (Gregory, 1929, pp. 141–142).

The Piltdown case is not an isolated example, but only one of many in which the enthusiasm of Darwinists went well beyond the facts. That the hoax occurred is less surprising than the fact that *it was accepted by so many scientists for almost half a century*. Steven J. Gould concluded that one of the most interesting questions about the affair is Why did *anyone* ever accept Piltdown Man [as genuine] in the first place? (1979, p. 86 emphasis mine). Among the many reasons that exist for its acceptance include the fact that the skull was unwittingly shattered by a workmans pick and had to be reassembled, allowing preconceptions to influence reassembly as is true of most putative human fossils (Baitsell, 1929, p. 167). Gould and many others largely ignore what is probably the best answer to the question as to why it was accepted for so long: the often blinding desire of naturalists and others to find evidence for their worldview. The lesson here was well expressed by Hawkes, namely that he found it was shocking to discover how often preconceived ideas have

affected the investigation of human origins. There is, of course, nothing like a fake for exposing such weaknesses among the experts. For example, to look back over the bold claims and subtle anatomical distinctions made by some of our greatest authorities concerning the recent human skull and modern apes jaw which together composed Piltdown Man, rouses either joy or pain according to ones feeling for scientists (Hawkes, 1964, p. 956).

She adds that there is no reason to suppose that tendencies to error [in this field] have grown very much less since then (1964, p. 952). A major problem for those many leading paleontologists who accepted the hoax was that *the forgery work was extremely sloppy*:

One reason for believing that the jaw went with the skull was the fact that the tops of the teeth were worn down in a manner which seemed to be characteristic of humans and not of apes. But no one noticed that the teeth had been artificially ground down to look like human teeth. No one noticed the scratches left by the abrasive agent, which the careless perpetrator of the hoax did not polish away. No one noticed that the job of flattening the surfaces of the teeth was overdone and the surfaces were too flat to be realistic. No one noticed that the teeth were so flat on top that the edges were angular instead of rounded. No one even noticed that the job had been done so carelessly that the tops of the different teeth were flattened at different angles. Also, because of the crudeness of the operation, the Piltdown cusps exhibit dentin quite flat and flush with surrounding enamel, a state of affairs explicable only by rapid artificial rubbing down of the surface (Davidheiser, 1969, p. 342).

To help look the part, the bones were painted with ordinary hardware store paint, probably a shade called Vandyke brown (Walsh, 1996, p. 70). Piltdown II fragments—a piece of the forehead and an isolated molar—were later found to be part of Piltdown I skull (Walsh, 1996, p. 70; Millar, 1972, p. 228). Davidheiser adds that x-ray analysis of the loose canine tooth found with the Piltdown skull had been worn down so far that

the pulp cavity was exposed, a phenomenon which does not happen as a result of natural wear, and someone had filled the pulp cavity with sand! Besides all this, it was an immature tooth which would not have had time to wear down a great deal. All of this was not only overlooked as evidence that something unnatural had happened, but it was rejected when it was pointed out. A dentist named Lyne pointed out that the canine tooth could not have been worn down naturally, but his cogent arguments were brushed aside by Woodward. Professor Woodward let himself be influenced by a Dr. Underwood who spoke in violent disagreement with Mr. Lynes contention of the immaturity of the canine and its paradoxical nature, and who declared that the wear of the canine was indubitably natural (1969, pp. 342–343).

History has proved that Mr. Lyne was correct and Dr. Underwood was wrong as should have been clear to anyone who had a basic knowledge of dentistry. Furthermore, the site where it was found was frequently underwater or damp and otherwise the area appears to be a most unlikely place where bones could last even hundreds of years, not to mention thousands (for photographs of Piltdown gravel pit where the bones were allegedly discovered see Spencer, 1990, pp. 160–163).

Evolutionists today in trying to rationalize the widespread acceptance of the Piltdown hoax often stress that doubters existed from the start, and the process of science eventually worked because the hoax was in due time exposed (Blinderman, 1986, p. 235). The same can be said for most all, if not all, of the evolutionists arguments, both those now discredited such as the vestigial organ theory, biogenesis, homology and many others as well as theories largely discredited but still touted as proof for evolution such as the abiogenesis theory and mutations as the major source of genetic variety (Larson, 1997, p. 30). These dissenters are frequently quoted by creationists to the chagrin of orthodox Darwinists. Both today and in the past, the dissenters of Piltdown man could be explained away:

G. S. Miller, Jr., who studied, not the original but a cast, came to the conclusion that the jaw and skull could not possibly pertain to the same individual or even the same genus, but that the former was that of a fossil chimpanzee . . . despite the fact that fossil

anthropoids were heretofore unknown in England. In this conclusion Mr. Miller has had quite a large American following. The matter has, however, been settled beyond question by the finding of a second specimen of the Piltdown man some two miles distant, consisting of diagnostic cranial fragments associated again with a lower molar of precisely similar character to those in the first jaw, a happening which could hardly occur, according to the law of probabilities, in both of the only known instances if the jaw and skull were not those of the same form (Baitsell, 1929, p. 168).

Another significant fact that illustrates the trend today is the Piltdown hoax appeared for some time in texts published *after* it was exposed. One egregious example of delayed admission is in the 1960 book *Adams Ancestors* by L. S. B. Leakey. In the fourth edition published by Harper it was finally corrected but only by adding a section on the hoax and retaining the internal discussions which in places implies Piltdown was a legitimate find, and other places which, to Leakey's credit, raises major questions about the find. This example is of special note because Leakey was then one of the foremost anthropologist in the world. Similarly, examples of now discredited ideas about evolution are still commonly found in evolution and biology textbooks.

Conclusions

The Piltdown case is an excellent example of how social and cultural expectations can powerfully influence scientific opinion. One researcher concluded that an inquest into Piltdown affair does not

offer much cheer to those of us who think that science is a legitimate enterprise that has drawn a credible chart of human evolution. Anyone conversant with the Piltdown history will readily, if not eagerly, agree that many of the researchers shaped reality to their hearts desire, protecting their theories, their careers, their reputations, all of which they lugged into the pit with them (Blinderman, 1986, p. 235).

In one of the most insightful assessments of the whole Piltdown affair, Eiseley noted that the amount of subjective speculation

indulged in for years over the Piltdown fossil, and to which many leading authorities contributed, can now be viewed historically as a remarkable case history in self-deception. It should serve as an everlasting warning to science that it is not the theologian alone who may exhibit irrational bias or give allegiance to theories with only the most tenuous basis in fact. That scientists in the early years of a new

discipline should have been easily deceived is not nearly so embarrassing as the rapidity with which they embraced the specimen solely because it fell in with preconceived wishes and could be used to support all manner of convenient hypotheses. The enormous bibliography in several languages which grew up around the skull is an ample indication, also, of how much breath can be expended fruitlessly upon ambiguous or dubious materials (Eiseley, 1966, p. 111).

Fix concludes that what was especially embarrassing for paleontology is not that one of its members should have stooped to manufacturing the evidence, but that so many made so much out of so little (Fix, 1984, p. 13).

Keith even said the exposure caused him to have a "loss of faith in the testimony of Man" (quoted in Williams, 1969, p. 286). The fact that it was proven a forgery is somewhat irrelevant now: It influenced millions of persons to accept Darwinism and was even used at the Scopes trial as proof of evolution. Once Darwinism was widely accepted, the fact that most of the evidence for the theory including vestigial organs, homology, the biogenetic law and the putative fossil evidence has been proved false does not now matter. What happened was eloquently stated by Pagel:

Darwin proclaimed a wholly material explanation for species, based on the principle of descent with modification. Lyell had opened the door, and Darwin showed God out. Palaeobiologists flocked to these scientific visions of a world in a constant state of flux and admixture. But instead of finding the slow, smooth and progressive changes Lyell and Darwin had expected, they saw in the fossil records rapid bursts of change, new species appearing seemingly out of nowhere and then remaining unchanged for millions of years—patterns hauntingly reminiscent of creation. But *there was no turning back*, and biologists have for the past century fought over how best to explain the diversity of life (1999, p. 665, emphasis mine).

Millar (1972 p. 10) estimates some 500 scholarly articles were written about Piltdown during its 40 year lifespan. If references to Piltdown in textbooks and articles about evolution were included, no doubt the count would be in the multi-thousands. Since clear evidence existed from the beginning that Piltdown was a hoax, or at least it was not evidence for human evolution, why did it take almost 50 years for this information to be published? It required almost 40 years before it was conclusively exposed. To answer this question

...the great German anatomist, G. Schwalbe, so frequently quoted by Professor Osborn, had to abandon the missing link opinion so picturesquely and noisily voiced as a scientific fact when he declared

that the proper restoration of the Piltdown fragments would make them belong not to any preceding stage of man, but to a well developed, good sized *Homo sapiens*, the true man of today. Why are such facts as these withheld from the young student and from his teacher if truth is really an objective? (McCann, 1922, pp. 8–9 *Italics mine*)

The most important lesson of Piltdown, as adroitly summarized by McCann almost 70 years ago, was that the affair showed the ease that evidence which evolutionarily links apes and men can be fabricated even if it requires

wide stretches of imagination in support of preconceived opinions. The materialistic evolutionists, who have misrepresented the Piltdown man and all that they have sought to make it signify, are careful not to refer to the English authorities in the biological sciences who discussed all the Piltdown remains upon the first report of their discovery to the Geological Society of London, December, 1912. They avoid all mention of the fact that even at that early date the English authorities refused to accept the cranium and jaw as belonging to the same individual (1922, p. 9).

Unfortunately, many Piltdown type fossils which are not what they are reported to be still exist in the textbooks today. In fact, Lubenow speculates that

if the australopithecines had not come into favor as the preferred evolutionary ancestors of humans, and Piltdown had not become an embarrassment because it no longer fit the scenario, the fraud might still be undiscovered and Piltdown might still be considered a legitimate fossil (Lubenow, 1992, p. 43).

In a survey of the human fossil record Fix (1984, p. 14) concluded that "the Piltdown fiasco has happened repeatedly" and is still being reenacted today. This is the true lesson of Piltdown (Vere, 1959).

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Notes on the Panorama of Science

Unaweep Canyon—Another Visit

Recently an interesting article (Shaver, 1998, pp. 218–224) on the origin of Unaweep Canyon (Figure 1) in southwest Colorado appeared in the *Quarterly*. Shaver suggested some puzzling geological problems facing creationists who would study the region. I would like to add some comments to Shaver's thought provoking paper.

The Origin of Unaweep Canyon—Uniformitarian Speculations

The origin of Unaweep Canyon has been puzzling to uniformitarians as noted by the variety of origin scenarios which have been offered to suggest how the canyon formed. Of course erosion by fluvial means is employed in most cases. Peale (1877), Cater (1966; 1970) and Sinnock (1981) conjectured that the ancestral Gunnison River carved the canyon. Gannett (1882), however, postulated that the canyon was once a channel of the Colorado River. Lohman (1961; 1965; 1981) proposed an elaborate scheme of stream piracy (two successive phases) involving both the Gunnison and Colorado rivers to form the canyon. Cole and Young (1983) listed evidences for glaciation found in Unaweep Canyon: U-shape canyon, truncated spurs, cirques, hanging valleys, till, outwash, solifluction features and blocked drainages. They considered "...that glaciation was an important agent in the final sculpting of the canyon" (p. 77). Oesleby (1977; 1983) measured the thickness of valley fill in Unaweep Canyon, which could be interpreted to be debris from previous erosional events.

Such fill along the edges of the canyon wall could yield a U-shape not carved by glacial forces. Sinnock (1981), when presenting his model involving a sequence of seven geomorphic events that led to the formation of the canyon, aptly commented that, "This model is but one of an infinite number of possible solutions to the problem of geomorphogenesis in the study area..." (p. 127). Thus when Shaver (1998) employed the wording, Unaweep Canyon mystery, in the title of his article, it described perfectly the state of origin speculations concerning the canyon.

Creationist Efforts in Southwest Colorado

Shaver has recently written another treatise (1999, pp. 11–16) on the region, describing a possible young earth origin of the Colorado National Monument (CNM), in which he further elaborated his two-phase model for the development of regional geomorphic features related to



Figure 1. Unaweep Canyon looking southwest. The inner gorge is cut into hard crystalline rocks. Slope above rim of the inner gorge on right are Triassic strata capped by a flat bench of Entrada Sandstone.

Flood and post-Flood events. He discussed Holroyd's work on Bangs Canyon (1994) claiming that catastrophic events were necessary to form the canyon as opposed to slow uniformitarian processes. Shaver also noted that the process of cliff sapping probably was instrumental in the formation of the CNM similar to rapid canyon development in the southeastern United States (Froede, 1996; Williams, 1995).

Oard (1998) joined the discussion on Unaweep Canyon and proposed a general canyon formation model throughout the world as a direct result of the Flood event. A related article on the catastrophic formation of the Black Canyon of the Gunnison River in southwestern Colorado was presented by Williams (1998).

Unaweep Canyon—Additional Observations

Considering the origin of Unaweep Canyon, possibly channelized high-velocity Flood water laden with abrasive particulate matter removed the sedimentary strata overburden then continued to scour into the crystalline basement. Once a preferred drainage pathway had been established, retreating Flood water continued to cut into the basement rock forming a canyon. Rapid uplift during the late stages of the Flood combined with a falling base level eventually left Unaweep Canyon "high and dry" with later post-Flood ice age precipitation accounting for any further erosion. Canyon sidewall erosion during the immediate post-Flood period resulted in scree piles along the floor of the canyon forming the U-shape thought by

some to reflect glacial weathering and erosion. Other interpretations are possible and I urge creationists to study this fascinating region of Colorado and offer their ideas for the development of geomorphic features such as Unaweep Canyon.

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Catastrophically Buried Old-Growth Forests Along the Oregon Coast

Hundreds of tree stumps of varying sizes are occasionally uncovered within the surf zone along portions of Oregon's coast (Figures 1–4. Other investigations into paleoforests in a surf zone setting along the United States Gulf of Mexico are found in Froede, 1995; 1997.). These stumps represent what were once old-growth forests which existed close to the former shoreline. An investiga-

tion of these paleoforests was recently conducted by Hart and Peterson (1997). The following account is a summary of their report:

Typically, tens to hundreds of tree stumps become exposed within the surf zone along portions of Oregon's coast following severe storm events associated with the Southern Oscillations of El Niño.



Figure 1. Neskowin Beach, Oregon. Tree stumps exposed within the surf zone in March 1998. The stumps are approximately 3 feet in height. Photographs by Fred Brauer.



Figure 2. Neskowin Beach, Oregon. Large tree stump in surf zone adjacent to Neskowin Creek exposed in March 1998.



Figure 3. Neskowin Beach, Oregon. Large weathered tree stump containing marine borings exposed in the surf zone in March 1998. Proposal Rock is in the background. The stump is approximately 3 feet in height.



Figure 4. Moolack Beach, Oregon. Large tree root mass with missing (eroded) stump exposed in the surf zone in March 1999. The root mass diameter is 18 feet which suggests an original trunk diameter of 6.5 feet.

These large late-Holocene age trees occur *in-situ* with their roots still intact. Radiometric dating of the freshly exposed tree stumps has been conducted in an attempt to age-date the former forest (ranging from $1,970 \pm 50$ to $4,340 \pm 70$ radiocarbon years). Unfortunately, the age of the wood creates a conflict between the age of the forest and a sea-level highstand position.

Paleosols and forest litter are in many cases found beneath and/or around the *in-situ* stumps. The excellent condition of the buried wood and underlying litter reflect rapid burial and preservation. Exposure of the wood and litter in the surf zone even for short periods of time results in the rapid destruction of both.

While changing sea-level position is believed to play a role in the inundation and burial of the

paleoforest, it is regional vertical tectonic movement associated with the active convergent margin of the Cascadia subduction zone which is believed to play the greatest role in the burial and preservation of these surf zone forests. Six stages are viewed as necessary to account for the formation of the tree stumps in the surf zone: 1) Wave cutting of the shore-line at a fixed sea-level position, creating a broad platform, 2) tectonic uplift of the platform, 3) growth of a forest (similar to the modern forest of that region) on the wave-cut platform, 4) rapid burial and preservation of the forest, 5) inundation of the forest at sea level, and 6) renewed erosion of the beach platform exposing the tree stumps in the surf zone. Debris flows and clastic dikes associated with many of the buried forests reflect tectonic conditions along this portion of Oregon's coast.

Within the Young-Earth Flood framework it is not surprising to expect the catastrophic burial and preservation of a forest in an area known to be seismically active. Place this buried forest adjacent to a coast and with the erosion of the overburden it would eventually become exposed in the surf zone. This is what we find along Oregon's shoreline today.

The Oregon coast at some point in the past experienced significant erosion resulting in the creation of a beach platform. Following this period, vertical tectonic movement (probably coupled with sea-level retreat) allowed this coastal area to become covered with old-growth forest. Later, the area dropped back within the surf zone, probably due to sea-level rise and vertical tectonism, and was buried under several feet of quartz sand. Today, large-scale storms remove the quartz sand and uncover portions of this once impressive forest. By the condition of the preserved wood and underlying forest litter it is obvious that these materials have only recently become exposed or the organic material would have been rapidly and completely destroyed. Perhaps recent regional uplift of this area has aided in the removal of the overlying sand exposing the tree stumps, or the beach sand source has been lost limiting the amount of sand available to cover the stumps within the surf zone. Either way the stumps, underlying

forest litter, and paleosols are exposed for the first time since they were originally buried.

Due to the size of some of the trees (some estimated to be over six feet in diameter) it is apparent that considerable time passed (a few hundred years) allowing the former forest to mature to a full growth stage. Stacked successions of paleoforests have not been found in this region. We are only observing the remainder of one paleoforest. This is expected within a Biblical framework, but not in the vast expanse of uniformitarian time.

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Book Reviews

Summer of the Gods by Edward Larson

Harvard University Press, Cambridge, MA. 1997, 318 pages, \$15.

The book is a detailed account of the Scopes trial of 1925 at Dayton, Tennessee, an event often tagged as the "Scopes Monkey Trial." Probably few if anyone in creation circles are unaware of this trial, one which has to this day ramifications in the battle between creation and evolution. Larson is a Professor of History at the University of Georgia at Athens and received his Ph.D. from the University of Wisconsin. One of his past professors was Ronald Numbers, who is no friend of young-earth creation (p. ix). This may be his bias. The book is subtitled *The Scopes Trial and America's Continuing Debate Over Science and Religion*. Much has already been written about this trial but Larson's treatment, while somewhat stilted, presents details lacking in other accounts.

There is little need to re-hash the story, one which has been so often repeated. Perhaps the value of Larson's work is that he has placed the trial in the midst of other concerns of early 20th Century America, an era when

there was unrest in the wake of the recent world war. The original intent of the trial was a test of a Tennessee law which forbid the teaching of evolution. Dayton merchants got on the bandwagon as they saw the possibilities of drawing folks to their sleepy town in the Tennessee hills. Soon others saw the trial as a line drawn in the sand between evolution and creation, and things escalated to the point that Clarence Darrow and William Jennings Bryan found themselves facing each other in a stuffy courtroom. The trial started as a contest as to who controls the classrooms.

While my own investigation into the trial may be faulty, I have been under the impression that Scopes was a physical education teacher (coach) and, occasionally, subbed as a teacher in science. Larson, however, says that Scopes was "a 24 year old science instructor and part-time football coach" (p. 89). The former seems to be a more accurate job description.

The movie and play *Inherit the Wind* are often held up as representing the facts of this trial but Larson goes to great lengths to show the error of this. The book provides valuable information, material which can be helpful when *Inherit the Wind* shows up in a local community. An interesting point revealed in this book is that many of the arguments brought forth in this trial remain with us today. This shows that the conflict is not, as alleged, between science and religion, but between two faith systems. Larson takes pains to show the inner workings of this trial, one in which no expert witnesses ever got to the stand. Although a number submitted depositions, none actually testified.

The author, perhaps lacking perception into things having to do with this issue, quotes a Unitarian minister who defends Scopes, implying that it was alright for a minister to be opposed to the anti-evolution bill in Tennessee. Larson, who should know better, fails to understand that Unitarianism and Evolutionism are similar.

In my opinion, the best parts of Larson's book are chapter 9 and 10, titled "Retelling the Tale" and "Distant Echoes." Here Larson shows how the account has become distorted over the years so that what we read today is far from what actually took place. His closing comments are worth reading: "As the amens for creationism

have increased in both number and volume over the years. ...secular critics have tended to revise their views of the play and the trial. Even aloof intellectuals have come to realize that a vast number of Americans still believe in the Bible and accept it as authoritative on matters of science. Moreover, if people accept the biblical account of special creation over the scientific theory of organic evolution, which is, after all, one of the core theories of modern biology, they most likely defer to biblical authority on other matters of public and private concern" (p. 265). The book's title came from Darrow's autobiography, *The Story of my Life*, published in 1932.

This is a generally good attempt to present an objective account of such a controversial event. As an historian, it is imperative that Larson not take a position, yet despite this concern, his bias came through as he tended to write of some who supported the anti-evolution bill as being "ultraliteral." He often noted that the problems at Dayton revolved around who took a literal view of the Bible, and yet those who read his book are expected to take his words literally! *Summer for the Gods* is good reading and could be useful in a classroom, provided there is careful attention by a teacher who can show where problems in the discussion exist.

Reviewed by Dan Schobert

The Creation Interpretation by Catie Frates

1997. Noble Publishing Associates, Gresham, OR. 112 pages, \$10.00

Author Catie Frates gives creation seminars nationally, and lives near Ocala, Florida. She also produces creation videos, and homeschools her three children.

This book presents basic creation material in a pleasant and accurate manner. Catie writes for those who believe in a recent creation, but who have questions.

The creation event is estimated at 4004 B.C., with the Flood beginning in 2400 B.C. Walter Brown's hydroplate theory is described as the probable Flood mechanism.

Since the peppered moth evidence for evolution now has been debunked, the next book edition needs to clarify this point, and also improve overall editing. In suggesting further resources, the *CRS Quarterly* is not mentioned. These weaknesses are eclipsed by the book's humor and user-friendly approach. The Foreword is written by Dennis Petersen.

Reviewed by Don DeYoung

Electromagnetism and the Sacred by Lawrence W. Fagg

Continuum, New York. 1999. 144 pages, \$24.95

This is the third book by nuclear physics professor (retired) Lawrence Fagg. He is well versed in modern scientific concepts from elementary particles and quantum electrodynamics to cosmology and the big bang. Fagg believes that a god (monotheist p. 111) has created the universe. However, the god to whom he credits creation used

evolution (p. 27) and can be inferred to be physically operating in the created world around us (p. 20). Christianity is only one of the many religious traditions that point to this creator god and refer to him as light like. Fagg does not present the arguments for creation or for the evolutionary methods used. But he assumes all that

modern science has uncovered about this creation leads to those conclusions. Based on this assumption Fagg proposes that this god remains immanent in nature and the only way humans can directly infer this immanence (p. 21) is through electromagnetic interactions (EMI) within nature. In fact EMI has been the underlying “work horse” of evolution (p. 115) and will be the driving force for human evolution to the next level (p. 71).

The book subtitle is “At the Frontier of Spirit and Matter”. The book proposes that ubiquity of electromagnetic interactions in nature (matter) can be used as an analogy of how God (spirit) is present and interacts with his creation. This idea is promoted to help integrate science and religion. God created the universe and left signs in it that humans can recognize. A large majority of these signs can only be recognized by scientific studies using EMI as the medium for detecting and characterizing (p. 64) such phenomena. The other three known forces (gravity, nuclear and weak) have much less noticeable effect on us and the world we live in. Ultimately these

forces may also be shown to originate from the same source, as already the weak force has been in theory successfully unified with electromagnetism during the early stages of the big bang (p. 36). The bringing together of science and religion in what Fagg calls natural theology should be mankind’s goal as part of the next evolutionary step. Electromagnetism in all its subtle forms is how we can best interact with our environment and will necessarily be the means to that end. To a theistic evolutionist this book may make sense as to how humans may learn of God’s immanence by analogy with the role of EMI in nature. However, to a Christian and Young Earth Creationist Jesus’ words in Matthew 11:27 are more applicable, “...neither knoweth any man the Father, save the Son, and he to whomsoever the Son will reveal him.”

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The Wisdom of the Bones by Alan Walker and Pat Shipman
Alfred A. Knopf, New York. 1996, 336 pages, \$25.50

It was August 22, 1984, and Kamoya Kimeu, the foreman of the fossil hominid expedition was prospecting for hominid remains west of Lake Turkana in Africa. The others of the group were resting. Search in that area had been disappointing and it was planned to move the camp to a new location the following day. Then he found a small piece of hominid frontal bone. He knew from its thickness that it was *Homo erectus*. The others were summoned but they could find nothing else on the surface. The tedious task began to break up the top layer of ground and sieve it for fossil fragments. With no success, they were about to give up when pieces of bone began to appear. As it turned out, they had discovered the most nearly complete skeleton of a hominid ever found, an adolescent *H. erectus* boy.

Intricate laboratory work is described, like a detective story, revealing features of the boy’s life. The authors comment, “How could an animal the size of a large, strong, tall youth manage with the brain of a toddler? What combination of mute cunning and amazing strength enabled *H. erectus* to spread out of Africa, the continent that had contained its ancestors for millions of years? What happened to the ecosystems it invaded? We do not know.”

In 1973 Kamoya Kimeu had found what was at that time the most nearly complete skeleton of *H. erectus*. It

was an adult female with a fatal bone disease. The malady was diagnosed as due to the ingestion of too much vitamin A. In the early days of Antarctic exploration men suffered from this when their rations ran out and they killed their dogs and ate the livers. The carnivore liver is rich in vitamin A. The significant thing in this case is that the scientists deduced that without aid an individual with this affliction could not live long enough for it to progress as far as it had in this case without the care of another individual. This led to the conclusion that *H. erectus* creatures were sufficiently advanced to have compassion on others of their kind and sustain them when in distress.

From their study of hominid bones the authors also conclude that “first our ancestors got *less* apelike, then the females got *more* apelike while the males continued to get less apelike, then the females reversed evolutionary directions and both sexes continued to follow the trajectory toward decreasing apishness.”

As evolutionists, the authors conclude, “We are first and foremost mammals and have to operate under the same biological, physiological, and biochemical “rules” as any other mammal. There was no special creation for humans, and there are no special exemptions from the constraints of anatomy.”

Reviewed by
Bolton Davidheiser

Letters to the Editor

Elginerpeton pancheni's Costly Walk Through Time

So far, *Elginerpeton pancheni* is the oldest known amphibian to date. Those working close to it reckon that it is about 373 myrs old. The earliest type of fish thought to have transformed into amphibians are known as Panderichthyids dated as 378 myrs ago.

The early amphibians show many signs of being predominantly, if not totally, aquatic creatures. But according to the latest discoveries, *Elginerpeton* had once left its watery existence for life on land, only to return again to a mainly, if not totally, aquatic existence (Westenberg, 1999, p. 124). This conclusion is based on the fact that *Elginerpeton* had robust limbs perfect in every way for life on land, but its foot had the sole twisted in such a way that it faced backwards rather than downwards and so the creature could not put its foot flat on the ground. Naturally, that arrangement would have been perfect for paddling in water. Therefore, it is believed that the rest of the perfectly terrestrially adapted limb would have once walked on, ground before returning to the water (Westenberg, 1999, p. 124). So it is imagined that *Elginerpeton* must have gone first from fish ancestor to a totally terrestrial amphibian. Then it must have begun to return again to the water.

In order to reach this date of 373 myrs where we find *Elginerpeton* returned to an aquatic existence, we must first trace the history of this amphibian. First of all *Elginerpeton* would have spent time living a land existence and a three myrs history for this is not unreasonable and this would bring us to 376 myrs. We must then take into account *Elginerpeton* going from an aquatic existence onto land and before all of this the time it must have taken going from fish to amphibian. We may or may not discover fossils believed to be within the time period from 373 myrs and 378 myrs, but if we take into consideration the aforementioned account of the history of *Elginerpeton*, we cannot help but conclude that fish simply did not evolve into amphibians and then back into an aquatic form again in a mere 5 myrs. This is a view that will be welcomed by creationists.

The oldest known lungfish are dated at 390 myrs. For the next 10 myrs they would have been giving rise to many of the other members of the order of fish that included Panderichthyids. But because of this, the time from 378 myrs to 370 myrs becomes the most important area for expecting to find evidence for fossils showing the transition from fish to amphibia. At the time of this writ-

ing no fossil corroborates the looked-for evolution of fish to amphibians. The article in the *National Geographic* describes *Elginerpeton* as being 370 myrs old. I am informed by those closest to it, however, that 373 myrs is the actual date involved. But even if we take 370 myrs as the *Elginerpeton* date and give it a history of three myrs, that would bring us back to 373 myrs. During the five million years between 373 myrs and 378 myrs a fish ancestor would have had to evolve into a fully terrestrial amphibian. Then the amphibian would have had to produce the partly aquatic *Elginerpeton*. Since these various changes could not possibly have occurred in the scant five myrs, the evolutionary theory should be abandoned no matter what further fossils are discovered. Amphibians must have already existed during that alleged time.

Perhaps three myrs would have been needed to produce the aquatic foot. Before that, many millions of years would have been required to convert a totally aquatic limb to one that is for the most part that of a land-dwelling creature. And before all of this, millions of years would have been necessary to change a fish to an amphibian in the first place. All of this would have taken sufficient time to rule out the idea that *Elginerpeton* had become an amphibian by 378 myrs ago. Thus even using an evolutionary time scale there is no way to produce all these changes in further fossil discoveries. Evolutionary theory is falsified. These fossil data point instead to the shared-themes model (or gene-them model) which accounts for any shared features between fish and amphibians.

For further reading of Devonian fish and amphibians see Brown, 1996; 1997.

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Comments on Wetumpka Impact Paper (CRSQ 36:32-37)

I would like to commend Carl Froede and Emmett Williams for their excellent paper on the Wetumpka structure in Alabama in a previous issue. It has been exciting to me to see papers by creationists regarding geological field work at impact sites.

Though the presence of the special “shock minerals” such as shocked quartz, coesite, or stishovite are more definitive indicators of an impact, the geological context sometimes tends to eliminate events other than impacts. This appears to be the case at Wetumpka. The severely jumbled underlying metamorphic and igneous rock, the remnants of a circular rim, and the lack of clear evidence of a volcanic origin seem to point to the structure being an astrobleme, or crater remnant. The authors do not rule out the possibility of it being of volcanic origin, though that seems unlikely. The authors provide I think a very plausible means of relating this impact to a young-earth Flood model. They suggest it may have took place in the late Flood/early post-Flood in a shallow marine environment or a beach perhaps. The geology of the area seems to definitely place it after most of the deposition of the Flood but before the post-Flood ice age. Flood waters would have been retreating and little or no additional marine sediments formed on top of the structure. On the other hand, terrestrial sediments were laid down on the crater after its formation, then these sediments were later eroded away to expose the structure. This is an example of how the geological study of impacts can shed light on the Flood and post-Flood phenomena. This tends to confirm that impacts were occurring during Noah’s Flood. The impacts, which I believe began at the onset of the Flood, apparently continued occasionally into the post-Flood period.

I would like to have seen some discussion in the paper of the distribution of impact ejecta in the Wetumpka region. The authors make a comment about the elevational differences between the northern and southern crater rims, the north rim being higher. It is pointed out that this “is believed to be due to the angle of impact.” From the perspective of crater physics, it is usually the ejecta that tells more about the direction of motion of the impactor than the shape of the crater. If the crater is elliptical in shape rather than circular, then this may indicate the object struck at a very low angle of approach (or high angle from the vertical). Thus, judging only from the information presented in this paper, I would think erosion by the local streams is a more likely explanation of the breaks and unevenness of the crater rim.

Using energy scaling techniques as well as some reasonable assumptions allows a rough estimate of the energy and size of the Wetumpka impactor. It is reasonable to use the Barringer impact in Arizona as a baseline in the scaling calculation. The diameter, kinetic energy, mass of

the impactor, and diameter of the impactor can be considered known for the Barringer site in Arizona (Norton, 1994). The Lampson Scaling Law (Melosh, 1989) can be used to calculate the energy in the Wetumpka impact from the Arizona impact.

$$\left[\frac{D}{D_0} = \sqrt[3]{\frac{W}{W_0}} \right]$$

In this equation, D is the diameter of the Wetumpka crater, D₀ the diameter of the Barringer crater, and W represents the kinetic energy in a likewise manner. The Wetumpka crater diameter is a little over four times the diameter of the Barringer site. This implies that if the energy of the Barringer impact was 1.7 megatons (7.1x10¹⁵ joules) the energy of the Wetumpka impact would be about 144 megatons (6x10¹⁷ joules). The Barringer impactor is believed to have been about 80 feet or 24 meters in diameter. Assuming a speed of 20 km/s and a density the same as for the Barringer object (assume 3.5 g/cm³), this will give a Wetumpka impactor about 300 feet or 90 meters diameter. (To obtain this, use the equation for kinetic energy and the relationship between volume, density, and mass for both impactors.) Of course, if the density and speed were different it would change these figures somewhat and the speed would be the more significant factor.

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Wetumpka Impact Crater Confirmed

Over a year ago we submitted an article which was recently published in the *Creation Research Society Quarterly* (Froede and Williams, 1999). In our article we agreed with the uniformitarian proposal that the Wetumpka Impact Crater was of extraterrestrial origin. However, at the time we wrote our article no conclusive evidence existed which confirmed this feature as an impact crater. We suggested that perhaps the coring of the crater floor might provide clearer evidence of impact origin.

During a period extending from June to August 1998, David King and Tony Neathery conducted a well drilling program on the floor of the Wetumpka Crater. Their effort was undertaken to retrieve basement rock from the bottom of the crater which would validate the impact origin for this feature. Two wells were drilled with the first well approximately 628 feet, and the second at 589 feet beneath the ground surface (King, n.d.). Neither of these wells reached the bottom of the crater floor.

In early March 1999, I had the opportunity to attend a field trip led by King and Neathery to the Wetumpka Crater. During this field trip it was shared with the participants that shocked quartz grains retrieved from one of the well cores provided the necessary evidence which clearly identifies the Wetumpka Crater as being of impact origin. A public meeting was held in the city of Wetumpka a week before our field trip where Peter Schultz, internationally recognized planetary geologist and professor of geology at Brown University, announced to the crowd that the Wetumpka Crater was of extraterrestrial origin (Blackburn, 1999).

Many questions still remain regarding the timing, type of object, direction, and size of the initial crater. However, these investigations can now proceed with an understanding that this large surface feature was formed as a result of impact with an extraterrestrial object.

None of the new information gained as a result of the crater floor drilling project or subsequent sedimentary analysis changes our original interpretation with regard to the timing, mechanism, or method of formation within the framework of a young-earth. We are optimistic that further investigation into this feature will show our proposed paleoenvironmental setting as being the best to fit the physical evidence.

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Earth Impacts, the Geologic Column, and Chicxulub

Some CRSQ readers will be aware of the papers on Earth impacts which I presented at the Fourth International Conference on Creationism, August 1998 (Spencer, 1998). Following are some comments on research I have done on the subject of impacts since the publication of these papers. I would like to mention Earth crater data obtained after the publication deadline of the *ICC Proceedings*, a minor error in the paper, and some recent findings relevant to the subject from the scientific literature.

In the *ICC Proceedings* paper, "Catastrophic Impact Bombardment Surrounding the Genesis Flood" I presented a table giving data on Earth astroblemes in relation to the Geologic Column. Table 1, page 559 of the *Proceedings* gives two data sets from Earth crater data compiled by O. Richard Norton, an astronomer and educator, and Richard Grieve of the Canadian Geological

Survey, Canada. The Norton data set was only 50 points, but was recent data from 1994 while the Grieve data was from 1982 and included 88 points. The 50-point data set included good information on the sites and is a set where there is a high confidence of them being impact sites. The Grieve data set of 1982 was considered a very authoritative list at the time and it has been quoted and used by many other authors. The Grieve data from 1982 also included some information on the sites. Richard Grieve used a ranking system to describe the state of preservation of the impact structures. After the publication deadline for the ICC papers, I was able to obtain a data set from the Canadian Geological Survey, including Grieve's Earth impact site list from 1998. There was no way to get this data into the *Proceedings* papers but it was in my presentations at the conference. The 1998 list of Earth astroblemes included 121 points (points without an as-

signed age figure were thrown out). This data set has the advantage of being very up to date but the disadvantage of their being no information about each site.

The crater numbers were totaled in the *ICC Proceedings* in a manner that contained an error. Following is a table showing how it was presented for the case of the 1982 data set.

Table I. Data presented as in ICC 1998 *Proceedings*; italicized labels are not correct.

Geologic Column Label	Evolutionary Age (Ma)	No. of Impacts, Grieve, 1982
Recent	< 1	7
Upper Cenozoic	5–1	3
Lower Cenozoic	65–5	7
<i>Mesozoic</i>	100–65	3
<i>Upper Paleozoic</i>	300–100	15
<i>Lower Paleozoic</i>	600–300	12
<i>Precambrian</i>	> 600	3

The Mesozoic, Upper Paleozoic, Lower Paleozoic, and Precambrian labels are not correct for the age periods shown in Table I (same for the Norton data set, not shown here). The counts of impact sites in each category are correct for the numerical age ranges shown, but not correct for the Geologic Periods shown. The Lower Paleozoic and Precambrian Period counts are not quite correct because geological societies recently adopted a different boundary age between the Precambrian and Cambrian Periods than the figure used in the *Proceedings*. This places the Precambrian/Cambrian boundary at 550 Million years ago rather than 600. Of course, as young earth creationists we do not accept these ages, but the difference does affect the counts of the astroblemes.

It is important for creationist geologists to look into how Earth impacts are distributed in the Geologic Column. Though there is not a real consensus on some questions about the Geologic Column and the Flood among creationists, this kind of data can shed light on the complex events of the Genesis Flood. The most important point is that impact structures are found in all types of rock and all through the Geologic Column, from Precambrian upward. Such data may be counted and presented in a variety of ways, so there is a danger of bias appearing in such a table. After recounting the points with the 1998 Grieve data set, two interesting ways of presenting the numbers follow in Tables II and III.

Some creationists might argue that showing the data this way shows a bias towards the uniformitarian presuppositions of evolutionary geology. So, I counted the data in another way, breaking down the ages into 12 equal uniformitarian time periods of 50 million years each. Ta-

ble III shows the data this way from Grieve's 1998 data set. (The data sets mentioned here are available from Spencer, 1998c.)

Table III shows that the greatest number of impacts are in recent strata, which are easier to discover since they are more accessible for study. The accessibility of the various strata is a very important consideration. A paper by Trefil and Raup (1990), uses statistical analysis to determine whether most Earth craters have the same age as the rock in which they are found. They conclude that this is the case at most impact sites. This conclusion needs to be reexamined based on young-age assumptions. Small craters are more likely to be eroded before the rock in which they are found is eroded. On the other hand, large craters are likely to "survive" even if there is significant erosion around the site. A large impact produces a variety of indicators of impact that may be observed even if the crater rim has eroded away, such as shocked minerals, breccia and deformed strata, magnetic anomalies, and various circular structures in the subsurface rock. Trefil and Raup show statistical data on the percentage of the continental surface which has each geological rock classification available near the surface. Cenozoic and Mesozoic rock are much more common on the surface of the continents than is Paleozoic rock. So, for example, Cambrian rock is less accessible than Cretaceous since it is

Table II. 1998 Earth crater data recounted to correctly correspond to Geologic Periods.

Geologic Period	Evolutionary Age (Ma)	Grieve data, 1998, 121 points
Cenozoic	64–Present	43
Mesozoic	249–65	33
Paleozoic	549–250	37
Precambrian	> 550	8

Table III. Earth Impacts throughout the Geologic Column, by equal "time" periods.

Evolutionary Age (Ma)	Grieve, 1998, 121 points
50–0	39
100–50	16
150–100	12
200–150	?
250–200	7
300–250	5
350–300	9
400–350	6
450–400	5
500–450	7
550–500	4
> 600	4

found over a much smaller area near the surface where we can study it easily. This may imply that the impact structures in the Paleozoic strata were more numerous than the above numbers tend to show, since those strata are less accessible today. This tends to be consistent with what I proposed in my ICC papers.

Another item of note was brought to my attention by Thomas Fritzsche, who presented an excellent paper at the 1998 ICC on the Chicxulub structure, in Yucatan. This structure has been accepted by many in the scientific community as the impact that led to the global extinction of dinosaurs. Recent seismic reflection sounding studies of the Chicxulub structure have shed light on an interesting controversy over the size of the original Chicxulub crater. Estimates of the transient crater diameter have ranged from 180 to 300 km. After the impact, slumping would reduce the observed diameter from this value. The original paper by Luis and Walter Alvarez, Frank Asaro and Helen Michel, in 1980, quoted geologist Richard Grieve as estimating that a 10 km diameter asteroid would produce a structure 200 km in diameter. The new seismic data from Chicxulub have revealed that the transient crater diameter was more like 100 km, and that the shock waves of the impact produced a fault structure that reached into the upper mantle. There is a prominent scarp structure around the Chicxulub impact site at about 195 km diameter. This was thought previously to be the main crater rim, but based on the new seismic studies the scarp must be considered a ring. This means that the Chicxulub structure is now viewed as a two or three ringed complex crater. Multi-ringed craters can have the rings either outside or inside the main crater rim. Not many impact sites on Earth have been proposed to be multi-ringed craters. This may be the best evidence of such a structure to date on Earth, though they are common on our Moon and Mars. On Earth, where erosion, tectonics, and sedimentation have altered crater structures, it can be very difficult to determine the main crater rim diameter; hence the controversy over the size of Chicxulub. What is significant to creationists is that this new data on Chicxulub significantly reduces the energy of the "dinosaur killer" impact. My ICC papers argue that one large impact, even a large one such as the one at Yucatan, could not cause *global* extinctions of the dinosaurs (Spencer, 1998a). The environmental effects of such an event are not long-lived enough (Spencer, 1998b), and from an evolutionary interpretation of the fossil record, the extinctions required too much time to associate them with one impact. The smaller size of the Yucatan impact makes the single-impact extinction hypothesis even less plausible.

Recently published papers by creationists (Faulkner 1999; Froede and Williams, 1999; Steele, 1999) underscore that impacts from space are an important piece of the puzzle in a biblical and scientific understanding of earth history and the Flood. The events of the post-Flood period, in my opinion, are a very adequate explanation of the extinction of the dinosaurs. It is possible to incorporate a significant number of impacts in our models of Noah's Flood.

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Erratum

CRSQ 36(2): September, 1999, pages 80 and 88. Two quotations were misattributed to Thomas Aquinas.

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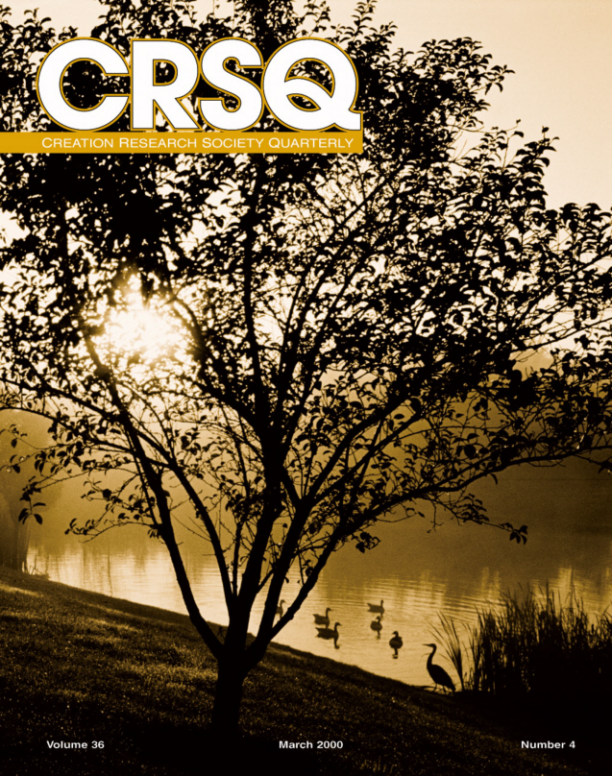
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4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the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

CRSQ



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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

Editor's Comments

Jerry Akridge discusses the possible development of a waterfall in Alabama from a creationist young-earth perspective. Possibly you may not have any interest in the formation of a specific waterfall, but Akridge offers some speculation on how these scenic geomorphic features may have formed under similar geologic circumstances which may pique your curiosity.

Dark matter is the topic of an article by the president of the Society, Don DeYoung. This esoteric subject is explored from many angles and the author's conclusions may surprise you. Is dark matter real or imaginary? We actually know very little about the universe in which we live.

A very complex example of parasitism is presented by Mark Armitage. The amazing details of this situation indicate that planning and design probably were necessary to establish the parasite-host relationship. It is unlikely, therefore, that trematode parasites could have originated by stochastic means. Darwinism is ruled out by clear thinking, but did the Creator design these parasites for other functions before the Fall of man? So often in scientific investigation "there are more questions than answers", and conclusions may be no more than speculation. But humans seldom will acknowledge this limitation of their perceptive abilities.

Jerry Bergman deals with the insurmountable problem of the origin of life from nonliving material by naturalistic

means. This leap of faith by evolutionists to believe that such a thing could happen is astounding, and it illustrates to what ends men will go to avoid the implication of a Creator ruling the cosmos. The hypothesis that a "spark of life" spontaneously generated on properly-arranged complex molecules is examined historically and scientifically by the author.

The topic of speleothem growth in caverns was the subject of an ongoing research program in the 1970s. George Matzko has revived this study and approaches it from a theoretical standpoint, bringing together old data with newly-generated kinetic and age-dating techniques. More scientists realize that speleothem growth can be quite rapid under the proper conditions. Equipment has been constructed at the Research Center in Arizona to continue the experimental activities. It is hoped that theoretical predictions and actual laboratory studies can be dovetailed into a successful effort.

Shorter dissertations on fossil man and rock spires on Lookout Mountain may interest you. You are welcome to write to the editor about any topic covered in this issue. I hope you enjoy the diverse contents of the March *Quarterly*.

Emmett L. Williams
Editor

Book Review

Subterranean by James Rollins
Avon Books, New York. 410 pages, \$7 paperback

This novel is the first book written by veterinarian and spelunker (cave explorer) James Rollins. A *New York Times* best seller, the novel illustrates what millions of Americans are reading. The story concerns a fictional cave complex found deep beneath the Antarctic ice. Underground there are mile-size caverns, rushing rivers, and ancient cliff dwellings. Even stranger are subterranean flocks of birds, energized and illuminated by glowing minerals. Vicious dinosaur-like monsters terrorize the explorers.

The collision hypothesis is offered for the demise of most dinosaurs (p. 101). In Rollins' imagination, prehistoric creatures have somehow continued to survive underground for 65 million years. Further confusion results from the comment that underground artifacts are carbon dated at 5.2 million years (p. 26). In practice, the carbon-14 technique is limited to just thousands of years. Author

Rollins has a background in evolutionary biology. His novel uniformly promotes such thinking. For example the cave creatures are all monotremes, including secretive aboriginal beings. Monotremes are "primitive" mammals which lay eggs (p. 246). Thus evolution somehow took an entirely different branch in the underground. There are also new age intimations: the aboriginal shamans are able to read minds and to tell the future.

Subterranean joins the current series of *Jurassic Park* and *Star Wars* stories. All portray "prehistoric" creatures living together with modern people, less fictional than the authors could possibly imagine.

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DeSoto Falls in DeSoto State Park, Alabama: Evidence for Recent Formation?

A. Jerry Akridge*

Abstract

Uniformitarian geology is based on long periods of time which are demanded for the formation of geomorphic features found on Earth. According to this doctrine, most extant geomorphic structures required millions of years of slow and gradual processes for their formation (Dunbar, 1955). In contrast to this, the Young-Earth Flood model predicts that these features were formed within the last few thousand years while undergoing the effects of

high-energy, short-term, catastrophic processes (Gish, 1985). Conditions which favored rapid modification of the Earth's surface were present during the period of the Flood Event and the subsequent Ice Age (following the geologic framework proposed by Froede, 1998). DeSoto Falls, located in DeSoto State Park, Alabama, is such a geomorphic feature that is best explained within the framework of the Young-Earth Flood model.

Site Location

DeSoto Falls is located within DeSoto State Park near Mentone, Alabama (Figure 1). This waterfall was formed by the west fork of the Little River which flows atop Lookout Mountain.

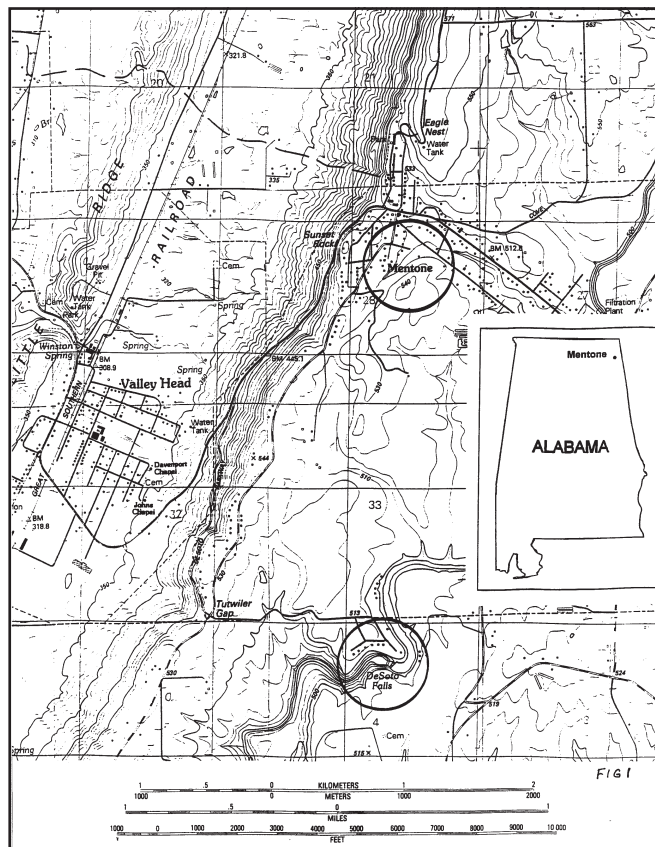


Figure 1. Map showing the location of DeSoto Falls in DeSoto State Park near Mentone, Alabama.

Description of Lookout Mountain

Lookout Mountain is the narrowest synclinal plateau within the Appalachian Plateaus Province of Alabama. It extends in a northeast to southwest direction from Chattanooga, Tennessee, to Gadsden, Alabama, a distance of approximately 80 miles (127 km) (Figure 2). The plateau varies in width from an approximate maximum of 10 miles (16 km) to a minimum of one mile (1.6 km). Compared to the long anticlinal valleys adjacent to and paralleling Lookout Mountain, the topographical relief is approximately 1,600 feet (488m). This syncline is capped by sandstone which is considered by uniformitarian geologists to be Pennsylvanian in age. This sandstone is part of the Pottsville Formation which covers much of north Alabama (Osborne, et al., 1989).

Description of the West Fork of the Little River

One of the major tributaries in the drainage basin associated with this part of Lookout Mountain containing DeSoto Falls is the west fork of the Little River. This river is approximately 25.3 miles (40.7 km) in length from its origin to its conjunction with the east fork of the Little River. Water flow in the tributary varies from almost none in dry weather to a heavy discharge during wet conditions. In its meandering, southward course, the tributary approaches within approximately 1,200 feet (366 m) of the western

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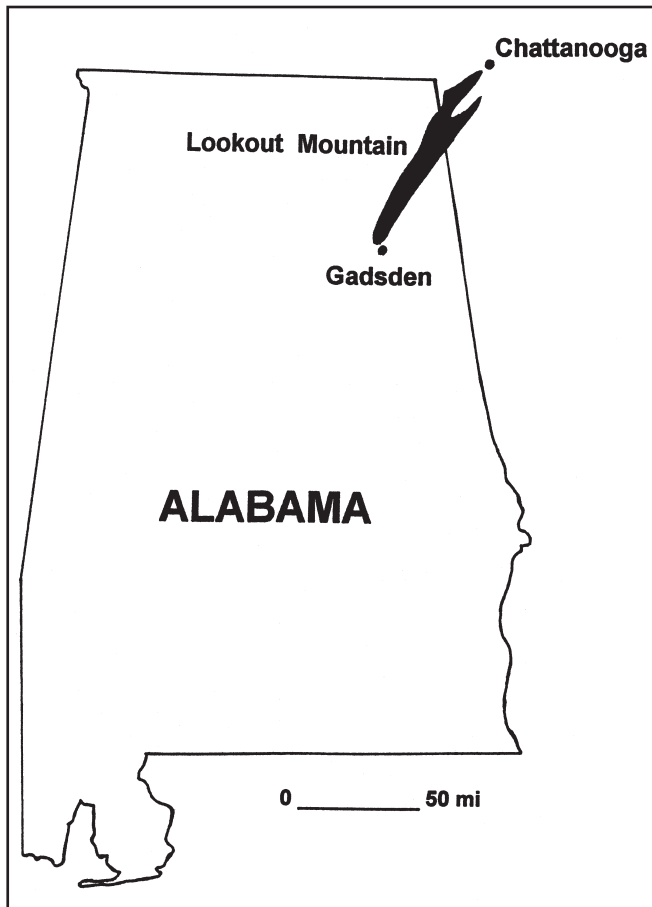


Figure 2. Map showing location of Lookout Mountain between Gadsden, Alabama, and Chattanooga, Tennessee.



Figure 3. View looking down canyon from the lip of DeSoto Falls with a small part of plunge pool visible in lower right. The south side of the cirque-shaped basin is seen on the left. The sheer cliff faces of the canyon of the west fork of the Little River are barely discernible through the heavy vegetation. The underfit west fork of the Little River can be seen exiting the catchment basin at the uppermost part of the plunge pool. Note people on light-colored area in lower right for scale.

margin of Lookout Mountain and approximately 4,000 feet (1.2 km) from its eastern margin. The gradient of the tributary is 834 feet (254 m) from its origin to the point of intersection with the east fork of the Little River. The west fork of the Little River exhibits the characteristics of an underfit stream in that it is too small to have carved the canyon through which it flows.

The Canyon of the West Fork of the Little River

A canyon, cut entirely from undifferentiated Pottsville Formation sandstone and varying in depth up to approximately 180 feet (54.9 m), hosts portions of the west fork of the Little River. The canyon has sheer cliff faces which drop 50 feet (15.2 m) or more before the talus apron is reached (Figure 3). Talus accumulation is minimal throughout the course of the canyon.

Description of DeSoto Falls

From its location on the west fork of the Little River, DeSoto Falls (Figures 4a and 4b) is approximately 9.3 miles (15 km) upriver from the conjunction of the east and west forks of the Little River. DeSoto Falls, comprised of a major and minor waterfall, provides an abrupt change in the topographical relief of the west fork of the Little River. The major waterfall measures approximately 100 feet (30.5 m). Approximately 75 feet (23 m) upstream from the major waterfall is another waterfall measuring 21 feet (6.4 m). A 19 foot (5.8 m) high dam spans the west fork of the Little River approximately 90 feet (30.5 m) upstream from the minor waterfall. Water flow in Figures 4a and 4b is about the maximum normally observed except during rare and unusually wet conditions.

DeSoto Falls plunges into a cirque-shaped catchment basin which is approximately 375 feet (114 m) in diameter. The plunge pool occupies most of the diameter of the catchment basin and is 35 feet (10.7 m) deep directly under the waterfall (Thomas, 1998). DeSoto Falls faces almost due west and is positioned approximately 4,700 feet (1.43 km) from the western margin of Lookout Mountain. The sides of the catchment basin have a maximum relief of approximately 180 feet (54.9 m) measured from the elevation of the plunge pool (Mizener, 1998).

An Anomaly of the Cross-Sectional Profile at DeSoto Falls

There are at least two apparent erosional profiles for the west fork of the Little River at DeSoto Falls (Figure 5). The



Figure 4a. Aerial view of DeSoto Falls. Note minor waterfall and cirque-shaped catchment basin.

prominent profile exhibits an erosional pattern in the sandstone which has a flattened, U-shaped cross-sectional profile (Figure 5-A). The other profile is the smaller cross-section (Figure 5-B) formed by downcutting of the sandstone ledge over which the present water flows to form the major waterfall. This rectangular-shaped erosional downcut in the ledge measures 50 feet (15.2 m) wide by eight feet (2.4 m) high and normally contains all of the water flowing over the waterfall except during rare and unusually wet conditions. During periods of moderate rainfall, the water depth at the lip of the falls is usually less than one foot (0.3 m). The amount of water flow in the rectangular downcut varies as the flow volume varies in the west fork of the Little River.

Possible Flood-Based Events Leading to the Formation of DeSoto Falls

This area of Alabama containing Lookout Mountain is within the Appalachian Plateaus and Valley and Ridge Provinces. How the folding and faulting of these strata were accomplished remains an enigma to uniformitarian geologists. However, much of the mystery can be unraveled by creationists in viewing the formation process as occurring rapidly during the high-energy events of the earth-covering Flood and its aftereffects.

During the Flood, large areas of the earth's surface became covered by layers of water transported sediment. Following deposition, the unlithified sediments were apparently subjected to compressional and tensional forces parallel to the Earth's surface and perpendicular to the resulting folds that formed throughout the Appalachian fold and thrust belt. These forces probably began during the later stages of the Flood after the deposition of these immense sediment layers, increased rapidly, and then exponentially decreased in intensity with the waning



Figure 4b. View of DeSoto Falls showing both minor and major waterfalls.

of the Floodwater and associated diastrophism. The unlithified sediments could have been bent and folded without cracking the strata, examples of which can be observed in many locations. When certain conditions, dependent on such factors as compressional/tensional forces, depth of sediments, resultant radii of folding, and the degree of lithification, were present in localized areas of Flood-laid strata, cracks and thrust faulting would have occurred. These factors would have resulted in the folding and faulting of strata which were then acted on by the power of the abating Floodwater.

Lookout Mountain is a narrow syncline bounded on each side by long anticlinal valleys which lie parallel to the synclinal axis of the mountain. During the Flood, compressional and tensional forces caused the formation of this synclinal structure and adjacent anticlines. The anticlines, which were initially higher in elevation than the syncline, were eroded more rapidly than the syncline to form the existing adjacent valleys (Akridge, 1998; Froede, 1997). Al-

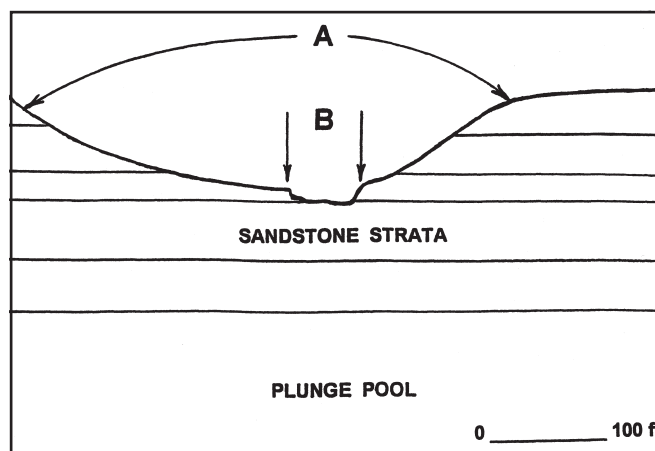


Figure 5. A cross-sectional profile of the west fork of the Little River at DeSoto Falls showing major (A) and minor (B) erosional profiles.

though this striking reversal of the elevations of the syncline and anticlines seems improbable, empirical data demonstrate that this did actually happen, leaving the structures now in existence. Uniformitarian geology does not supply a reasonable explanation of how this anomaly could have taken place. Only the Young-Earth Flood model provides credible answers to the otherwise perplexing mysteries found in these and other Appalachian geomorphic structures.

As the retreating Floodwater gathered kinetic energy during the later stages of the Flood, it would have had tremendous erosive power in carving the Earth's features. As the newly formed syncline and adjacent anticlines were subjected to the erosional assault of fast moving Floodwater, they would have undergone differential erosion. Initially, the elevated anticlines would have offered greater hydrodynamic resistance to the energized water and they would have been eroded at a faster rate than the adjacent synclines. As the anticlines were rapidly worn down, the folded strata which had high angles of dip within the anticlinal structures would be exposed and eroded faster than the syncline (Akridge, 1998). The water would have moved in a direction paralleling the exposed edges of the folded strata which would have had greater susceptibility to erosion than the comparatively horizontal beds of the syncline.

In the area of study, the plateau-like top of the Lookout Mountain syncline dips to the west and south. Floodwater would have flowed across this area in the direction of the slope of the top of the syncline. Once the anticlines were eroded to lower elevations than the syncline, the water would have concentrated its erosive power in the newly forming anticlinal valleys. Thus, the differential rate of erosion would have been amplified with the greater concentration of Floodwater flowing around the syncline at this time during the Flood.

Speculations on the Formation of DeSoto Falls

The drainage basin on top of the Lookout Mountain syncline was likely established by the swift currents of Floodwater. During the later time frame of the Flood, the abating, high-energy water would have been directed through this drainage system, its energy being focused along newly forming downcuts. The semi-lithified strata on top of the syncline underwent rapid downcutting in the areas favoring maximum water flow. Canyons would have been quickly formed in the path of the energetic water. What is now the west fork of the Little River would have been one of the major concentrations for the route of water on its way to a lower elevation. This fast moving water would have been perhaps many tens of feet deep as it

gouged out the canyon and drainage patterns which now contain the west fork of the Little River.

Water flow through this area of interest during the inception of the canyon, coupled with the existing topography, would have established conditions favoring the construction of waterfalls at appropriate points in its travel. With the establishment of a drainage gradient directing Floodwater withdrawal across the top of the synclinal ridge, conditions would have been optimum for the enhancement and development of erosional scarps later remaining as waterfalls throughout the drainage basin and canyon system of Lookout Mountain. While this paper is written mainly as a treatise on one major waterfall (DeSoto Falls), I propose that other waterfalls within this area may have also been established by the same processes in effect at the time of large-scale canyon formation.

As huge volumes of water surged at high velocities over sudden relief changes in the rapidly forming canyon which now hosts the west fork of the Little River, the erosional rate at and near the relief changes would be greatly amplified. The high velocity water would change from a more laminar flow to become increasingly turbulent as it entered the zones of relief change. This very turbulent water would propagate powerful forces which could have dislodged fragments from the rock forming the relief changes and multiply the rate of erosion by the impact and abrasion by these fragments with the surrounding rock. When water flow is greater than 30 ft/sec (9 m/sec), cavitation can be produced. As vapor bubbles produced from the effect of cavitation implode in contact with rock in the path of the water, a powerful erosive agent is introduced which can hammer on the affected rock with a force of up to approximately 440,000 lb/in² (31,000 kg/cm²) (Barnes, 1956). Thus, cavitation impacts could have quickly eroded large quantities of rock in the path of the energized water (Holroyd, 1990a, b).

As tens of feet of water flowed over erosional scarps which would later become waterfalls, powerful eddies would have been generated which would erode the foot of the relief changes such that undercutting of these structures would be accomplished. Once enough of the underlying strata was undercut, failure of the upper portions of the ledges would have resulted, causing the ledges to break off and the cycle to be repeated in an upgradient portion of the strata. This is believed to have been one of the main causes of erosional retreat of the waterfalls formed by these processes.

Initially, what is now DeSoto Falls would probably have been located many miles downstream from its present position. Due to massive amounts of headward erosion during the formative processes described above, the erosional retreat of the structure could have been as much as tens of feet per hour. For example, during the Lake Missoula Flood, it is postulated that in a week of flooding, Palouse

Falls, a 180 foot high (54.9 m) feature, would have had an erosional retreat from its beginning at the Snake River of 180 ft/hr (54.9 m/hr) [Austin, 1992]. The 400 foot deep (122 m), six mile (9.7 km) long Palouse Canyon and Palouse Falls were apparently formed within this short time frame by the same catastrophic type of erosion believed to be responsible for DeSoto Falls and the related canyon.

Significance of the Cross-Sectional Profile at DeSoto Falls

As discussed earlier, the Floodwater would have initially flowed across the Lookout Mountain syncline and adjacent anticlines in similar volumes. With the erosion of the anticlines and the subsequent reduction in elevation of the anticlines below the level of the synclinal plateau, greater amounts of water would have been diverted through the newly forming anticlinal valleys and away from the higher elevation of the plateau. At the point in time when the anticlines became lower in elevation than the syncline, I believe that the major erosional work in forming the main cross-sectional profile (Figure 5-A) of the canyon at DeSoto Falls was accomplished.

With the detour of major volumes of water through the anticlinal valleys and away from the synclinal plateau, the large cross-sectional profile (Figure 5-A) would have then undergone minor erosional modification as compared to its catastrophic beginning. The reduced water flow from that point in time would serve as the erosional agent in forming the rectangular downcut (Figures 5-B and 6) on the lip of the major waterfall. Large amounts of rainfall and abnormally wet years subsequent to the Flood during the Ice Age would have supplied heavy water flow through this tributary basin, further enhancing erosion of the rectangular downcut. This rectangular downcut, along with the major erosional profile of the canyon, now represent the effects of a much greater water flow than is observed now.

Evidences for the Recent and Cataclysmic Formation of DeSoto Falls

Many evidences speak of DeSoto Falls and its host canyon being of relatively recent origin. Waterfalls are recognized as short-lived features in the existence of a stream (Leet and Judson, p. 235). By their very nature, waterfalls are hurrying their own demise in that their concentrated erosional energy seeks to smooth the sudden drop of a waterfall to a gradual descent in the longitudinal profile of a stream.

The canyon containing DeSoto Falls has vertical side-walls until the talus slope is contacted. Vertical cliffs indicate formation in the relatively recent past as insufficient



Figure 6. The rectangular downcut on the lip of DeSoto Falls which normally contains all the water going over the waterfall. The downcut extends from just below the fence in the upper right to the sandstone shelf on the left. This photo taken during a drought when only a small amount of water flow present. The plunge pool is visible in the catchment basin above the lip of the falls. Four foot (1.2 m) fence provides scale.

time has elapsed for erosion to smooth the cliff scarp to a shallower angle. Also, the presence of minimal talus along the steep canyon walls is an indicator of recent origin. Given the uniformitarian model of millions of years of erosion, there should be no waterfalls present as erosion would have occurred evenly across the surface of the syncline. Additionally, the talus volume should be much greater, with talus extending upward to the formerly steep cliff edges which would be but gentle undulations in the topography.

This logic can also be applied to the sheer catchment basin walls which are shaped similar to a huge cylinder that has been turned vertically on its end. Given time, the catchment basin would be eroded such that the structure would tend to resemble a large wash bowl with shallow sloping sides. In this scenario, DeSoto Falls would not exist, its former vertical structure having been reduced by erosion such that water in what is now the west fork of the Little River would enter this area flowing over gentle slopes.

If a stream is the only agent responsible for valley formation, one can predict that the result would be a vertical-sided gorge which is no wider than the channel of the stream (Leet and Judson, p. 234). This canyon supplies evidence of a large current of water (the original "stream") having carved the canyon through which it coursed. There was insufficient time for the effects of slope wash and mass movement to be primary factors in eroding the canyon walls such that they sloped upward and outward from the stream channel as modern examples demonstrate operating under uniform conditions. When huge volumes of

Floodwater assuaged after a short period of high-energy catastrophic action, the canyon was left much as it remains today. The canyon then became subject to relatively minor erosional modification by the effects of the wet post-Flood Ice Age and the introduction of recent uniform processes.

While the vertical walls of the canyon and catchment basin both speak of recent formation, they also indicate that cataclysmic forces were at work during this same time frame. The catchment basin and canyon are both geomorphic features which could not have been carved by present day levels of water movement as postulated by uniformitarian geologists. The catchment basin has been undercut around much of its base at the elevation of the plunge pool (Figure 7). This undercutting was probably caused by the effect of erosion as high volumes of swirling, sediment-laden water poured over this sharp relief change during the later stages of the Flood, and extending into the wet weather conditions of the Ice Age. Today, the relatively minor turbulent action and low sediment load of swirling water from the waterfall cannot significantly impact or erode the catchment basin. Much of the undercut feature is now protected from further significant erosional modification by a talus dike cover (Figure 7).

Because there is minimal talus accumulation, it is apparent that a large volume of sandstone has been removed from the canyon during its formation. Once eroded, the talus was flushed from the canyon and deposited somewhere beyond modern discovery. The Flood is the only recorded source of energized water that could have accomplished such a task given minimal time in relatively recent history.

Conclusion

The physical evidences for the formation of DeSoto Falls and its host canyon favor a rapid origin within the past few thousand years by hydraulic forces not now in effect. The data collected in this study support an interpretation within the Young-Earth Flood model with continuing post-Flood modification of the features during the time of increased precipitation and wet weather in the subsequent Ice Age.

Erosion which occurred during the Flood appears to have had the greater effect on this topography. However, features in this area seem to indicate that lesser, but significant erosion did also occur during the wet period following the Flood. The rectangular downcut on the lip of the major waterfall is one evidence which strongly supports this interpretation.

The physical evidences found here directly contradict the uniformitarian presuppositions of up to 300 million years of time said to be necessary for the origin of the can-



Figure 7. Undercut areas of DeSoto Falls' catchment basin at the elevation of plunge pool. Note talus dike now protecting undercut areas from significant erosion. Person on rock in water provides scale.

yon and waterfalls. The locale has a youthful appearance that speaks of high-energy erosional processes which were introduced quickly, accomplished their work rapidly, and were attenuated exponentially over a short time frame. After the Flood and the Ice Age, the forces which were responsible for the catastrophic modification of this area had ended, allowing the more uniform processes to begin their erosional work. This would be predicted by the Young-Earth Flood model.

DeSoto Falls and its host canyon stand as a visible and strong testimony of the power and effect of a hydraulic cataclysm which impacted the area in the relatively recent past. Because the geomorphic features in this area support an interpretation based on the Young-Earth Flood model, continued study of this interesting area of Alabama by creation researchers is encouraged.

Acknowledgments

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Book Review

Tornado in a Junkyard, by James Perloff

Refuge Books. P.O. Box 191, Arlington, MA 02476-0002. 1999, 321 pages, \$ 16.95

James Perloff has aimed at the layman in writing this book and as such includes mild warnings such as the material “is full of technical words” (p. 33). He also throws in layman-friendly words such as Bozo, fiddlesticks, blooey, nah, and oh yeah, and phrases such as “Whoa! Here comes a Nolan Ryan fastball” (p.31), and “Come on, gimme a break!” (p.170). Although this style may be disconcerting to someone expecting a “college-level” dissertation, Perloff has succeeded in presenting a number of analyses about aspects of the creation/evolution controversy without losing the layman reader.

Some might argue that he has gone too far in his attempt to align himself with the masses. For example, in his second chapter he says,

This book will examine the growing case against evolution. That means we’ll deal with—ugh—“science stuff.” But we’ll try to keep it simple and interesting, like those *Dummies* books (p.8).

The book’s title, of course, comes from Sir Fred Hoyle’s famous quote that the probability of higher life forms emerging by chance are comparable to the odds that “a tornado sweeping through a junk-yard might assemble a Boeing 747 from the materials therein” (p.74).

Perloff says “all but a few of my quotes come from evolutionists” (p.23), and this is easily verified by a look at his

“Notes” on page 281 where avowed evolutionists are noted most often, followed by creationists and a few such as Behe and Denton who tell of the extensive problems with evolution but do not fully accept creationism.

The author has included far more illustrations (83) than have most other creationist writers in a book this size and this fact will appeal very much to the layman he is trying to reach.

Several books recently have referred to the Scopes trial and its negative aspects for creationism. In a chapter titled, “Trial by Hollywood,” Perloff gives details of the trial not often seen in creation/evolution literature. He gives the true account of the Scopes trial as contrasted with the movie version called “Inherit the Wind.” Perloff cites at least 23 instances in which the movie sharply disagreed with the facts of the trial.

Perloff has used a unique approach by his extensive use of colloquial language but, hopefully, it will be an effective method to bring the creation viewpoint to those who otherwise might never read about it.

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Dark Matter

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Abstract

Dark matter has never been directly observed. Its presence is indicated by unexplained gravitational effects on stars and galaxies. It is sought within galaxies, in galaxy clusters and throughout space. Surprisingly, dark matter appears to comprise the bulk

of the entire universe. This article surveys the evidence along with possible micro and macroscopic dark matter candidates. The entire idea is then evaluated from the creation perspective. There are also theological implications.

Introduction

Astronomy is sometimes presented as successfully having answered the most basic questions about the universe. One popular book attempts to explain the complete evolution of the universe to within 10^{-43} seconds of its origin (Hawking, 1996). This number is called the *Planck time*, when some cosmologists think the present laws of physics originated. In truth, of course, many fundamental questions remain. We actually know very little about our neighboring planets, and much less about the deep space beyond. Consider just a few of the mysteries in modern astronomy:

- Origin of the moon
- Star and galaxy formation
- Source of cosmic rays
- Nature of quasars and their distances
- Absence of evolved life elsewhere
- Dark matter

The last entry is explored in this article. Dark matter is so called because it emits no detectable radiation. In our current understanding of astronomy and physics, dark matter must comprise the majority of mass in the universe, between 90–99 percent. Yet it has never been detected with certainty, if it indeed exists. Carl Sagan described it as dark, quintessential, deeply mysterious stuff wholly unknown on earth (Sagan, 1994, p. 399). Astronomers therefore have no idea of the composition of the bulk of the entire universe. So much for a fundamental understanding of the physical universe! Dark matter is an apt topic for review and for a creationist evaluation. There is a large number of dark matter discussions and references currently available on the internet.

What Dark Matter is *Not*

The term *dark matter* does not refer to dark nebulae. These are abundant interstellar clouds of dust, which block the light from background stars, and therefore appear as dark silhouettes. Nearby examples include Orion's Horsehead nebula, the Great Rift in Cygnus and the Coal Sack near the Southern Cross.

Some students of the Bible have described a particular dark region in the northern sky. This is further proposed as the literal direction toward heaven. The idea is based on Job 26:7 which describes the north stretched out "over the empty place." However, there is no such northern region of space which is devoid of stars or galaxies. The Job reference simply describes the vastness of space in which stars exist, including the northern sky (DeYoung, 1986).

Neither does dark matter refer to dark line spectra. Stellar light spectra typically show dark lines where certain wavelengths have been absorbed by the star's own atmospheric gases. Also, dark matter does not refer to black holes. Finally, dark matter does not involve Olber's paradox, the profound question of why the sky is dark at night, in spite of seemingly endless stars.

The Location of Dark Matter

There are several alternate names for dark matter including missing mass, hidden matter, shadow matter and hot or cold dark matter. Why is it thought to exist and where must it be located? Dark matter will be discussed in three hierarchical categories. It is sought first within single galaxies. Next, the invisible material is thought to "glue" galaxy groups or clusters together. Finally, popular versions of the big bang model require immense amounts of dark matter existing throughout space. These three reservoirs for dark matter will be considered in the following sections.

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Single Galaxies

In our solar system, inner planets travel faster than the outer planets. Mercury has an orbital velocity of about 107,000 miles/hour (172,000 km/h), while Pluto's velocity averages nearly ten times less, only 10,000 miles/hour (16,000 km/h). This variation in speed follows directly from Kepler's third law of planetary motion,

$$T^2 = \frac{4\pi^2}{GM} r^3 \quad (1)$$

$$v = \sqrt{\frac{GM}{r}} \quad (2)$$

Here T , r , and v are the planet's orbital period, average radial distance from the sun and velocity. G is the universal gravity constant and M is the solar mass.

The stars within galaxies also experience orbital motion. In this case, however, the main gravitational mass is not concentrated at the center as in the solar system. Instead, stellar masses are spread throughout the galaxy, with vast orbits about the center. Isaac Newton proved that for such orbits, only mass lying within a star's orbit affects the star's motion. The gravity force from external mass cancels completely. This is exactly true only for a uniform spherical or circular distribution of mass. However a galaxy provides a fair approximation, including the disk-shaped spiral galaxies.

Equations 1 and 2 can be applied to an entire galaxy of revolving stars. Each star responds to the total gravitation of the partial mass of the galaxy that lies within its orbit. And it is exactly as if this mass were all positioned at the center of the galaxy. The orbital velocity of a star can be measured from the Doppler shift of its light. If the star is near the outer edge of a galaxy, taking r as the galaxy radius and knowing v , equation 2 then gives the total mass M of the galaxy. And here a major problem arises. In every case, the calculated galaxy mass is at least 5–10 times the mass of all the visible stars and other matter in the galaxy. This missing mass component is considered to be invisible dark matter.

There is a second way to look at the mass problem with spiral galaxies. One can plot a *rotation curve*, a graph of velocity versus distance from the galaxy center for component stars. Equation 2 shows that, for the solar system, planet velocity decreases as the inverse square root of distance from the sun. Because of the mass distribution of a spiral galaxy, equation 2 is not followed precisely. However, star velocities should still decrease as their outward distance increases. Instead, however, measurements show *flat* rotation curves for galaxies (Figure 1). That is, the orbital velocities of remote galaxy stars are largely constant, or even *increase* slightly with distance. The unexpected nature of the rotation curve was first noted by astronomers Vera Rubin and Kent Floyd in 1970, for the Andromeda

galaxy. Said in another way, the outer galaxy stars revolve unexpectedly fast. If galaxies are stable, this implies a large amount of dark matter affecting stellar motion. Otherwise, spiral galaxies should be flying apart. One possible mass distribution is a giant halo of invisible matter surrounding and permeating entire galaxies. X-ray telescopes, including *Rosat*, have shown possible evidence for this halo around the Milky Way. However the question remains, how can 90 percent of galaxy mass remain invisible to optical telescopes?

Galaxy Clusters

The terms *missing mass* and *dark matter* were first suggested in 1933 by Cal Tech astrophysicist Fritz Zwicky. He observed the Coma cluster, a group of at least 1,000 galaxies located 400 million light years distant. These galaxies are assumed to be gravitationally bound together. Zwicky noticed that the galaxies had random velocities, and moved much faster than expected. In fact the galaxy cluster should have disintegrated by now. This anomalous motion is likewise true of our own *local group* of galaxies. This local group consists of the Milky Way, Andromeda, Magellanic Clouds and about 30 other galaxies, all lying within about a three million light year region.

Why have not these galaxies within clusters escaped from each other? As before, an invisible binding mass of galaxy groups is considered as dark matter. The galaxy motions suggest that the dark matter mass totals at least ten times that of all the visible galaxies. This shortfall in mass is much greater for the galaxy clusters than that within individual galaxies. The Coma cluster is found to be 90 percent missing. Another example, the Virgo cluster is 98 percent missing. That is, there is assumed to be 50 times more mass than is actually observed. Figure 2 is a photo-

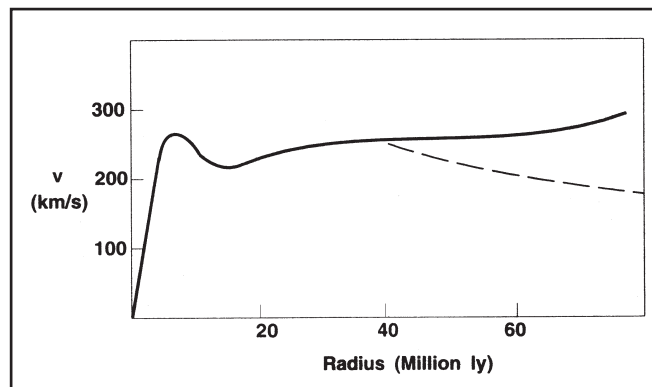


Figure 1. A schematic rotation curve for a typical spiral galaxy. The dashed line shows the trend of star velocities expected from Equation 2, if most of the mass of the galaxy were within 40 million light years of the center. The solid line shows actual measurements (Hawley and Holcomb., 1998, p. 390).

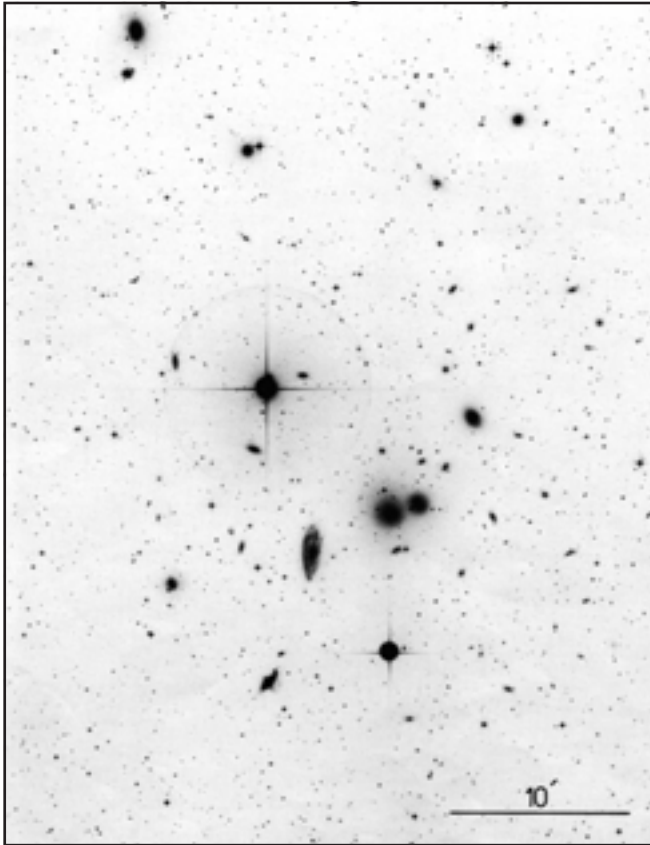


Figure 2. The central part of the galaxy cluster Abell 1060. The photo is from the Royal Observatory, Edinburgh, England (Bruck, 1990, p. 96).

graph negative of the center of the galaxy cluster Abell 1060. The smaller pinpoints of light are nearby Milky Way stars. The spirals and elliptical galaxies shown in the figure are a few of Abell 1060's two hundred galaxy members. The cluster is about 220 million light years away.

Visible gas clouds within galaxy clusters also have added to the dark matter requirement. X-ray observations reveal vast clouds of hot, low-density gas within the clusters. Elsewhere, similar clouds appear to suffuse regions of space far from galaxy clusters. These energetic gas molecules are moving so fast that the observed clouds would quickly leak away and dissipate on an evolutionary time scale. It is therefore concluded that the clouds must contain much more matter than we see, binding them together.

In several cases, *gravitational lenses* appear to give multiple images of the same quasar. Quasars are thought to be far distant, very bright sources of light. Apparently, separate light signals from a distant quasar can be bent by an intervening galaxy and then directed toward the earth. In some cases the light-deflecting galaxies also can be seen. On a more local scale, similar gravity lensing sometimes appears to occur for stars within or near the Milky Way galaxy. However in these cases there is no observed intervening object. Dark matter is suggested as the cause of this light

deflection. Several gravity lens surveys are currently underway. It is hoped that positive results may help determine the *size* of dark matter objects (Holz, 1999).

Virial Theorem

The *virial theorem* can be used to calculate the mass of a single galaxy or a galaxy cluster. It applies if a system is gravitationally stable, without collapse or disintegration taking place. The theorem states that the total gravitational potential energy of the star system equals exactly twice the total kinetic energy. If this condition is not met, the component objects either will cascade inward or escape, depending on the direction of imbalance.

From the virial theorem comes the mass formula for a galaxy cluster (Bruck, 1990, p. 99),

$$M = \frac{3V^2 R}{G} \quad (3)$$

Here V is the average of the squared radial velocities observed for member galaxies within the cluster. R is an estimate of the geometric radius of the entire cluster and G is the gravity constant.

As an example, consider Abell 1060, a cluster of about 200 galaxies located 220 million light years away (Figure 2). Its V is about 7.14×10^5 m/s (0.24% light speed) and R is 6.1×10^{22} m (6.5 million light years). The virial mass result is 14×10^{44} kg, or about 7×10^{14} solar masses. If there are 200 galaxies, each then averages 3.5×10^{12} solar masses. This is about 10 times higher than the known mass of Andromeda and the Milky Way galaxies. The Abell 1060 galaxies probably do not contain this much extra mass. Instead the mass may exist as dark matter spread between the galaxies. A similar numerical discrepancy exists for *every* galaxy cluster, assuming they obey the virial condition.

Some astrophysicists have proposed that galaxy clusters are *not* gravitationally bound after all, so the virial theorem does not apply. The use of the theorem to calculate unseen mass has been called "totally unreasonable" (Burbidge, et al., 1999, p. 42). However if the galaxies are disrupting, then the clusters must be far younger than the multi-billion year age usually assigned to them (Bowers and Deemings, 1984, p. 504).

The Universe

Dark matter is also required on the largest scale of all, that of the entire universe. In this case it is tied to versions of the big bang theory in at least two ways. First, dark matter is enlisted to explain the large-scale structure of the universe. In this

view, the initial universe expansion from a singularity must have experienced positional variations in temperature or energy density. This resulted in a “clumpiness” of matter, with subsequent formation of gas clouds, stars and galaxies. The initial clumps grew larger in this way because of the gravity attraction of invisible cold dark matter concentrations.

Dark matter is also involved in the popular inflationary big bang model which predicts that the curvature of the universe must be *flat* (Figure 3). This means that the density of matter is exactly balanced between a universe which eventually collapses (a closed, finite universe), and one which expands forever (an open, infinite universe). The required *critical* density for a flat universe is about 10^{-26} g/cm³. This corresponds to approximately 10 hydrogen atoms per cubic meter of space. Observed density estimates, although crude, lead to a value 10–100 times smaller than the critical density. Therefore a great amount of dark matter is needed to result in a flat, closed universe with zero curvature.

What is Dark Matter?

This is an unanswered question since dark matter has never been directly observed, and may not even exist. Nevertheless, many possible candidates have been suggested (Trimble, 1987). Several will be listed and briefly evaluated here.

Non-luminous stars include primordial black holes; black, brown or red dwarfs; and energy-depleted white dwarfs. An immense number of these unlit stars would be needed to supply the necessary dark matter. If they average 0.1 solar mass and comprise 90 percent of the total known universe mass, then there must be at least 10^{25} such stars. The basic problem is that *none* have been detected and identified with certainty. Surely, such an astonishing number of non-luminous stars easily should be detected with modern instruments. Even black holes themselves remain as theoretical constructs which have not been verified with certainty.

The brown dwarfs are a special case of failed, low mass stars which never ignited their internal nuclear fusion reactions. They are sometimes pictured as large gaseous planets, somewhat like Jupiter. They have also been called MACHOS, or massive compact halo objects. Efforts have been made to detect brown dwarfs indirectly by their eclipsing of normal stars. That is, one watches for a distant star to temporarily disappear when covered. The background starlight might also be distorted in a *microlensing* effect. No clear brown dwarf evidence has been found in this way, in spite of detailed searches (Hawley and Holcomb, 1998, p. 391). There may be many brown dwarf stars, or they may be very rare.

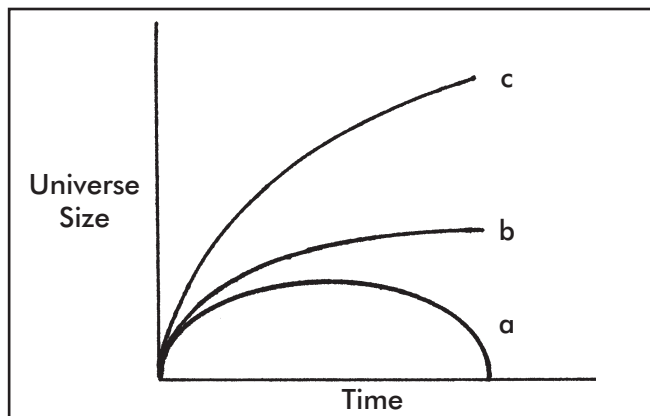


Figure 3. Three views of the expansion of the universe over evolutionary time. The universe is either a: closed, eventually collapsing on itself, b: flat, ceasing expansion after infinite time; or c: open, expanding outward forever.

Diffuse matter would consist of unseen dust or gas particles that are widely dispersed. It has been described as molecular clouds, intergalactic matter, and as halo or coronal material which surrounds and permeates galaxies. The Milky Way contains 10^{11} solar masses. The required invisible dark matter is 100 times greater, 10^{13} solar masses worth. This would be an incredible amount of unseen diffuse matter.

Neutrinos are an abundant product of nuclear fusion, the process thought to energize stars including our sun. Creationists have suggested that gravity contraction may also be occurring within stars (Steidl, 1983). Whatever the combination, some nuclear fusion does occur with resulting neutrino production. From the sun, this sends a continuous flood of neutrinos toward earth with a flux as great as 10^{12} neutrinos/cm² · s.

Solar neutrinos have been detected, although only at about one-third of their expected number. Neutrinos require large, highly specialized detectors since the particles are very elusive and unreactive. Most travel directly through the earth's 8,000 mile diameter without any atomic collisions occurring.

Thus far, laboratory studies of neutrinos show zero mass. However, there is a suggestion that neutrinos might oscillate between different forms as they travel along at light speed. This behavior could mask a vanishingly small but finite mass. With their large abundance throughout space, neutrinos could thus comprise much of the sought-after dark matter. The proposed dynamical behavior for neutrinos might also explain their low abundance as measured from the sun. The problem remains, however, that no one has observed any mass whatsoever for neutrinos. The idea of neutrino mass appears to be a desperate hope for solving the embarrassing mass deficit.

Exotic particles are wisps of localized energy in space that have been theorized but never observed. In physics

jargon, exotic particles are *nonbarionic*. They have much less mass than normal baryons such as neutrons and protons. Exotic particles are often given fanciful acronyms. WIMPS, or weakly interacting massive particles, are predicted by certain theoretical physics models. No one knows whether such dark matter particles exist. Nevertheless, they have been enlisted to help solve the solar neutrino problem. It is proposed that WIMPS inside the sun might help spread heat throughout the solar core. Solar energy could then be generated at a slightly lower temperature, with fewer neutrinos produced than now expected.

A WIMP detector has been built in England, deep underground. It consists of 200,000 liters of pure water. Scientists hope that an occasional WIMP particle speeding in from space might interact with a hydrogen atom in a detectable way. Results thus far have not been encouraging (Seife, 1999).

Axions, whimsically named for a laundry detergent, are another type of hypothesized subatomic particle which contribute mass to space. Other proposed but unobserved particles include photinos, neutralinos, gravitons, mini-black holes and antimatter. Astronomers also speak of *bowling balls*, a shorthand title for ordinary space matter in some hard-to-detect form.

Other exotic particle candidates include cosmic strings or membranes, preons and monopoles. There is certainly no shortage of suggestions to identify dark matter. In reality, however, the dark matter mystery remains completely unsolved after seven decades of intense study.

A Creationist Response

We have seen that dark matter is required if the laws of motion and gravity hold for galaxies, and if galaxy systems are stable. Since creationists are not locked into the big bang theory or evolutionary time, there are several options to consider. They will be discussed here as questions.

Are the laws of nature universal? This question allows for entirely different, unknown laws operating elsewhere in space. Dark matter then might be only an illusion, based on our local understanding of physics. However, there is no reason to expect such an unknowable *multiverse* instead of a *universe*. Instead, light signals coming from deep space, in all the intricate details of their spectra, appear much like light sources within our laboratories. Therefore the dark matter problem cannot easily be solved by rejecting known physics. Newton's and Kepler's laws of motion and gravity appear to be universal in their extent and application.

Are galaxies stable? If dark matter is lacking in galaxies, then over time they will simply disintegrate. This would be a major problem for evolutionary time, since galaxies then should no longer exist. In the recent creation view, how-

ever, little galaxy change would be noticeable since the creation event. After all, galaxies average 100,000 light years in diameter. In just 10,000 years, galaxy enlargement would be minimal.

Still, there is little reason to expect that galaxies are unstable in this way. With few exceptions, mainly within the solar system, transients and instabilities are not found in space studies. Instead, the created universe is marked by great durability. Consider our sun, which has sufficient hydrogen fuel to last for billions of years into the future, although the Creator, of course, may have other plans. Galaxies can be assumed to be stable, and thus must contain some form of dark matter.

Are galaxy clusters stable? Clusters are an entirely separate category from individual galaxies. There is little reason from a creation perspective why these clusters need to be bound together by unseen matter. The Creator may simply have placed these clusters throughout space much as we see them, with random galaxy velocities. Even if unbound, these clusters would only dissipate on a billion year time scale because of their vast size. Galaxy clusters may well be unstable in the long term.

Must the universe be flat? The creation view has no such requirement. The flatness requirement arises only with the big bang theory. The Creator, with equal ease, could have made a closed, flat or open universe. However, I suggest that it may well be open, with a lack of large scale dark matter. The simple reason may be to frustrate all natural origin theories, most of which call for a closed or flat universe. Something similar occurs for the planets. We find sufficient created variety and uniqueness in the solar system to cancel all natural attempts at an explanation, including the popular nebular hypothesis.

What then is dark matter? I have suggested that dark matter exists within galaxies, if not elsewhere. We have considered various physical micro and macro-size possibilities. But there is another option. Perhaps the dark matter we seek is in reality the unseen hand of the Creator. We know from Colossians 1:17 that God in some way holds all things together. Therefore at some point, physical reality must mesh with the spiritual. And that point may lie in the unexplicable problems of modern science.

The law of gravity has been known since it was first explained by Isaac Newton in 1687. On a deep level, however, gravity remains a mystery. That is, we have no idea how objects physically communicate their positions and interact with each other. This ignorance about gravity or dark matter, for both creationists and non-creationists alike, should be a humbling experience. We know very little about physical reality, since we presently "see through a glass darkly" (I Corinthians 13:12). Creationists look forward to the future, when our understanding will be made complete.

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Book Review

The Design Inference by William A. Dembski

Cambridge University Press, New York. 1999, 243 pages, \$59.95

This book is based on the author's doctoral work in mathematics at the University of Chicago, his post doctorate work in complexity theory at Princeton, and his second doctorate in philosophy at the University of Illinois. Dembski's work is critical to the creation-evolution controversy because it deals with the essential question "What is the probability that life and the universe are the product of design versus a product of chance?" Creationists often use probability arguments to show the enormous unlikelihood of life evolving by natural law and chance.

A common analogy is the calculation of the likelihood of the body's 206 bones being placed by chance in the correct order (Bergman, 1999). This analogy, while useful, is limited because life does not result from placing existing structures in the proper order, but is dependent upon many highly improbable events. It is well recognized by creationists and most evolutionists that the probability of life evolving naturalistically is extremely small. In Gould's famous analogy, if earth's history were to be replayed "a thousand times," it probably would not produce the human brain again (Gould, 1989, pp. 233–234).

The application of probability calculations to life's origin is often obscured by evolutionists who argue that highly improbable events happen every day. Therefore, they argue, because life is highly improbable does not prove that a creator must exist to explain life's existence. An example which shows that the problem is not the mathematics, but its application was originally discussed by Polanyi (1962, p. 33). Both the chances that 100 stones randomly placed in a garden in any one pattern as well as

to spell "Welcome to Wales by British Railways" are infinitely small. If we are looking for one *special arrangement* of stones only, the likelihood of finding it in thousands of gardens is minuscule unless intelligence arranges the stones in the desired order. Therefore, the likelihood of a meaningful message requires intelligence to produce a specific order of stones. One could spend several lifetimes examining gardens, and the likelihood of finding the phrase "Welcome to Wales, etc." produced by chance still has a probability of zero.

Mathematics, especially statistics, is a tool that can be used and abused as the classic book by Huff (1953) eloquently demonstrates. A common example used by evolutionists to explain away creationists' probability arguments is noting the minuscule likelihood of a given assemblage of the specific persons at a creation conference occurring by chance. The problem is an almost infinite variety of combinations will meet our criteria, such as when 100 paid registrations are received, the criteria has been met and the conference will be held. Any 1,000 persons attending meet our criteria, not a certain combination. As a result, the likelihood of the particular combination occurring is not minuscule but one. Conversely, events produced by intelligence require the combination of a *specific* set of events which *as a set* will not occur by chance.

Dembski illustrates how intelligent design can be proven utilizing examples including determining if an electronic signal is random or the result of intelligence. This problem has been worked out years ago in connection with SETI and other programs which attempt to find evidence

of intelligence in outer space based on extraterrestrial radio signals. If the signal contains information defined as non-random data, an intelligent sender is considered probable even if we cannot interpret the information.

As another example, much work has been expended in the area of criminology and forensic science to determine if a set of events has occurred by chance or by design, consequently implicating a suspect. An example is a murder investigation: a man known to have threatened the life of a woman is seen leaving her apartment just after a gunshot is heard. Then five minutes later the victim's husband and son simultaneously enter the apartment and discover the body. The fingerprints on the murder weapon and the victim's blood on his clothes provide evidence which in total is considered overwhelming.

Determining if events are due to intelligent causes or undirected natural causes plus chance is not only the heart of the justice system and extraterrestrial intelligence searches, but many other areas also. An example is determining if an airplane's mechanical failure occurred due to chance, design imperfection, or a deliberate attempt to sabotage the airplane. Dembski shows in detail how decision theory enables us to accurately determine if a series of events such as the above are likely due to chance or to intelligent causes and design.

Dembski concludes that two hallmarks of intelligent causes are (1) specific events occurring which have small probability and (2) the event is specified in advance. Just about everything that happens is highly improbable if chance alone is considered, but when the improbable event is *also specified* i.e., predicted, then judgments about intelligent causation can be made.

Dembski deals with properly classified events as either highly probable or highly improbable. The extreme cases elicit little or no debate from informed adults. Throwing a set of dice and having both turn up sixes 400 times in a row is possible, but most people would be justifiably certain that this result did not occur purely by chance. Likely, design must have intervened i.e., each side of both dices has a six, for example. Conversely, the cutoff point i.e., how small a probability is small enough to eliminate chance, is more difficult.

In an attempt to draw the line, Dembski utilizes many sources such as Emile Borel's basic law of probability which states if the occurrence of an event happening by chance is beyond 1 in 1050 we can state with certainty that this event will *never* happen by chance no matter how much time or how many opportunities exist. The key to his

concept is the *explanatory filter* which involves determining if an event is due to design by ruling out both regularity and chance. If an event is regular such as the result of a law (e.g., gravity), the event will always normally happen and design is not necessary, at least proximally, but may be necessary as a distal explanation. Next, chance must be ruled out. The process of how this is done is the subject of much of Dembski's work.

The key question Dembski tries to answer is, "Is life's emergence and development sufficiently probable to obviate the need for a supernatural designer?" (p. 2). Determining if an event is improbable requires determining how closely it conforms to a pattern, where only one event will meet the criteria. This analysis helps us to determine if an event occurred due to probability or as a result of intelligence.

This brief review in no way does justice to this important book. Dembski's work is critical in the creation-evolution controversy and no doubt will in the future be viewed as a classic which placed the creation worldview on a firm scientific basis. In section 2-3 called "the creation-evolution controversy" Dembski shows why the arguments by Darwinist Richard Dawkins are untenable. While some readers may not want to wade through the mathematical sections, much of the book is assessable to the intelligent lay person. Research in creation is progressing on numerous fronts, and in this author's opinion the core areas which are decisive in falsifying the Darwinian worldview are design inference theory, molecular biology, and genetic research.

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To proceed from the skeptic's perspective in science, philosophy, or any other discipline is anything but neutral; it is inherently anti-theistic and has no more justification as a starting point for intellectual inquiry than does theism.

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Trematode Parasites: What Is Their Genesis?

Mark H. Armitage*

Abstract

An overview of trematode¹ parasitology from the evolution and creation perspectives is presented, including a discussion of the “design-like” features of these parasites. No credible evolutionary explanations are found in the evolutionary literature to account for these “design-like” aspects.

Histological microtechnique for electron microscopy is also reviewed and some cyst ultrastructural data are reported. A caring God may have designed trematodes, now recognized as parasites, to serve other functions before the Fall of man (Genesis 3).

Introduction

The purposes of this study are to review some of the “design-like” behaviors and structures of this group of parasites, to search for a reasonable explanation for their existence in the evolutionary literature, and to provide a creation-based explanation for their origins.

As shown previously (Lumsden and Armitage, 1999), digenetic, heterophyid trematode parasitic worms of the genus *Ascocotyle* infect certain amnicolid snails as first intermediate hosts (such as *Littoradinops*). They also infect certain cyprinodont and poeciliid estuarine fishes (*Cyprinodon*, *Poecilia*, *Fundulus*, *Gambusia*), as second intermediate hosts in a three-step life cycle. The hermaphroditic, adult trematode worms mature in the intestines of definitive hosts, most often piscivorous birds, but also certain mammals such as the raccoon. The *Ascocotyle* group comprises some 30 different species, which vary by mostly minute morphological differences, such as spine count and shape, organ position and size, and organ shape within adults. They also vary in metacercarial cyst shape and thickness, location of infection within the second intermediate host, and the specific host type.

The cyst wall configuration, as observed by TEM (this paper) also can serve as a diagnostic species characteristic. It is on the basis of these morphological features and not reproductive isolation alone that species are identified within this group. These parasites cannot be classified on the single basis of reproductive isolation, as many animal species are, because trematodes are hermaphroditic and several species often inhabit the same estuary.

All of these observed differences are considered by creationists to be at the microevolutionary level of variation, or normal variation within a created kind. The creation model of origins predicts small changes within a kind based on the genome designed by the Creator at the beginning. In contrast, very large scale genomic changes, as espoused by the evolution model of origins, would be necessary to change the *Ascocotyle* worm into a cestode or an annelid, if it could be done at all.

Ascocotyle parasites have been described from Argentina (Ostrowski de Nunez, 1976; 1992; 1993), Brazil (Travassos, 1930), the Caribbean (Price, 1935), Egypt (Looss, 1899), Eastern U.S. (Stunkard and Uzman, 1955; Burton, 1956; 1958; Leigh, 1954; 1956; 1959; 1974; Hutton and Sogandares-Bernal, 1959; 1960; Harkema and Miller, 1962; Miller and Harkema, 1962; Stein, 1968), Gulf Coastal U.S. (Font, Overstreet and Heard, 1984; Font, Heard and Overstreet, 1984; Sogandares-Bernal and Bridgman, 1960; Sogandares-Bernal and Lumsden, 1963; 1964; Lumsden, 1963a, b; 1968), and California (Armitage, 1997b; 1999) but there is a significant paucity of reports of incidence from the Western U.S.

Some workers have reported on the apparent pathogenicity of the *Ascocotyle* genus (Martin and Steele, 1970; Snyder et al., 1989; Font, Overstreet and Heard, 1984; Font, Heard and Overstreet, 1984), but many more have shown large numbers of parasites within infections of no pathogenicity (Stunkard and Uzman, 1955; Burton, 1956; Lenhoff et al., 1960; Lumsden, 1963a; Schroeder and Leigh, 1965; Skinner, 1975; Coleman, 1993; Ostrowski de Nunez, 1993) other than occasional blood flow impediment caused by mechanical occlusion within the heart or

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¹This term and other technical terms are defined in a list of definitions at the end of this paper.

the circulatory system. Some significant ultrastructural observations (Lumsden, 1968; Stein and Lumsden, 1971a, b; this paper) using TEM, show that there is absolutely no pathogenicity or host immune response resulting from the presence of the parasite within host tissues. Many workers have even reported that heavily infected snails and fish live for up to a year or more in laboratory aquaria (Leigh, 1956; Stein, 1968; Font, Heard and Overstreet, 1984, and my own observations over many months).

There has been very little discussion by previous workers regarding the complexity of the *Ascocotyle* life cycle (which requires parasitization of three distinct hosts for completion of its life cycle) and what mechanisms may have brought this multifarious system into place. Most, if not all of the evolutionary literature on digeneans in general and ascocotylids in particular fails to develop a credible, empirically-based phylogeny for these organisms.

Some aspects of the *Ascocotyle* life cycle exhibit “design-like” features in behavior, morphology, and structure. These features take the form of behaviors which guide the microscopic parasite to the appropriate host (even in the presence of other fishes), behaviors and sensory papillae which guide the parasite to the appropriate organ for encystment, and specialized structures which allow tissue penetration. There are also other complex structures which control safe passage of the parasite through the digestive or circulatory systems of intermediate and definitive hosts and minimize host immune response.

Workers at the University of California Santa Barbara, have collected some of the same hosts used in this study and have described the actual alteration of host behavior by trematode parasites to ensure predation by the definitive host (Lafferty and Morris, 1996). Their failure to provide an evolutionary explanation for such a highly designed system, however, is evident. Other limited discussions of evolution within the *Ascocotyle* group are offered (Sogandares-Bernal and Lumsden, 1964; Skinner, 1975; Font, Heard and Overstreet, 1984), but no serious explanation has been proposed for how these complex life cycles were initiated and how they arrived at their present state.

The real question is, can parasites be designed? If they can be designed, what would constitute a design feature and how would it be recognizable as such? If certain features are attributed to design, can evolutionary explanations likewise be made for them? If parasites such as *Ascocotyle* were designed, can that design be attributed to a Master-Designer within a Biblical creationist model of origins?

Implications for Creationism

The heteroecious life cycle of the *Ascocotyle* parasite is complex and it clearly shows that it is obligated to a cycle

requiring the timely intervention of at least three different hosts for it to achieve fecundity. Many questions are raised by such life cycles with respect to possible natural selection or environmental pressures which may have driven the *Ascocotyle* parasite (and most trematodes) to seek refuge within these very different hosts in order to reach maturity.

There is no reference in the ascocotylid literature to any significant mechanism which may account for the presence of such complex life cycles, except the usual vague homage paid to an evolutionary “parasite strategy,” and/or “selective advantage.” Some discussion is made in defense of possible evolution-based parasite-host relationships (Sogandares-Bernal and Lumsden, 1964; Yamaguti, 1971; Skinner, 1975; Font, Heard and Overstreet 1984; Lafferty and Morris, 1996), but answers are often speculative. Statements such as Yamaguti’s (1971) prevail:

The present information indicates that the adoption of the parasitic habit occurred at an extremely remote period (of earth history) and that the evolution of parasitic life cycles with accompanying adaptations of the parasites, has proceeded hand in hand with the evolution of their hosts. (brackets mine).

There is no question that worm parasitism has been a part of the biosphere since early times (Poinar, 1984; Ferreira, et al., 1993), and in the creationist model, it certainly pre-dates the Flood. To relegate its origins to a misty past, however, is to avoid the obvious question: Where, when and how did it arise?

The evolutionary-based, trial and error method of adaptation proposed by these authors, fails to serve as an acceptable explanation for the presence of heteroecious life cycles and likewise falls flat in explaining the complex biochemical and sanctuary interactions between these parasites and their hosts. Evolutionary progression would require countless failed random experiments on the part of a parasite to make the transition from a free-living state to life within three completely different host environments, something that an ascocotylid now freely enjoys. Evolution appears to fail in this regard because it cannot be in an organism’s “best interest” to “fetter itself” to another organism, upon which it must depend for its very survival, let alone three different organisms in multiple habitats. Behe (1996) has shown that complex biochemical interactions (which themselves are based upon irreducibly complex biochemical structures) — cannot be formed on a trial and error basis. If these relationships were designed by a Master-Planner from inception, however, then a possible symbiotic exchange may be taking place (or occurred once in the past) and the relationship could be explained on that basis.

Except for one brief note in Smith (1984) describing some alteration of host behavior by parasites, and my recent papers (Armitage, 1997a; 1998; Lumsden and Armi-

tage, 1999), no worker has seriously studied trematodes from a strictly creationist viewpoint. Furthermore, there is no reference in ascocotylid literature which states that a possible positive relationship might exist between this group of worms and their hosts. On the contrary, these infections are often characterized by researchers as merely being benign or minimally harmful (Stein and Lumsden, 1971a, b; Coleman, 1993). This study represents the first attempt to show that these heteroecious life cycles and specialized structures are too complex to have developed by chance, and to present a creationist design argument for the presence of such parasites.

On the other hand, it is most difficult to account for these apparently created structures on an evolutionary basis. The very fact that these organisms can invade a host and go undetected by the immune system implies that certain biocompatibilities were in place before the life cycle was initiated.

Evolutionary Explanations for Apparently Designed Features

A search of the ascocotylid literature failed to produce a satisfactory evolutionary explanation which can account for the complex life cycle and the "design-like" structures employed within this group. One is hard-pressed to synthesize any meaningful evolutionary rationale from this literature, particularly in the field of host behavior modification. Comments like: "a parasite can parlay a small (host) behavioral modification into a large increase in predation" abound (Lafferty and Morris, 1996, p. 1394) (brackets mine).

Stunkard (1946) reviews Odhner's contention that similarities in the reproductive and excretory systems of digenetic trematodes indicate a common origin of all digeneans but he does not elaborate further. Sogandares-Bernal and Lumsden (1964) do not offer a mechanistic solution for the origin or complexity of the ascocotylids, but they do state that a significant and complex behavior of the worm "to remain in the definitive host long enough to produce, but not release a potentially dangerous (to the host) burden of eggs" may be an evolutionary adaptation by the parasite (brackets mine). Cable (1974) does attempt a phylogenetic survey of the trematodes, but does not focus on the digeneans or design features *per se*. Skinner (1975, p. 342) contends (with little argument) that parasites evolve slower than their hosts. He focuses on the intricate features of ascocotylids, saying, "their narrowly defined habitat and high specialization...(makes them) good material for the exploration of evolutionary development...", and "...similarities in the parasite fauna point to close host relationships..." (brackets mine). Overstreet (1978) suggests that the evolutionary relationships of some fishes can be ex-

plained on the basis of the similar types of parasites which infect them. With respect to the complexity of the life cycle, he then states, however, "The more complicated the life cycle and the greater the variation in the stages, the more a cycle can be influenced by the environment" (Overstreet, 1993, p. 127), indicating that possibly the environment molded the life cycle.

In a section of their book describing the staggering complexity of digenetic trematode eyespots, chemosensory papillae and other sensory structures, Schmidt and Roberts (1989, p. 234) exclaim that the "sensory endings (in one larval stage) are strikingly similar to the olfactory receptors of the vertebrate nasal epithelium!" but offer no mechanism of how they came to be that way (brackets mine). This would support a strange phylogeny indeed!

As to why trematode cercariae typically manifest abundantly more sense organs than the supposedly more highly developed adults, they surmise that "(this is) undoubtedly related to the adaptive value of finding a host quickly" (p. 233) (brackets mine). The assumption here is that once the worm adapted to finding a host by using these sense organs, the energy required to maintain the sense organs in the adult became less adaptive than just losing them. This is just one example in a long string of the typically imaginative explanations offered by evolutionists, but then Schmidt and Roberts (1989, p. 240) admit that the complexity of the life cycle has fueled the imagination for a long time:

This alternation of sexual and asexual generations in different hosts is one of the most striking biological phenomena. The variability and complexity of life cycles and ontogeny have stimulated the imaginations of zoologists for more than 100 years, creating a huge amount of literature on the subject. Even so, many mysteries remain, and research on questions of trematode life cycles remains active.

With respect to the wildly different environments this parasite must deal with as it passes from host to host, Schmidt and Roberts (1989, p. 248) state, that they go through a "sequence of totally different habitats in which the various stages must survive, with physiological adjustments that must often be made extremely rapidly." There are wide swings in osmotic pressures from host to host. The chemical nature of the host skin must be detected. They need to penetrate host skin using leukotrienes and prostaglandins (which are very sophisticated proteins) and they must possess a myriad of ways to evade host immunological detection once they are on board. Although the synthesis of these highly specific proteins and enzymes by microscopic parasites is currently unexplainable, evolutionary authors are reluctant to relinquish the supposed materialistic origin:

When one considers that *chance* governs the successful completion of much of the life cycle of any

given parasite, it becomes apparent that the odds against success are nearly overwhelming (Schmidt and Roberts, 1989, p. 12) (*emphasis mine*).

The use of sophisticated macromolecules by these parasites to alter host behavior is also discussed by Lafferty and Morris (1996, p. 1395) who admit that, "We know little about the mechanisms parasites use to alter host behavior, but some evidence exists for sophisticated manipulation of (host) hormones and neurochemicals..." (brackets mine). How this remarkable manipulative ability came about is not discussed.

Schmidt and Roberts (1989, p. 254) emphasize the fact that natural selection provides little help in understanding trematode origins:

Whatever the ancestral digenean, any system of their phylogeny must rationalize the evolution of their complex life cycles in terms of natural selection, a most perplexing task.

The subsequent evolutionary reconstruction is padded with phrases like, 'most authorities today believe', 'this may imply', 'it is not difficult to imagine', 'it may be assumed', 'was probably', 'it is likely that', and 'less difficult to visualize'. It can be seen that the origin of these parasites from an evolutionary point of view is indeed perplexing.

With respect to the supposed evolutionary development of symbiosis and parasitism, McLaughlin and Cain (1983, pp. 189–190) also tender some less than convincing arguments, and frankly state that the "data are scarce". They reference just one laboratory study in which a bacterium and an amoeba established a mutualistic relationship after 100 generations in a controlled laboratory environment. These authors offer four general principles for the origin of symbiosis and admit that:

Naturally, the...model is speculative...

1) Symbioses originate rapidly and frequently in nature. Partners evolve rapidly under the pressures of adapting to the symbiotic relationship. Once a complete, free-living life cycle is impossible for one of the partners, it is committed to the evolutionary progression described.

2) One partner, the host...eventually gains control of the relationship after it becomes obligatory to the other partner, the symbiont.

3) The evolutionary progress is unidirectional; the symbiont often becomes less pathogenic, then non-parasitic, then actually beneficial to the host (if this is possible; if the symbiont has nothing to offer, then it simply becomes extinct).

4) Eventually, the desirable features of the symbiont which can be incorporated by the host are so incorporated. The symbiont becomes either extinct or a diminishing part of the host.

To their credit, the authors are candid about the lack of experimental support for their logic. The problem with

this kind of evolutionary scenario is that generous anthropomorphisms are ascribed to microscopic creatures which can in no way be self-aware. They cannot be aware of the concepts of symbiosis, parasitism, "interesting ploys", "desirable features", "nothing to offer", "selective advantage", etc.—all of which are teleological value judgments which are constantly and readily made. How, indeed, can a parasite "know" what is in its "best interest" from an evolutionary (or any) point of view? Perhaps these authors only mean that these seemingly directed behaviors and structures really occur as a result of natural selection in gene pools, but if that is the case, they do not say so.

Further, the whole idea that a microscopic trematode or other parasite can "guide" its intermediate host to the actual definitive host by "scheming" to alter its behavior via an evolutionary "strategy" is absurd. Carney (1969) discusses the alteration of formicine ant behavior by the lancet fluke trematode (*Dicrocoelium dendriticum*). He writes about this and the liver fluke (*Brachylecithum mosquensis*) which "ensure" their own predation by the herbivorous sheep which serves as the definitive host. These trematodes evidently cause the ant to climb to the tips of grass during the period when sheep graze. With no supporting material, Carney states:

Both flukes have parallelly evolved the ability to alter their intermediate host's behavior such that their own chance of survival is enhanced... Bizarre adaptations to parasitism such as these are one of the most interesting aspects of biology, although often the least known, and indicate a long association between these flukes and their respective hymenopteran hosts (p. 610).

Curio (1988) comments on this as well, stating:

To manipulate hosts behavior patterns seems to ask a lot in evolutionary novelties. However, the brainworm when inducing an ant to cling to the top of plants capitalizes on an apparently ancient behavior... the parasite needed "merely" to reactivate a hidden potential of the ant (p. 151).

Moore (1984) surveys several parasites, particularly in the acanthocephalans (spiny headed worms), which are known to alter intermediate host behavior, and he laments:

...the parasites do not induce novel behavior patterns but merely elicit existing patterns at disastrously inappropriate times. Nevertheless, this is quite a feat, and a general physiological explanation of how an acanthocephalan accomplishes it while floating in the body cavity of the host has yet to be found. The realization that parasites can change host behavior has intriguing implications. Biologists observing certain animals in the field must now take into account the possibility that the observed behavior may have been 'rigged' (p. 115).

Moore, however, does not elaborate on who or what may have done the 'rigging'. In a discussion of host castration by parasites, Hurd (1990, p. 274) writes:

Baudoin (1974), considered parasitic castration in the wider sense, outlined above as an evolutionary strategy, and concluded that a parasite-induced manipulation of host resources away from reproduction may produce increased host survival, thus leading to increased parasite fitness as a result of an improved environment.

In this case it is assumed either that the parasite has "understood" what host resources are and has "devised" a "strategy" to ensure its own fitness, or that chance, natural selection, and mutation caused it.

Aeby (1991) discusses trematodes which encyst in coral polyps as an intermediate stage, changing the polyp appearance and behavior. These trematodes later mature in the definitive host, a coral-eating fish attracted by these very changes.

In the discussion, she writes:

One might question why fish would evolve to feed on infected polyps... I can only speculate about this, but there are several hypothetical explanations... The parasite residing in the fish may have adopted the 'prudent parasite' strategy (Holmes 1983) in which the parasite produces minimal damage to the host (p. 267).

The fact that a parasite induces minimal damage on its fish host hardly seems a compelling reason for a fish to begin feeding on infected polyps in the first place!

Lafferty and Morris (1996, p. 1390) state, "Three main lines of evidence currently support the hypothesis that behavior modification is a parasite strategy evolved to increase transmission..." The authors then go on to point out that the very fact that increased predation by the definitive host is occurring in conjunction with parasitism is evidence enough that such a "strategy" has evolved. One clue to an evolutionary origin for these parasites would be the discovery of a free-living variety or finding a parasitic trematode that completed all stages of the life cycle in one host. There is, however, only one example in the literature of all three stages of this life cycle occurring in one host (Barger and Esch, 2000), but there are no free-living forms. A snail is required as a first intermediate host, followed by a fish or frog, and finally a piscivorous bird or mammal. All digenetic heterophyid trematodes are endoparasitic and obligated to these hosts. Why would a parasite initially become completely dependent upon a host for its very survival? How could such a relationship develop over time from a free-living state to a parasitic state? Why would an *Ascocotyle* tie itself to such a risky developmental route, where not one, but three hosts are required?

Overstreet (1978) classifies all organisms which live together as symbionts. He states that a symbiont becomes a

parasite, "when (it) depends entirely upon a host, occasionally harming it..." (p. 2). Commensals live together and "eat from the same table", and mutualism occurs when "...both parties benefit and both metabolically depend on each other" (Overstreet 1978, pp. 2-4; 1993). There is no doubt that an *Ascocotyle* is a parasite and a commensal. Quite possibly it even has a metabolic dependence upon one or more of its hosts to dissolve its cysts. Some question remains as to whether the *Ascocotyle* worm is involved in a mutualistic relationship in which it actually benefits its host. All members of this genus have an oral coronet of large spines at the adult stage, some having two rows, some having one row, etc. (Armitage 1997a). Of what purpose are these spines? The adult worm appears to lodge in the intestinal mucosal crypts of the definitive host, but does not penetrate the mucosal layer (Font, Overstreet and Heard, 1984; Font, Heard and Overstreet, 1984). Worms hold on in a cup-shaped fashion, over the host villi, by using both the acetabulum and the oral sucker. Yet no pathology to the villi is observed so the oral spines are possibly not used as holdfasts. But of what value are two rows of spines rather than one, or of one additional incomplete row in preference to a complete one? Why is a single incomplete row never observed? The tegument of these worms is entirely covered with a carpet of fine body spines which certainly must aid in anchoring the parasite and resisting host peristalsis.

In experiments conducted with cercaria of *A. mcintoshii* Price, Leigh (1974) discovered that cercarial penetration glands are HCl-sensitive and fully evert in weak solutions of HCl. Of what purpose is a set of penetration glands that are activated only in the presence of HCl, glands that are required for entry into host tissues, unless the parasite in question "anticipates" the gastric juices of the fish which swallows it as the second intermediate host? Could a trial and error method account for this elegant penetration gland? This biochemical functional system seems to fall within Behe's (1996) category of "irreducible complexity." If the sensitivity to HCl were removed, would the parasite fail to penetrate the host tissue? To bequeath this biocompatibility to the ancient processes of time and chance strains one's scientific credibility to the breaking point. One of the most compelling arguments for design within this *Ascocotyle* group comes from the structure of the metacercarial cyst, which is HCl resistant, and yet, temperature, pH and trypsin sensitive (Stein, 1968). Without a temperature of 37° C, a solution adjusted to pH 7.5, and the presence of trypsin, the cyst will not dissolve. Only with this combination can the parasite, encased within its miniature ark, successfully pass the definitive host stomach and dissolve only within the somewhat protective confines of the intestine, which is perfectly matched to its required conditions. Schmidt and Roberts (1989, p. 248) observe, "This combination of conditions is not likely to be present

anywhere but in the intestine of a homoiothermic vertebrate...".

The evolutionary literature has failed to supply us with a proper explanation for how these "design-like" features may have come about by the chance, random processes of evolutionary descent.

Intelligent Design Explanations

The questions which confront us have to do with the relationships, behaviors and specialized structures observed in this parasite — all of which appear to have been designed (Armitage, 1998). Such designs exhibit irreducible complexity as observed by Behe (1996) for the chemical basis of human vision and blood clotting. Behe's conclusion is that a gradualistic, Darwinian mechanism could never have produced these features:

The impotence of Darwinian theory in accounting for the molecular basis of life is evident not only from the analysis in this book, but also from the complete absence in the professional scientific literature of any detailed models by which complex biochemical systems could have been produced...the scientific community is paralyzed. No one at Harvard University, no one at the National Institutes of Health, no member of the National Academy of Sciences, no Nobel prize winner—no one at all can give a detailed account of how the cilium, or vision, or blood clotting, or any complex biochemical process might have developed in a Darwinian fashion (p. 187).

And:

There is an elephant in the roomful of scientists who are trying to explain the development of life. The elephant is labeled 'intelligent design.' To a person who does not feel obligated to restrict his search to unintelligent causes, the straightforward conclusion is that many biochemical systems were designed. They were designed not by the laws of nature, not by chance and necessity; rather they were *planned*. (p.193) (emphasis in the original).

Ascocotylids are able to rapidly manufacture macromolecules necessary to render osmotic potentials harmless. They can synthesize host penetration macromolecules used for swiftly and painlessly entering their intermediate hosts. They also produce the macromolecules which will envelop them with a immune-transparent cyst that will not dissolve in HCl but which will come apart readily in a warm, pH adjusted, environment, bathed in trypsin and bile salts. All these characters demand planning just as much as does Behe's blood clotting mechanism. But the question remains of whether or not a loving God would plan invaders such as these. Were these organisms designed from the start to perform functions they no

longer perform? Answers to these questions may vary but we can be sure that a loving God did not intend the rampant parasitism we observe today.

The only acceptable alternative to the evolution explanation is that these complex life cycles and "design-like" structures were planned by the Creator, at the point in history when He designed all of the other living organisms. Why and how some symbionts have today become pathogenic is open for speculation, but in a creation scenario, pathobiology must certainly be related somehow to the Fall of Adam and the subsequent Curse (Genesis 1:31; 3:18).

Delving Deeper into Trematode Biology: Microtechnique

In an effort to explain the basis of this and other studies, in which TEM has been applied to the cyst walls of trematode worms, a primer on the preparation of biological material is presented in the appendix. The appendix and the illustrations will also serve to orient the reader to the field of microtechnique and to show contrasting features in *Ascocotyle* cysts.

The Ultrastructure of Metacercarial Cyst Walls

At one time researchers believed that the thick-walled metacercarial cyst of trematodes encysted in various hosts was a direct response by the host to the presence of the parasite within tissues (Sogandares-Bernal and Lumsden, 1964). It now is known however, that cyst walls are produced by secretions from the tegument of the metacercaria and may even be used to delineate differing species based upon its unique structure (Stein and Lumsden, 1971b; Stein and Basch, 1977). But certain other authors have not agreed that this is a species characteristic (Huffman, 1968; Wittrock et al., 1991; Walker and Wittrock, 1992). The extent of host response to the presence of cysts varies considerably. The typical host response is the production of a fibrous collagen capsule surrounding the cyst, along with associated host fibroblasts, but there is little or no host immune response (Lumsden, 1968; Stein and Lumsden, 1971a, b; Mitchell, 1974; Higgins et al., 1977; Stein and Basch, 1977; Gulka and Fried, 1979; So and Wittrock, 1982; Galaktionov et al., 1997).

The variation in layers of cyst walls within the ascocotylids is seen in the following examples. *Ascocotyle pachycystis* (Figure 1), produces a four-layered cyst up to 35 micrometers in thickness (Stein and Lumsden, 1971b) with two major, bilayered lamellae. *A. chandleri* (not shown) exhibits a 15 micrometer-thick cyst with two layers (Lumsden, 1968). *A. leighi* (Figure 2), was shown to have a 10 to 11 micrometer thick cyst which also has two layers

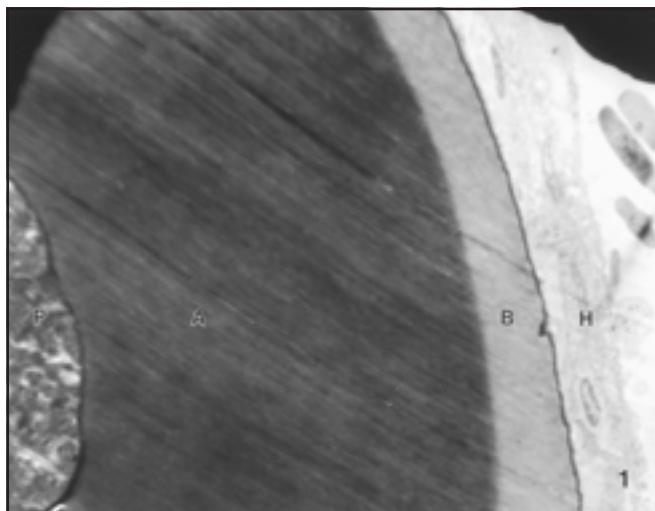


Figure 1. *Ascocotyle pachycystis* in *Cyprinodon* heart, (2,000X). This figure shows a cross section of a fluke parasite (*Ascocotyle*) cyst, growing in the heart of a sheepshead minnow (*Cyprinodon*). Note the very thick layers of the cyst which protect the parasite. Legend for figures 1–4: P = parasite tissue, A = cyst wall 1, B = cyst wall 2, H = host tissue).

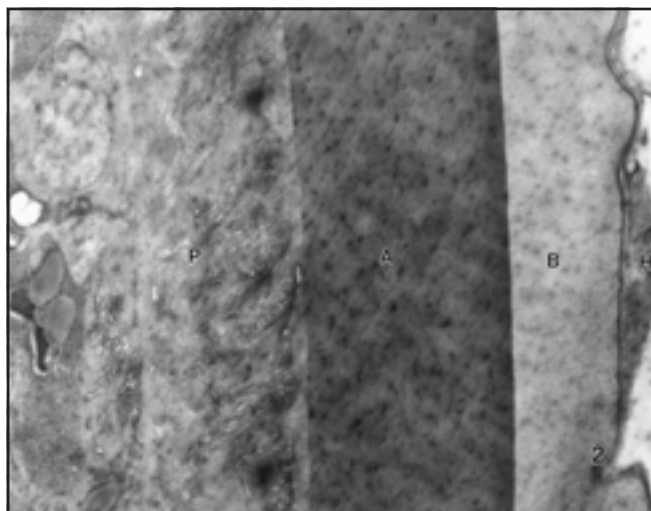


Figure 2. *Ascocotyle leighi* in *Poecilia* heart, (7,000X). This is a cross section of another species of *Ascocotyle* fluke (*A. leighi*) in the heart of the sailfin molly (*Poecilia*). The cyst in this case is much thinner; yet this parasite, when mature is almost identical in shape to *A. pachycystis*.

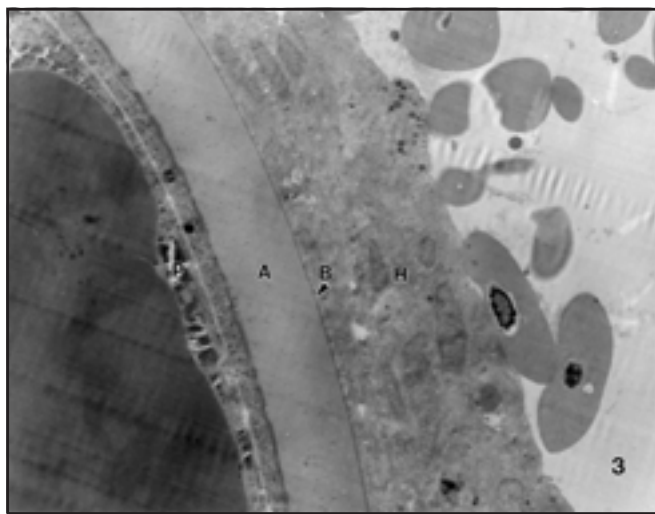


Figure 3. *Ascocotyle tenuicollis* in *Gambusia* heart, (4,000X). Within the heart of *Gambusia*, the mosquitofish, is the cyst of another fluke, *A. tenuicollis*, also shown in cross section. This cyst closely resembles that of *A. leighi*; yet it is a different species found in a different fish host.

(Stein and Lumsden, 1971a). The cysts of *A. tenuicollis* (Figure 3), collected in Mississippi come closer in structure to *A. chandleri* than any other member of this genus because of a three-layered, nine micrometer-thick cyst. *A. sexidigita* has a 16 micrometer-thick, three layered cyst (not shown). *A. (P.) diminuta* has a single cyst wall of 1.5 to 3 micrometers in width (Figure 4), which in every respect resembles the very tegument of the metacercaria it is harboring. The wall is comprised of a spongy matrix of tissue

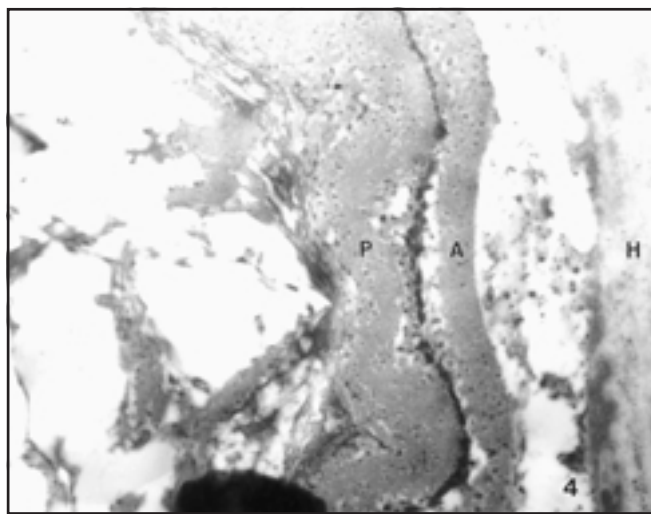


Figure 4. *Ascocotyle (Phagicola) diminuta* in *Fundulus* gill, (8,000X). This fluke, *A. diminuta* is found in the gill tissue of the Killifish (*Fundulus*) and one or two others. Note that the cyst wall and the parasite outer skin are almost identical in appearance.

interspersed with dense nuclei and a very thin granular outer border.

Definitions

Acetabulum: The ventral sucker on a trematode worm.

Amnicolid and Hydrobiid: fresh or brackish water snails belonging to the family Hydrobiidae which are charac-

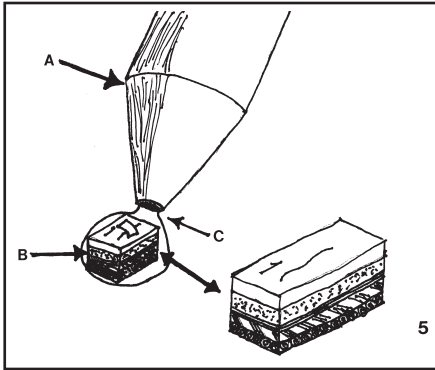


Figure 5. Dissected fish tissue block is chemically processed. Tissues for electron microscopy must first be stabilized in a fixative, such as formalin. This preserves, as close to the living specimen as possible, the ultrastructure of the tissue for the microscope. Legend for figures 5–9: A = dropper, B = tissue block, C = solution, D = capsule, E = polymer, F = thin sections, G = knife, H = grid, I = specimen chamber).

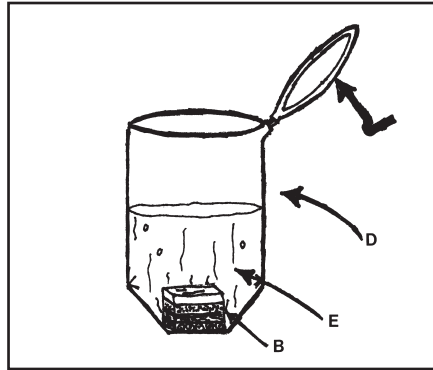


Figure 6. Processed tissue is placed in a liquid polymer. A liquid polymer (plastic) is used to infiltrate the tissues after they have been preserved properly. Once the tissue is thoroughly impregnated with the polymer, it is placed into an oven overnight for hardening. The tissues can then withstand the harshness of the electron microscope.

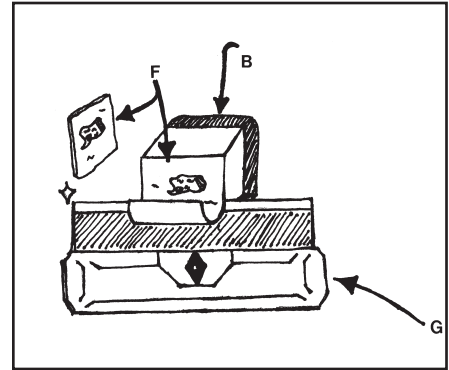


Figure 7. Hardened polymer block with tissue is sectioned into ultra thin sections. Very thin sections of the tissue block are made with a glass or diamond knife of surgical sharpness. These thin sections will go into the microscope.

terized by true gills and opercula, versus pulmonate, or air-breathing, structures.

Cercarial: The last larval stage of trematodes, free swimming, from the first intermediate host, to the second intermediate host, where penetration of that host occurs.

Creationism: The belief that God created all things as described in Genesis.

Cyprinodont: the killifish family of fresh and saltwater minnows.

Digenetic: Subclass Digenea, parasitic worms, a subclass of the Trematoda, having two or more asexual generations, an alternation of hosts, the first almost always a mollusc, and which are endoparasitic in vertebrates such as birds.

Evolutionism: the belief that all life forms arose over millions of years from a common ancestor due to mutations in the genetic code and a stochastic “system” of selection called Natural Selection.

Fecundity: The capacity of an organism to produce offspring.

Hermaphroditic: (often) self-fertilizing organisms which contain both male and female sexual organs.

Heteroecious: “many houses” or complex cycles which require several different hosts to complete.

Heterophyid: having a bifurcated intestinal organ or ceca usually long and truncated.

Metacercaria: the third, or preadult stage of the trematode life cycle, often involving an encystment within the second intermediate host.

Micromorphology: body structures which can only be seen by means of magnification.

Pathogenicity: The causing of disease or toxic response in another organism.

Poeciliid: the topminnow or live-bearer family of fresh and brackish water fishes which hatch young internally and bear live young.

Piscivorous: fish eating vertebrates such as herons, egrets, and raccoons.

Redia: An intermediate larval stage of trematodes that develops asexually within a sporocyst inside the first intermediate host, usually a snail.

SEM: Scanning electron microscope, which images metal coated whole mounts, in magnifications of 100:20,000 diameters using secondary electron capture.

Sensory Papillae: Sophisticated sensory projections from cells or tissues, often containing cilia.

Symbiosis: The intimate and protracted association of individuals of different species.

Tegument: The outer layer or skin of a trematode parasite.

TEM: Transmission electron microscope, which images metal coated thin sections, to magnifications up to 200,000 diameters using primary or direct electron capture.

Trematode: Class Trematoda of helminths which are parasitic flatworms (flukes) mainly in the digestive tract of all classes of vertebrates. These trematodes possess a digestive tract, specialized sensory organs, and muscular sucking disks which serve to attach the fluke to the host.

Appendix

Biological tissues such as *Ascocotyle* cysts must be processed properly in order to be viewed in an electron microscope. First, the tissue of interest must be dissected and chemically processed in fixative, buffers, and alcohols (Lumsden, 1970). Then it must be embedded in a liquid polymer that will harden upon heating (Figures 5–6). Once hardened, the tissues can be thin sectioned on an ultramicrotome (Figure 7: blade and tissue block shown). Finally, tissue sections are transferred to thin metal grids on which they are stained with metal salts and placed into a special chamber in the TEM (Figures 8–9).

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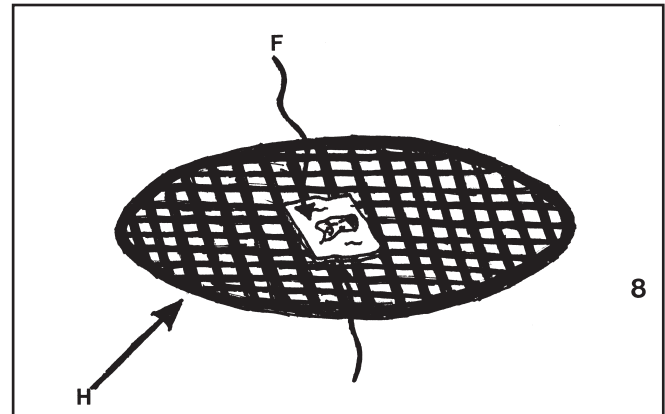


Figure 8. Individual sections are placed onto TEM grids and stained. The grids are metal substrates used to support the thin sections and for handling into and out of the heavy metal staining solutions (lead and uranium salts) as well as the microscope.

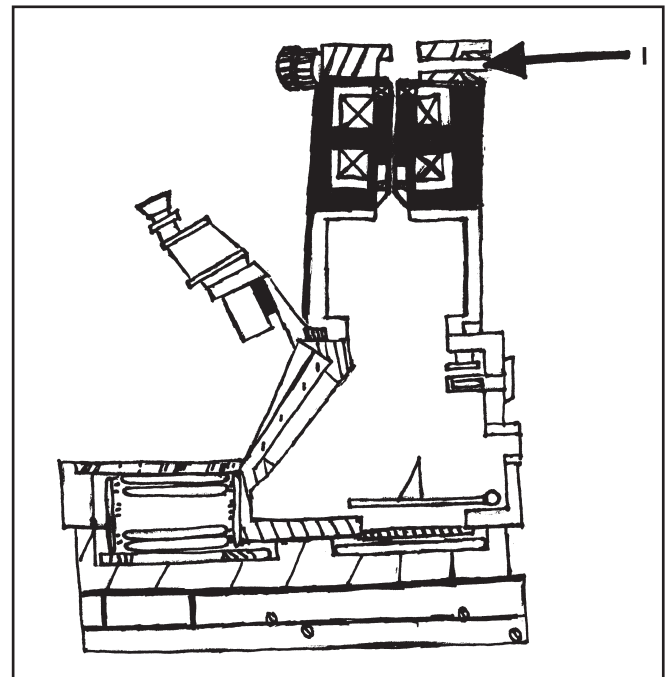


Figure 9. Grids are placed into the TEM for imaging. Once stained, the grids, holding the stained sections are placed into the electron beam. Tissues which took up the metal stain block the passage (transmission) of electrons and appear dark under the microscope.

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Why Abiogenesis Is Impossible

Jerry Bergman*

Abstract

If naturalistic molecules-to-human-life evolution were true, multibillions of links are required to bridge modern humans with the chemicals that once existed in the hypothetical “primitive soup.” This putative soup, assumed by many scientists to have given birth to life over 3.5 billion years ago, was located in the ocean or mud puddles. Others argue that the origin of life could not have been in the sea but rather must have occurred in clay on dry land. Still others conclude that abiogenesis was more likely to have occurred in hot vents. It is

widely recognized that major scientific problems exist with all naturalistic origin of life scenarios. This is made clear in the conclusions of many leading origin-of-life researchers. A major aspect of the abiogenesis question is “What is the minimum number of parts necessary for an autotrophic free living organism to live, and could these parts assemble by naturalistic means?” Research shows that at the lowest level this number is in the multimillions, producing an irreducible level of complexity that cannot be bridged by any known natural means.

Introduction

Abiogenesis is the theory that life can arise spontaneously from non-life molecules under proper conditions. Evidence for a large number of transitional forms to bridge the stages of this process is critical to prove the abiogenesis theory, especially during the early stages of the process. The view of how life originally developed from non-life to an organism capable of independent life and reproduction presented by the mass media is very similar to the following widely publicized account:

Four and a half billion years ago the young planet Earth... was almost completely engulfed by the shallow primordial seas. Powerful winds gathered *random molecules* from the atmosphere. Some were deposited in the seas. Tides and currents swept the *molecules* together. And somewhere in this ancient ocean the miracle of life began... *The first organized form of primitive life was a tiny protozoan [a one-celled animal]*. Millions of protozoa populated the ancient seas. These early organisms were completely self-sufficient in their sea-water world. *They moved about their aquatic environment feeding on bacteria and other organisms...* From these one-celled organisms evolved all life on earth (from the Emmy award winning PBS NOVA film *The Miracle of Life*; quoted in Hanegraaff, 1998, p. 70, emphasis in original).

Science textbook authors Wynn and Wiggins describe the abiogenesis process currently accepted by Darwinists:

Aristotle believed that decaying material could be transformed by the “spontaneous action of Nature” into living animals. His hypothesis was ultimately rejected, but... Aristotle’s hypothesis has been replaced by *another* spontaneous generation hypothesis, one that requires billions of years to go from the molecules of the universe to cells, and then, via random mutation/natural selection, from cells to the variety of organisms living today. This version, which postulates chance happenings eventually leading to the phenomenon of life, is biology’s Theory of Evolution (1997, p. 105).

The question on which this paper focuses is “How much evidence exists for this view of life’s origin?” When Darwinists discuss “missing links” they often imply that relatively few links are missing in what is a rather complete chain which connects the putative chemical precursors of life that is theorized to have existed an estimated 3.5 billion years ago to all life forms existing today. Standen noted a half century ago that the term “missing link” is misleading because it suggests that only *one* link is missing whereas it is more accurate to state that *so many links are missing* that it is not evident whether there was ever a chain (Standen, 1950, p. 106). This assertion now has been well documented by many creationists and others (see Bergman, 1998; Gish, 1995; Lubenow, 1994, 1992; Rodabaugh, 1976; and Moore, 1976).

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Scientists not only have been unable to find a *single undisputed link* that clearly connects *two of the hundreds of major family groups*, but they have not even been able to produce a plausible starting point for their hypothetical evolutionary chain (Shapiro, 1986). The first links—actually the first hundreds of thousands or more links that are required to produce life—still are missing (Behe, 1996, pp. 154–156)! Horgan concluded that if he were a creationist today he would focus on the origin of life because this

...is by far the weakest strut of the chassis of modern biology. The origin of life is a science writer's dream. It abounds with exotic scientists and exotic theories, which are never entirely abandoned or accepted, but merely go in and out of fashion (1996, p. 138).

The major links in the molecules-to-man theory that must be bridged include (a) evolution of simple molecules into complex molecules, (b) evolution of complex molecules into simple organic molecules, (c) evolution of simple organic molecules into complex organic molecules, (d) eventual evolution of complex organic molecules into DNA or similar information storage molecules, and (e) eventually evolution into the first cells. This process requires multimillions of links, all which either are missing or controversial. Scientists even lack plausible just-so stories for most of evolution. Furthermore the parts required to provide life clearly have specifications that rule out most substitutions.

In the entire realm of science no class of molecule is currently known which can remotely compete with proteins. *It seems increasingly unlikely that the abilities of proteins could be realized to the same degree in any other material form.* Proteins are not only unique, but give every impression of being ideally adapted for their role as the universal constructor devices of the cell ... Again, we have an example in which the only feasible candidate for a particular biological role gives every impression of being supremely fit for that role (Denton, 1998, p. 188, emphasis in original).

The logical order in which life developed is hypothesized to include the following basic major stages:

1. Certain simple molecules underwent spontaneous, random chemical reactions until after about half-a-billion years complex organic molecules were produced.
2. Molecules that could replicate eventually were formed (the most common guess is nucleic acid molecules), along with enzymes and nutrient molecules that were surrounded by membraned cells.
3. Cells eventually somehow “learned” how to reproduce by copying a DNA molecule (which contains a complete set of instructions for building a next generation of cells). During the reproduction process,

the mutations changed the DNA code and produced cells that differed from the originals.

4. The variety of cells generated by this process eventually developed the machinery required to do all that was necessary to survive, reproduce, and create the next generation of cells in their likeness. Those cells that were better able to survive became more numerous in the population (adapted from Wynn and Wiggins, 1997, p. 172).

The problem of the early evolution of life and the unfounded optimism of scientists was well put by Dawkins. He concluded that Earth's chemistry was different on our early, lifeless, planet, and that at this time there existed

...no life, no biology, only physics and chemistry, and the details of the Earth's chemistry were very different. Most, though not all, of the informed speculation begins in what has been called the primeval soup, a weak broth of simple organic chemicals in the sea. Nobody knows how it happened but, somehow, without violating the laws of physics and chemistry, a molecule arose that just happened to have the property of self-copying—a replicator. This may seem like a big stroke of luck... Freakish or not, this kind of luck does happen... [and] it had to happen only once... What is more, as far as we know, it may have happened on only one planet out of a billion billion planets in the universe. Of course many people think that it actually happened on lots and lots of planets, but we only have *evidence* that it happened on one planet, after a lapse of half a billion to a billion years. So the sort of lucky event we are looking at *could* be so wildly improbable that the chances of its happening, somewhere in the universe, could be as low as one in a billion billion billion in any one year. If it *did* happen on only one planet, anywhere in the universe, that planet has to be our planet—because here we are talking about it (Dawkins, 1996, pp. 282–283, emphasis in original).

The Evidence for the Early Steps of Evolution

The first step in evolution was the development of simple self-copying molecules consisting of carbon dioxide, water and other inorganic compounds. No one has proven that a simple self-copying molecule can self-generate a compound such as DNA. Nor has anyone been able to create one in a laboratory or even on paper. The hypothetical weak “primeval soup” was not like soups experienced by humans but was highly diluted, likely close to pure water. The process is described as life having originated spontaneously from organic compounds in the oceans of the primitive Earth. The proposal assumes

that primitive oceans contained large quantities of simple organic compounds that reacted to form structures of greater and greater complexity, until there arose a structure that we would call living. In other words, the first living organism developed by means of a series of nonbiological steps, none of which would be highly improbably on the basis of what is known today. This theory, [was] first set forth clearly by A.I. Oparin (1938) ... (Newman, 1967, p. 662).

An astounding number of speculations, models, theories and controversies still surround every aspect of the origin of life problem (Lahav 1999). Although some early scientists proposed that "organic life ... is eternal," most realized it must have come "into existence at a certain period in the past" (Haeckel, 1905, p. 339). It now is acknowledged that the first living organism could not have arisen directly from inorganic matter (water, carbon dioxide, and other inorganic nutrients) even as a result of some extraordinary event. Before the explosive growth of our knowledge of the cell during the last 30 years, it was known that "the simplest bacteria are extremely complex, and the chances of their arising directly from inorganic materials, with no steps in between, are too remote to consider seriously." (Newman, 1967, p. 662). Most major discoveries about cell biology and molecular biology have been made since then.

Search for the Evidence of Earliest Life

Theories abound, but no direct evidence for the beginning of the theoretical evolutionary climb of life up what Richard Dawkins and many evolutionists call "mount improbable" ever has been discovered (Dawkins, 1996). Nor have researchers been able to develop a plausible theory to explain how life *could* evolve from non-life. Many equally implausible theories now exist, most of which are based primarily on speculation. The ancients believed life originated by spontaneous generation from inanimate matter or once living but now dead matter. Aristotle even believed that under the proper conditions putatively "simple" animals such as worms, fleas, mice, and dogs could spring to life spontaneously from moist "Mother Earth."

The spontaneous generation of life theory eventually was proved false by hundreds of research studies such as the 1668 experiment by Italian physician Francesco Redi (1626–1697). In one of the first controlled biological experiments, Redi proved that maggots appeared in meat *only* after flies had deposited their eggs on it (Jenkins-Jones, 1997). Maggots do not spontaneously generate on their own as previously believed by less rigorous experimenters.

Despite Redi's evidence, however, the belief in spontaneous generation of life was so strong in the 1600s that even Redi continued to believe that spontaneous generation could occur *in certain instances*. After the microscope proved the existence of bacteria in 1683, many scientists concluded that these "simple" microscopic organisms must have "spontaneously generated," thereby providing evolution with its beginning. Pasteur and other researchers, though, soon disproved this idea, and the fields of microbiology and biochemistry have since documented quite eloquently the enormous complexity of these compact living creatures (Black, 1998).

Nearly all biologists were convinced by the latter half of the nineteenth century that spontaneous generation of all types of living organisms was impossible (Bergman, 1993a). Now that naturalism dominates science, Darwinists reason that at least one spontaneous generation of life event *must* have occurred in the distant past because no other naturalistic origin-of-life method exists aside from panspermia, which only moves the spontaneous generation of life event elsewhere (Bergman, 1993b). As theism was filtered out of science, spontaneous generation gradually was resurrected in spite of its previous defeat. The solution was to add a large amount of time to the broth:

Aristotle believed that decaying material could be transformed by the "spontaneous action of Nature" into living animals. His hypothesis was ultimately rejected, but, in a way, he might not have been completely wrong. Aristotle's hypothesis has been replaced by *another* spontaneous generation hypothesis, one that requires billions of years to go from the molecules of the universe to cells, and then, *via random mutation/natural selection*, from cells to the variety of organisms living today. This version, which postulates chance happenings eventually leading to the phenomenon of life, is biology's Theory of Evolution (Wynn and Wiggins, 1997, p. 105, emphasis mine).

Although this view now is widely accepted among evolutionists, no one has been able to locate convincing fossil (or other) evidence to support it. The plausibility of abiogenesis has changed greatly in recent years due to research in molecular biology that has revealed exactly how complex life is, and how much evidence exists against the probability of spontaneous generation. In the 1870s and 1880s scientists believed that devising a plausible explanation for the origin of life

would be fairly easy. For one thing, they assumed that life was essentially a rather simple substance called protoplasm that could be easily constructed by combining and recombining simple chemicals such as carbon dioxide, oxygen, and nitrogen (Meyer, 1996, p. 25).

The German evolutionary biologist Ernst Haeckel (1925) even referred to monera cells as simple homogeneous globules of plasm. Haeckel believed that a living cell about as complex as a bowl of Jell-o® could exist, and his origin of life theory reflected this completely erroneous view. He even concluded that cell “autogony” (the term he used to describe living things’ ability to reproduce) was similar to the process of inorganic crystallization. In his words:

The most ancient organisms which arose by spontaneous generation—the original parents of all subsequent organisms—must necessarily be supposed to have been Monera—simple, soft, albuminous lumps of plasma, without structure, without any definite form, and entirely without any hard and formed parts.

About the same time T. H. Huxley proposed a simple two-step method of chemical recombination that he thought could explain the origin of the first living cell. Both Haeckel and Huxley thought that just as salt could be produced spontaneously by mixing powdered sodium metal and heated chlorine gas, a living cell could be produced by mixing the few chemicals they believed were required. Haeckel taught that the basis of life is a substance called “plasm,” and this plasm constitutes

the material foundations of the phenomena of life ... All the other materials that we find in the living organism are products or derivatives of the active plasm: In view of the extraordinary significance which we must assign to the plasm—as the universal vehicle of all the vital phenomena [or as Huxley said “the physical basis of life”]—it is very important to understand clearly all its properties, especially the chemical ones ... In every case where we have with great difficulty succeeded in examining the plasm as far as possible and separating it from the plasma-products, it has the appearance of a colorless, viscous substance, the chief physical property of which is its peculiar thickness and consistency ... Active living protoplasm ... is best compared to a cold jelly or solution of glue (1905 pp. 121,123).

Once the brew was mixed, eons of time allowed spontaneous chemical reactions to produce the simple “protoplasmic substance” that scientists once assumed to be the essence of life (Meyer, 1996, p. 25). As late as 1928, the germ cell still was thought to be relatively simple and

...no one now questions that individual development everywhere consists of progress from a relatively simple to a relatively complex form. Development is not the unfolding of an infolded organism; it is the formation of new structures and functions by combinations and transformations of the relatively simple structures and functions of the germ cells (Conklin, 1928, pp. 63–64).

Cytologists now realize that a living cell contains hundreds of thousands of different complex parts such as various motor proteins that are assembled to produce the most complex “machine” in the Universe—a machine far more complex than the most complex Cray super computer. We now also realize after a century of research that the eukaryote protozoa thought to be as simple as a bowl of gelatin in Darwin’s day actually are enormously more complex than the prokaryote cell. Furthermore, molecular biology has demonstrated that the basic design of the cell is

essentially the same in all living systems on earth from bacteria to mammals... In terms of their basic biochemical design... no living system can be thought of as being primitive or ancestral with respect to any other system, nor is there the slightest empirical hint of an evolutionary sequence among all the incredibly diverse cells on earth (Denton, 1986, p. 250).

This is a major problem for Darwinism because life at the cellular level generally does not reveal a gradual increase in complexity as it ascends the evolutionary ladder from protozoa to humans. The reason that all cells are basically alike is because the basic biochemical requirements and constraints for all life are the same:

A curious similarity underlies the seemingly varied forms of life we see on the earth today: the most central molecular machinery of modern organisms has always been found to be essentially the same. This unity of biochemistry has surely been one of the great discoveries of the past 100 years (Cairns-Smith, 1985, p. 90).

The most critical gap that must be explained is that between life and non-life because

Cells and organisms are very complex... [and] there is a surprising uniformity among living things. We know from DNA sequence analyses that plants and higher animals are closely related, not only to each other, but to relatively simple single-celled organisms such as yeasts. Cells are so similar in their structure and function that many of their proteins can be interchanged from one organism to another. For example, yeast cells share with human cells many of the central molecules that regulate their cell cycle, and several of the human proteins will substitute in the yeast cell for their yeast equivalents! (Alberts, 1992, p. xii).

The *belief* that spontaneous regeneration, while admittedly very rare, is still attractive as illustrated by Sagan and Leonard’s conclusion, “Most scientists agree that life will appear spontaneously in any place where conditions remain sufficiently favorable for a very long time” (1972, p. 9). This claim then is followed by an admission from Sagan and Leonard that raises doubts not only about abiogenesis, but about Darwinism generally, namely, “this

conviction [about the origin of life] is based on inferences and extrapolations." The many problems, inferences, and extrapolations needed to create abiogenesis just-so stories once were candidly admitted by Dawkins:

An origin of life, anywhere, consists of the chance arising of a self-replicating entity. Nowadays, the replicator that matters on Earth is the DNA molecule, but the original replicator probably was not DNA. We don't know what it was. Unlike DNA, the original replicating molecules cannot have relied upon complicated machinery to duplicate them. Although, in some sense, they must have been equivalent to "Duplicate me" instructions, the "language" in which the instructions were written was not a highly formalized language such that only a complicated machine could obey them. The original replicator cannot have needed elaborate decoding, as DNA instructions... do today. Self-duplication was an inherent property of the entity's structure just as, say, hardness is an inherent property of a diamond... the original replicators, unlike their later successors the DNA molecules, did not have complicated decoding and instruction-obeying machinery, because complicated machinery is the kind of thing that arises in the world only after many generations of evolution. And evolution does not get started until there are replicators. In the teeth of the so-called "Catch-22 of the origin of life"... the original self-duplicating entities must have been simple enough to arise by the spontaneous accidents of chemistry (1996, p. 285).

The method used in constructing these hypothetical replicators is not stated, nor has it ever been demonstrated to exist either in the laboratory or on paper. The difficulties of terrestrial abiogenesis are so great that some evolutionists have hypothesized that life could not have originated on earth but must have been transported here from another planet via star dust, meteors, comets, or spaceships (Bergman, 1993b)! As noted above, panspermia does not solve the origin of life problem though, but instead moves the abiogenesis problem elsewhere. Furthermore, since so far as we know no living organism can survive very long in space because of cosmic rays and other radiation, "this theory is ... highly dubious, although it has not been disproved; also, it does not answer the question of where or how life did originate" (Newman, 1967, p. 662).

Darwin evidentially recognized how serious the abiogenesis problem was for his theory, and once even conceded that all existing terrestrial life must have descended from some primitive life form that was called into life "by the Creator" (1900, p. 316). But to admit, as Darwin did, the possibility of *one or a few creations is to open the door to the possibility of many or even thousands!* If God made one animal type, He also could have made two or many thousands of different types. No contemporary hypothesis today

has provided a viable explanation as to how the abiogenesis origin of life could occur by naturalistic means. The problems are so serious that the majority of evolutionists today tend to shun the whole subject of abiogenesis.

History of Modern Abiogenesis Research

The "warm soup" theory, still the most widely held theory of abiogenesis among evolutionists, was developed most extensively by Russian scientist A.I. Oparin in the 1920s. The theory held that life evolved when organic molecules rained into the primitive oceans from an atmospheric soup of chemicals interacting with solar energy. Later Haldane (1928), Bernal (1947) and Urey (1952) published their research to try to support this model, all with little success. Then came what some felt was a breakthrough by Harold Urey and his graduate student Stanley Miller in the early 1950s.

The most famous origin of life experiment was completed in 1953 by Stanley Miller at the University of Chicago. At the time Miller was a 23-year-old graduate student working under Urey who was trying to recreate in his laboratory the conditions then thought to have preceded the origin of life. The Miller/Urey experiments involved filling a sealed glass apparatus with methane, ammonia, hydrogen gases (representing what they thought composed the early atmosphere) and water vapor (to simulate the ocean). Next, they used a spark-discharge device to strike the gases in the flask with simulated lightning while a heating coil kept the water boiling. Within a few days, the water and gas mix produced a reddish stain on the sides of the flask. After analyzing the substances that had been formed, they found several types of amino acids. Eventually Miller and other scientists were able to produce 10 of the 20 amino acids required for life by techniques similar to the original Miller/Urey experiments.

Urey and Miller assumed that the results were significant because some of the organic compounds produced were the building blocks of proteins, the basic structure of all life (Horgan, 1996, p. 130). Although widely heralded by the press as "proving" the origin of life could have occurred on the early earth under natural conditions without intelligence, the experiment actually provided compelling evidence for exactly the opposite conclusion. For example, equal quantities of both right- and left-handed organic molecules always were produced by the Urey/Miller procedure. In real life, nearly all amino acids found in proteins are left handed, almost all polymers of carbohydrates are right handed, and the opposite type can be toxic to the cell. In a summary the famous Urey/Miller origin-of-life experiment, Horgan concluded:

Miller's results seem to provide stunning evidence that life could arise from what the British

chemist J.B.S. Haldane had called the “primordial soup.” Pundits speculated that scientists, like Mary Shelley’s Dr. Frankenstein, would shortly conjure up living organisms in their laboratories and thereby demonstrate in detail how genesis unfolded. It hasn’t worked out that way. In fact, almost 40 years after his original experiment, Miller told me that solving the riddle of the origin of life had turned out to be more difficult than he or anyone else had envisioned (1996, p. 138).

The reasons why creating life in a test tube turned out to be far more difficult than Miller or anyone else expected are numerous and include the fact that scientists now know that the complexity of life is far greater than Miller or anyone else in pre-DNA revolution 1953 ever imagined. Actually life is far more complex and contains far more information than anyone in the 1980s believed possible. In an interview with Miller, now considered one of “the most diligent and respected origin-of-life researchers,” Horgan reported that after Miller completed his 1953 experiment, he

...dedicated himself to the search for the secret of life. He developed a reputation as both a rigorous experimentalist and a bit of a curmudgeon, someone who is quick to criticize what he feels is shoddy work....he fretted that his field still had a reputation as a fringe discipline, not worthy of serious pursuit.... Miller seemed unimpressed with any of the current proposals on the origin of life, referring to them as “nonsense” or “paper chemistry.” He was so contemptuous of some hypotheses that, when I asked his opinion of them, he merely shook his head, sighed deeply, and snickered—as if overcome by the folly of humanity. Stuart Kauffman’s theory of autocatalysis fell into this category. “Running equations through a computer does not constitute an experiment,” Miller sniffed. Miller acknowledged that scientists may never know precisely where and when life emerged. “We’re trying to discuss a historical event, which is very different from the usual kind of science, and so criteria and methods are very different,” he remarked... (Horgan, 1996, p. 139).

The major problem of Miller’s experiment is well put by Davies,

Making the building blocks of life is easy—amino acids have been found in meteorites and even in outer space. But just as bricks alone don’t make a house, so it takes more than a random collection of amino acids to make life. Like house bricks, the building blocks of life have to be assembled in a very specific and exceedingly elaborate way before they have the desired function (Davies, 1999, p. 28).

We now realize that the Urey/Miller experiments did not produce evidence for abiogenesis because, although

amino acids are the building blocks of life, the key to life is information (Pigliucci, 1999; Dembski, 1998). Natural objects in forms resembling the English alphabet (circles, straight lines and similar) abound in nature, but this does not help us to understand the origin of information (such as that in Shakespeare’s plays) because this task requires intelligence both to create the information (the play) and then to translate that information into symbols. What must be explained is the *source of the information* in the text (the words and ideas), not the existence of circles and straight lines. Likewise, the information contained in the genome must be explained (Dembski, 1998). Complicating the situation is the fact that

research has since drawn Miller’s hypothetical atmosphere into question, causing many scientists to doubt the relevance of his findings. Recently, scientists have focused on an even more exotic amino acid source: meteorites. Chyba is one of several researchers who have evidence that extraterrestrial amino acids may have hitched a ride to Earth on far flung space rocks (Simpson, 1999, p. 26).

Yet another difficulty is, even if the source of the amino acids and the many other compounds needed for life could be explained, it still must be explained as to how these many diverse elements became aggregated in the same area and then properly assembled themselves. This problem is a major stumbling block to any theory of abiogenesis:

...no one has ever satisfactorily explained how the widely distributed ingredients linked up into proteins. Presumed conditions of primordial Earth would have driven the amino acids toward lonely isolation. That’s one of the strongest reasons that Wächtershäuser, Morowitz, and other hydrothermal vent theorists want to move the kitchen [that cooked life] to the ocean floor. If the process starts down deep at discrete vents, they say, it can build amino acids—and link them up—right there (Simpson, 1999, p. 26).

Several recent discoveries have led some scientists to conclude that life may have arisen in submarine vents whose temperatures approach 350° C. Unfortunately for both warm pond and hydrothermal vent theorists, heat may be the downfall of their theory.

Heat and Biochemical Degradation Problems

Charles Darwin’s hypothesis that life first originated on earth in a warm little pond somewhere on a primitive earth has been used widely by most nontheists for over a century in attempts to explain the origin of life. Several reasons exist for favoring a warm environment for the start of life on

earth. A major reason is that the putative oldest known organisms on earth are alleged to be hyperthermophiles that require temperatures between 80° and 110° C in order to thrive (Levy and Miller, 1998). In addition some atmospheric models have concluded that the surface temperature of the early earth was much higher than it is today.

A major drawback of the "warm little pond" origin-of-life theory is its apparent ability to produce sufficient concentrations of the many complex compounds required to construct the first living organisms. These compounds must be sufficiently stable to insure that the balance between synthesis and degradation favors synthesis (Levy and Miller, 1998). The warm pond and hot vent theories also have been seriously disputed by experimental research that has found the half-lives of many critically important compounds needed for life to be far "too short to allow for the adequate accumulation of these compounds" (Levy and Miller, 1998, p. 7933). Furthermore, research has documented that "unless the origin of life took place extremely rapidly (in less than 100 years), we conclude that a high temperature origin of life... cannot involve adenine, uracil, guanine or cytosine" because these compounds break down far too fast in a warm environment. In a hydrothermal environment, most of these compounds could neither form in the first place, nor exist for a significant amount of time (Levy and Miller, p. 7933).

As Levy and Miller explain, "the rapid rates of hydrolysis of the nucleotide bases A,U,G and T at temperatures much above 0° Celsius would present a major problem in the accumulation of these presumed essential components on the early earth" (p. 7933). For this reason, Levy and Miller postulated that either a two-letter code or an alternative base pair was used instead. This requires the development of an entirely *different kind* of life, a conclusion that is not only highly speculative, but likely impossible because no other known compounds have the required properties for life that adenine, uracil, guanine and cytosine possess. Furthermore, this would require life to evolve based on a hypothetical two-letter code or alternative base pair system. Then life would have to *re-evolve* into a radically new form based on the present code, a change that appears to be impossible according to our current understanding of molecular biology.

Furthermore, the authors found that, given the minimal time perceived to be necessary for evolution to occur, cytosine is unstable *even at temperatures as cold as 0° C*. Without cytosine neither DNA or RNA can exist. One of the main problems with Miller's theory is that his experimental methodology has not been able to produce much more than a few amino acids which actually lend little or no insight into possible mechanisms of abiogenesis.

Even the simpler molecules are produced only in small amounts in realistic experiments simulating

possible primitive earth conditions. What is worse, these molecules are generally minor constituents of tars: It remains problematical how they could have been separated and purified through geochemical processes whose normal effects are to make organic mixtures more and more of a jumble. With somewhat more complex molecules these difficulties rapidly increase. In particular a purely geochemical origin of nucleotides (the subunits of DNA and RNA) presents great difficulties. In any case, nucleotides have not yet been produced in realistic experiments of the kind Miller did. (Cairns-Smith, 1985, p. 90).

Postulating alternative codes for an origin-of-life event at temperatures close to the freezing point of water is a rationalization designed to overcome what appears to be a set of insurmountable problems for the abiogenesis theory. Given these problems, why do so many biologists believe that life on earth originated by spontaneous generation under favorable conditions? Yockey concludes that although Miller's paradigm was at one time

worth consideration, now the entire effort in the primeval soup paradigm is self-deception based on the ideology of its champions... The history of science shows that a paradigm, once it has achieved the status of acceptance (and is incorporated in textbooks) and regardless of its failures, is declared invalid only when a new paradigm is available to replace it ... It is a characteristic of the true believer in religion, philosophy and ideology that he must have a set of beliefs, come what may... There is no reason that this should be different in the research on the origin of life ...Belief in a primeval soup on the grounds that no other paradigm is available is an example of the logical *fallacy of the false alternative*... (Yockey, 1992, p. 336 emphasis in original).

The many problems with the warm soup model have motivated the development of many other abiogenesis models. One is the cold temperature model that is gaining in acceptance as the flaws of the hot model become more obvious. As Vogel notes, many researchers still

argue that the first cells arose in the scalding waters of hot springs or geothermal vents, while a small but prominent band of holdouts insists on cool pools or even cold oceans. With no fossils to go by, the argument has circled a variety of indirect clues ... But now ... comes good news from the cold camp: Evidence from the genes of living organisms suggests that the cell that gave rise to all of today's life-forms was ill-suited for extremely hot conditions (Vogel, 1999, p. 155).

Based on a geochemical assessment, Thaxton, Bradley, and Olsen (1984 p. 66) concluded that in the atmosphere

the “many destructive interactions would have so vastly diminished, if not altogether consumed, essential precursor chemicals, that chemical evolution rates would have been negligible” in the various water basins on the primitive earth. They concluded that the “soup” would have been far too diluted for direct polymerization to occur. Even local ponds where some concentrating of soup ingredients may have occurred would have met with the same problem.

Furthermore, no geological evidence indicates an organic soup, even a small organic pond, ever existed on this planet. It is becoming clear that however life began on earth, the usually conceived notion that life emerged from an oceanic soup of organic chemicals is a most implausible hypothesis. We may therefore with fairness call this scenario “the myth of the prebiotic soup” (Thaxton, Bradley, and Olsen, 1984, p. 66).

It also is theorized that life must have begun in clay because the “clay-life” explanation explains several problems not explained by the “primordial soup” theory. Graham Cairns-Smith of the University of Scotland first proposed the clay-life theory about 40 years ago, and many scientists have since come to believe that life on earth must have begun from clay rather than in the the warm little pond as proposed by Darwin. The clay-life theory holds that an accumulation of chemicals produced in clay by the sun eventually led to the hypothetical self-replicating molecules that evolved into cells and then eventually into all life forms on earth today.

The theory argues that only clay has the two essential properties necessary for life: the capacity to both store and transfer energy. Furthermore, because some clay components have the ability to act as catalysts, clay is capable of some of the same lifelike attributes as those exhibited by enzymes. Additionally the mineral structure of certain clays are almost as intricate as some organic molecules. However, the clay theory suffered from its own set of problems, and as a result has been discarded by most theorists. At the very least, the Stanley Miller experiments proved that amino acids can be formed under certain conditions. The clay theory has yet to achieve even this much. As a result, Miller’s experiments continue to be cited because no other viable source exists for the production of amino acids. Now, the hot thermal vent theory is being discussed once again by many as an alternative although, as noted above, it too suffers from potentially lethal problems.

What is Needed to Produce Life

Naturalism requires enormously long periods of time to allow non-living matter to evolve into the hypothetical speck of viable protoplasm needed to start the process that results in life. Even *more* time is needed to evolve the protoplasm

into the enormous variety of highly organized complex life forms that have been found in Cambrian rocks. Neo-Darwinism suggests that life originated over 3.5 billion years ago, yet a rich fossil record for less than roughly 600 million years commonly is claimed. Consequently, almost all the record is missing, and evidence for the most critical two billion years of evolution is sparse at best with what little actually exists being highly equivocal.

A major issue then, in abiogenesis is “what is the *minimum* number of possible parts that allows something to live?” The number of parts needed is large, but how large is difficult to determine. In order to be considered “alive,” an organism must possess the ability to metabolize and assimilate food, to respire, to grow, to reproduce and to respond to stimuli (a trait known as irritability). These criteria were developed by biologists who were trying to understand the process we call life. Although these criteria are not perfect, they are useful in spite of cases that seem to contradict our definition. A mule, for instance, cannot usually reproduce but clearly is alive, and a crystal can “reproduce” but clearly is not alive. One attempt by an evolutionist to determine what is needed in order to self-replicate produced the following conclusions:

If we ditch the selfish-replicator illusion, and accept that the only known biological entity capable of autonomous replication is the cell (full of cooperating genes and proteins, etc.)... DNA replication is so error-prone that it needs the prior existence of protein enzymes to improve the copying fidelity of a gene-size piece of DNA. “Catch-22,” say Maynard Smith and Szathmary. So, wheel on RNA with its now recognized properties of carrying both informational and enzymatic activity, leading the authors to state: “In essence, the first RNA molecules did not need a protein polymerase to replicate them; they replicated themselves.” Is this a fact or a hope? I would have thought it relevant to point out for ‘biologists in general’ that not one self-replicating RNA has emerged to date from quadrillions (10^{24}) of artificially synthesized, random RNA sequences (Dover, 1999, p. 218).

The cell, then appears to be the only biological entity that self-reproduces and simultaneously possesses the other traits required for life. The question then becomes “What is the *simplest* cell that can exist?”

Many bacteria and all viruses possess less complexity than required for an organism normally defined as “living,” and for this reason must live as parasites which require the existence of complex cells in order to reproduce. For this reason Trefil noted that the question of where viruses come from is an “enduring mystery” in evolution. Viruses usually are much smaller than parasitic bacteria and are not considered alive because they must rely on their host even more than bacteria do. Viruses consist primarily

of a coat of proteins surrounding DNA or RNA that contains a handful of genes, and since they do not

... reproduce in the normal way, it's hard to see how they could have gotten started. One theory: they are parasites who, over a long period of time, have lost the ability to reproduce independently... Viruses are among the smallest of "living" things. A typical virus, like the one that causes ordinary influenza, may be no more than a thousand atoms across. This is in comparison with cells which may be hundreds or even thousands of times that size. Its small size is one reason that it is so easy for a virus to spread from one host to another—it's hard to filter out anything that small (Trefil, 1992, p. 91).

In order to reproduce, a virus's genes must invade a living cell and take control of its much larger DNA. A bacterium is 400 times greater in size than the smallest known virus, while a typical human cell averages 200 times larger than the smallest known bacterium. The QB virus is only 24 nanometers long, contains only 3 genes and is almost 20 times smaller than *Escherichia coli*, billions of which inhabit the human intestines. *E. coli* is 1,000 nanometers long compared to a typical human cell that is about 10,000 nanometers long (1 nanometer equals 1 billionth of a meter, or about 1/25-millionths of an inch) and contains an estimated 100,000 genes. Researchers have detected microbes in human and bovine blood that are only 2-millionths of an inch in diameter, but these organisms cannot live on their own because they need more than simple inorganic, or common inorganic molecules to survive.

Since parasites lack many of the genes (and other biological machinery) required to survive on their own, in order to grow and reproduce they must obtain the nutrients and other services they require from the organisms that serve as their hosts. Independent free-living creatures such as people, mice and roses are far more complex than organisms like parasites and viruses that are dependent on these complex free-living organisms. Abiogenesis theory requires that the first life forms consisted of free-living autotrophs (i.e. organisms that are able to manufacture their own food) since the complex life forms needed to sustain heterotrophs (organisms that cannot manufacture their own food) did not exist until later.

Most extremely small organisms existing today are dependent on other, more complex organisms. Some organisms can overcome their lack of size and genes by borrowing genes from their hosts or by gorging on a rich broth of organic chemicals like blood. Some microbes live in colonies in which different members provide different services. Unless one postulates the unlikely scenario of the simultaneous spontaneous generation of *many different organisms*, one has to demonstrate the evolution of an organism that can survive on its own, or with others like itself, as a symbiont or cannibal. Consequently, the putative first

life forms must have been much more complex than most examples of "simple" life known to exist today.

The simplest microorganisms, Chlamydia and Rickettsia, are the smallest living things known, but also are both parasites and thus too simple to be the first life. Only a few hundred atoms across, they are smaller than the largest virus and have about half as much DNA as do other species of bacteria. Although they are about as small as possible and still be living, these two forms of life still possess the millions of atomic parts necessary to carry out the biochemical functions required for life, yet they still are too simple to live on their own and thus must use the cellular machinery of a host in order to live (Trefil, 1992, p. 28). Many of the smaller bacteria are not free living, but are parasite like viruses that can live only with the help of more complex organisms (Galtier et al., 1999).

The gap between non-life and the simplest cell is illustrated by what is believed to be the organism with the smallest known genome of any free living organism *Mycoplasma genitalium* (Fraser et al., 1995). *M. genitalium* is 200 nanometers long and contains only 482 genes or over 0.5 million base pairs which compares to 4,253 genes for *E. coli* (about 4,720,000 nucleotide base pairs), with each gene producing an enormously complex protein machine (Fraser et al., 1995). *M. genitalium* also must live off other life because they are too simple to live on their own. They invade reproductive tract cells and live as parasites on organelles that are far larger and more complicated but which must *first* exist for the survival of parasitic organisms to be possible. The first life therefore must be much more complex than *M. genitalium* even though it is estimated to manufacture about 600 different proteins. A typical eukaryote cell consists of an estimated 40,000 different protein molecules and is so complex that to acknowledge that the "cells exist at all is a marvel... even the simplest of the living cells is far more fascinating than any human-made object" (Alberts, 1992, pp. xii, xiv).

M. genitalium is one-fifth the size of *E. coli* but four times larger than the putative nanobacteria. Blood nanobacteria are only 50 nanometers long (which is smaller than some viruses), and possess a currently unknown number of genes. When Finnish biologist Olavi Kajander discovered nanobacteria in 1998, he called them a "bizarre new form of life." Nanobacteria now are speculated to resemble primitive life forms which presumably arose in the postulated chemical soup that existed when earth was young. Kajander concluded that nanobacteria may serve as a model for primordial life, and that their modern-day primordial soup is blood. Actually, nanobacteria cannot be the smallest form of life because they evidently are parasites and primordial life must be able to live independently. Like viruses they are not considered alive but are of intense medical interest because they may be one cause of kidney stones (Kajander and Ciftcioglu, 1998). Other re-

searchers think these bacteria are only a degenerate form of larger bacteria.

For these reasons, when researching the minimum requirements needed to live the example of *E. coli* is more realistic. Most bacteria require several thousand genes to carry out the minimum functions necessary for life. Denton notes that even though the tiniest bacterial cells are incredibly small, weighing under 10^{-12} grams, each bacterium is a

veritable micro-miniaturized factory containing thousands of exquisitely designed pieces of intricate molecular machinery, made up altogether of one hundred thousand million atoms, far more complicated than any machine built by man and absolutely without parallel in the non-living world (Denton, 1986, p. 250).

The simplest form of life requires millions of parts at the atomic level, and the higher life forms require trillions. Furthermore, the many macromolecules necessary for life are constructed of even smaller parts called elements. That life requires a certain minimum number of parts is well documented; the only debate now is *how many* millions of functionally integrated parts are necessary. The minimum number may not produce an organism that can survive long enough to effectively reproduce. Schopf notes that simple life without complex repair systems to fix damaged genes and their protein products stand little chance of surviving. When a mutation occurs

cells like those of humans with two copies of each gene can often get by with one healthy version. But a mutation can be deadly if it occurs in an organism with only a single copy of its genes, like many primitive forms of life.... (Schopf, 1999, p. 102)

Therefore, the answer to our original question, "What is the smallest form of nonparasitic life?" probably is an organism close to size and complexity of *E. Coli*, possibly even larger. No answer is currently possible because we have much to learn about what is required for life. As researchers discover new exotic "life" forms thriving in rocks, ice, acid, boiling water and other extreme environments, they are finding the biological world to be much more complex than assumed merely a decade ago. The oceans now are known to be teeming with microscopic cells which form the base of the food chain on which fish and other larger animals depend. It now is estimated that small, free-living aquatic bacteria make up about *one-half* of the entire biomass of the oceans (MacAyeal, 1995).

Many highly complex animals appear very early in the fossil record and many "simple" animals thrive today. The earliest fossils known, which are believed to be those of cyanobacteria, are quite similar structurally and biochemically to bacteria living today. Yet it is claimed they thrived almost as soon as earth formed (Schopf, 1993; Galtier et al., 1999). Estimated at 3.5 billion years old, these earliest

known forms of life are incredibly complex. Furthermore, remarkably diverse types of animals existed very early in earth history and no less than eleven different species have been found so far. A concern Corliss raises is "why after such rapid diversification did these microorganisms remain essentially unchanged for the next 3.465 billion years? Such stasis, common in biology, is puzzling" (1993, p. 2). *E. coli*, as far as we can tell, is the same today as in the fossil record.

Probability Arguments

As Coppedge (1973) notes, even 1) postulating a primordial sea with every single component necessary for life, 2) speeding up the bonding rate so as to form different chemical combinations a trillion times more rapidly than hypothesized to have occurred, 3) allowing for a 4.6 billion-year-old earth and 4) using all atoms on the earth still leaves the probability of a single protein molecule being arranged by chance is 1 in 10,261. Using the lowest estimate made before the discoveries of the past two decades raised the number several fold. Coppedge estimates the probability of 1 in $10^{119,879}$ is necessary to obtain the minimum set of the required estimate of 239 protein molecules for the smallest theoretical life form.

At this rate he estimates it would require $10^{119,831}$ years on the average to obtain a set of these proteins by naturalistic evolution (1973, pp. 110, 114). The number he obtained is $10^{119,831}$ greater than the current estimate for the age of the earth (4.6 billion years). In other words, this event is outside the range of probability. Natural selection cannot occur until an organism exists and is able to reproduce which requires that the first complex life form first exist as a functioning unit.

In spite of the overwhelming empirical and probabilistic evidence that life could not originate by natural processes, evolutionists possess an unwavering belief that some day they will have an answer to how life could spontaneously generate. Nobel laureate Christian de Duve (1995) argues that life is the product of law-driven chemical steps, each one of which must have been highly probable in the right circumstances. This reliance upon an unknown "law" favoring life has been postulated to replace the view that life's origin was a freakish accident unlikely to occur anywhere, is now popular. Chance is now out of favor in part because it has become clear that even the simplest conceivable life form (still much simpler than any actual organism) would have to be so complex that accidental self-assembly would be nothing short of miraculous even in two billion years (Spetner, 1997). Furthermore, natural selection cannot operate until biological reproducing units exist. This hoped for "law," though, has no basis in fact nor does it even have a theoretical basis. It is a nebu-

lous concept which results from a determination to continue the quest for a naturalistic explanation of life. In the words of Horgan:

One day, he [Stanley Miller] vowed, scientists would discover the self-replicating molecule that had triggered the great saga of evolution....[and] the discovery of the first genetic material [will] legitimize Miller's field. "It would take off like a rocket," Miller muttered through clenched teeth. Would such a discovery be immediately self-apparent? Miller nodded. "It will be in the nature of something that will make you say, 'Jesus, there it is. How could you have overlooked this for so long?' And everybody will be totally convinced" (Horgan, 1996, p. 139).

The atheistic world view requires abiogenesis; therefore scientists must try to deal with the probability arguments. The most common approach is similar to the attempt by Stenger, who does not refute the argument but tries to explain it by way analogy:

For example, every human being on Earth is the product of a highly elaborate combination of genes that would be a very unlikely outcome of a random toss. Think of what an unlikely being you are—the result of so many chance encounters between your male and female ancestors. What if your great great great grandmother had not survived that childhood illness? What if your grandfather had been killed by a stray bullet in a war, before he met your grandmother? Despite all those contingencies, you still exist. And if you ask, *after the fact*, what is the probability for your particular set of genes existing, the answer is one hundred percent. Certainty! (1998, p. 9).

The major problem with this argument, as shown by Dembski, is that it is a gross misuse of statistics, one of the most important tools science has ever developed. Although change is involved, intelligence is critically important even in the events Stenger describes. The fallacy of his reasoning can be illustrated by comparing it to a court case using DNA. Stenger's analogy cannot negate the finding that the likelihood is 1 in 100 million that a blood sample found on the victim at the crime is the suspect's. For this reason, it is highly probable that the accused was at the crime scene; the fact that his blood was mixed with the victim's, will no doubt be accepted by the court and an attempt to destroy this conclusion by use of an analogy such as Stenger's will likely be rejected.

Conclusions

It appears that the field of molecular biology will falsify Darwinism. An estimated 100,000 different proteins are used to construct humans alone. Furthermore, one million species are known, and as many as 10 million may ex-

ist. Although many proteins are used in most life forms, as many as *100 million or more protein variations* may exist in all plant and animal life. According to Asimov:

Now, almost each of all the thousands of reactions in the body is catalyzed by a specific enzyme ... a different one in each case ... and every enzyme is a protein, a *different* protein. The human body is not alone in having thousands of different enzymes—so does every other species of creature. Many of the reactions that take place in human cells also happen in the cells of other creatures. Some of the reactions, indeed, are universal, in that they take place in all cells of every type. This means that an enzyme capable of catalyzing a particular reaction may be present in the cells of wolves, octopi, moss, and bacteria, as well as in our own cells. And yet each of these enzymes, capable though it is of catalyzing one particular reaction, is characteristic of its own species. They may all be distinguished from one another. It follows that every species of creature has thousands of enzymes and that all those enzymes may be different. Since there are over a million different species on earth, it may be possible—judging from the enzymes alone—that different proteins exist by the millions! (Asimov, 1962, pp. 27–28).

Even using an unrealistically low estimate of 1,000 steps required to "evolve" the average protein (if this were possible) implies that many *trillions* of links were needed to evolve the proteins that once existed or that exist today. And *not one* clear transitional protein that is morphologically and chemically in between the ancient and modern form of the protein has been convincingly demonstrated. The same problem exists with fats, nucleic acids, carbohydrates and the other compounds that are produced by, and necessary for, life.

Scientists have yet to discover a single molecule that has "learned to make copies of itself" (Simpson, 1999, p. 26). Many scientists seem to be oblivious of this fact because

Articles appearing regularly in scientific journals claim to have generated self-replicating peptides or RNA strands, but they fail to provide a natural source for their compounds or an explanation for what fuels them... this top-down approach... [is like] a caveman coming across a modern car and trying to figure out how to make it. "It would be like taking the engine out of the car, starting it up, and trying to see how that engine works" (Simpson, 1999, p.26).

Some bacteria, specifically phototrophs and lithotrophs, contain all the metabolic machinery necessary to construct most of their growth factors (amino acids, vitamins, purines and pyrimidines) from raw materials (usually O₂, light, a carbon source, nitrogen, phosphorus, sulfur and a dozen or so trace minerals). They can live in

an environment with few needs but first must possess the complex functional metabolic machinery necessary to produce the compounds needed to live from a few types of raw materials. This requires more metabolic machinery in order to manufacture the many needed organic compounds necessary for life. Evolution was much more plausible when life was believed to be a relatively simple material similar to, in Haeckel's words, the "transparent viscous albumin that surrounds the yolk in the hen's egg" which evolved into all life today. Haeckel taught the process occurred as follows:

By far the greater part of the plasm that comes under investigation as active living matter in organisms is metaplastm, or secondary plasm, the originally homogeneous substance of which has acquired definite structures by phyletic differentiations in the course of millions of years (1905, p.126).

Abiogenesis is only one area of research which illustrates that the naturalistic origin of life hypothesis has become less and less probable as molecular biology has progressed, and is now at the point that its plausibility appears outside the realm of probability. Numerous origin-of-life researchers, have lamented the fact that molecular biology during the past half-a-century has not been very kind to *any* naturalistic origin-of-life theory. Perhaps this explains why researchers now are speculating that other events such as panspermia or an undiscovered "life law" are more probable than all existing terrestrial abiogenesis theories, and can better deal with the many seemingly insurmountable problems of abiogenesis.

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Editor's Note

The *Quarterly* has published numerous items on the same subject as Dr. Bergman's article. Readers should find the following references of interest.

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“Some of the Injuns have stories about what they call the Thunder-Bird, some great bird or flying thing that makes a noise like thunder. There was a Mexican whosaid something like that used to land in a lake, Lake Elizabeth, they called it. Used to kill his sheep sometimes. Then later there was a story about two cowboys who killed a flying reptile or something down in the desert in Arizona.”

Louis L'Amour. 1983. *The Lonesome Gods*. Bantam Books, New York. Ch. 27, p. 2

What is the Upward Limit for the Rate of Speleothem Formation?

George T. Matzko*

Abstract

The speleothem formation experiments conducted in the late 1970s by the Society have been resurrected at the Van Andel Creation Research Center. A new experimental apparatus has been constructed, other ancillary equipment collected and testing has begun. The earlier work is reviewed and the results of that research are summarized. The deposition of speleothems from a theoretical per-

spective, emphasizing the chemical processes involved, is considered. Recent advances in the age dating are examined. The factors that affect speleothem growth are discussed. Recent studies conducted in natural cave environments are mentioned. The kinetics of speleothem precipitation is being studied in an attempt to predict what natural conditions encourage rapid development.

Introduction

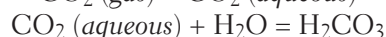
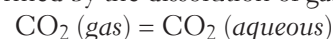
The rate of speleothem (stalagmite and stalactite) formation is an intriguing chemical problem that has been investigated by creationists on and off for the last 30 years (Gish, 1989). Creationist interest in this somewhat arcane topic derives from the obvious disparity between descriptions of slow speleothem growth rates normally touted by guides in commercial caverns compared to reports of rapid, even catastrophic, growth of dripstone formations in the uniformitarian and creationist literature (Gardner, 1935; Meyers and Doolan, 1987; Williams, et al., 1976; Williams and Herdclotz, 1977; 1978; Williams, House and Herdclotz, 1981; Williams, 1988b; Wolfrom, 1994). However, for dramatic appeal, nothing can surpass the Carlsbad Bat (Whitcomb, 1973). In October 1953, *National Geographic Magazine* published a photograph of a bat that was preserved in a stalagmite before it had a chance to decompose (Sutherland, 1953). The same photograph was used as a cover illustration for the September 1971 *Quarterly* (8:93).

For the sake of clarity, it should be mentioned what is not being considered in this article: the rapid formation of dripstone from concrete-mortared structures. Stalactite growth in this environment does not proceed by the same chemical reaction as it does in natural limestone caves (Williams and Herdclotz, 1977, p. 198; Williams, 1988a; Wise, 1988). Another important but related issue that is not covered in this article is the mechanism by which caves are formed in the first place. For specula-

tions on cave formation during and after the Flood, see Williams and Herdclotz, 1977, pp. 197–198; 1978, p. 88. One aspect of this problem which is pertinent to this discussion is the suggestion that sulfuric acid may have played a role in dissolving limestone during the early part of a cave's history (Moorehouse, 1968; Oard, 1998). If some caves have been formed by sulfuric acid dissolution, it may be possible that sulfuric acid also played a role in the formation of some of the older speleothems. Sulfate ions are normally found in water samples taken from caves. For example, calcite precipitating water samples from Warm River Cave, Virginia were found to contain from 128 to 438 mg/L SO_4^{2-} during tests in 1984 (Herman and Lorah, 1986). But as far as it is known now, the main effect of CaSO_4 on dissolution and precipitation rates of solid CaCO_3 is a common-ion effect (Buhmann and Dreybrodt, 1987). See earlier experiments on dissolution of limestone and dolomite by acid solutions in Williams and Herdclotz, 1977, pp. 193–194.

Chemistry of Speleothem Formation

What we do know is that the primary chemical agent involved in the formation of speleothems is carbon dioxide. The solubility of calcite in pure water is very small, about 6 ppm at 10°C, but carbonate minerals are readily soluble in acid, and the acid most important to karst processes is carbonic acid, formed by the dissolution of gaseous CO_2 :



The net reaction for the dissolution of calcite is:



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In most cases it is believed that calcite speleothems are formed when ground water which is supersaturated with CaCO_3 enters a cave. Outgassing of dissolved CO_2 lowers carbonate solubility in these drip waters and leads to crystalline calcite deposition.

The calculation of calcite deposition rates therefore hinges on the combinations and permutations inherent in carbonate equilibria. For example, the concentration of dissolved calcite varies with the cube root of the CO_2 partial pressure as follows (White, 1988, p.130):

$$m_{\text{Ca}^{2+}}^3 = P_{\text{CO}_2} \frac{K_1 K_c K_{\text{CO}_2}}{4K_2 (\gamma_{\text{Ca}^{2+}})(\gamma_{\text{HCO}_3^-})^2}$$

where:

K_1 and K_2 = equilibrium constants for the dissociation of carbonic acid.

K_c = the solubility product constant for calcium carbonate.

P_{CO_2} = the partial pressure of carbon dioxide.

α and γ = the activities and activity coefficients of the respective species.

K_{CO_2} = a bulk equilibrium constant that describes all neutral carbon bearing species:

$$K_{\text{CO}_2} = \frac{\alpha_{\text{H}_2\text{CO}_3}}{P_{\text{CO}_2}}$$

In addition to equilibrium relationships, the kinetics of calcite dissolution and deposition must also be considered. The kinetics are determined by three independent processes (Buhmann and Dreybrodt, 1985a):

- The kinetics of dissolution (or deposition) at the phase boundary between the solvent aqueous system $\text{CaCO}_3 - \text{H}_2\text{O} - \text{CO}_2$ and the limestone.
- The kinetics of the conversion of CO_2 to carbonic acid.
- Mass transport of the dissolved species, i.e. Ca^{2+} , HCO_3^- , CO_3^{2-} , CO_2 and H_2CO_3 , by diffusion from and to the phase boundaries.

The first kinetic model that included the three processes listed above, and therefore accounted for the mechanisms taking place at the surface of the CaCO_3 rock, is the Plummer-Wigley-Parkhurst model (Plummer, 1978). The Plummer-Wigley-Parkhurst or PWP equation gives the dissolution rate as a function of the species Ca^{2+} , H^+ , HCO_3^- and H_2CO_3 at the CaCO_3 surface:

$$F = \kappa_1 (\text{H}^+) + \kappa_2 (\text{H}_2\text{CO}_3^*) + \kappa_3 - \kappa_4 (\text{Ca}^{2+})(\text{HCO}_3^-)$$

where F is the flux of Ca^{2+} ions.

The first three rate constants are temperature (K) dependent:

$$\log \kappa_1 = 0.198 - 444T^{-1}$$

$$\log \kappa_2 = 2.84 - 2177T^{-1}$$

$$\log \kappa_3 = -5.86 - 317T^{-1}$$

The fourth rate constant is dependent on the activity of the aggressive agent and is given by Plummer, Wigley and Parkhurst (1978). The quantities in round brackets in the PWP equation are the activities of the corresponding species and $(\text{H}_2\text{CO}_3^*) = (\text{H}_2\text{CO}_3^0) + (\text{CO}_2)$. Note that because the PWP equation is a rate equation, containing forward and backward reactions, it is valid for the precipitation of CaCO_3 as well as its dissolution. All that is required is to change the sign of F (Inskeep and Bloom, 1985).

The PWP model has been tested extensively under a variety of conditions (Buhmann and Dreybrodt, 1985b; Dreybrodt and Buhmann, 1991; Dreybrodt, et al., 1992; Liu and Dreybrodt, 1997; Fairchild, et al., 1999). During these tests the dissolution or precipitation rates were found to roughly correspond with the equation,

$$R = \alpha ([\text{Ca}^{2+}]_{\text{eq}} - [\text{Ca}^{2+}])$$

(Buhmann and Dreybrodt or B-D model), where α is a function of CO_2 pressure, thickness of the water film covering the CaCO_3 surface, and temperature. $[\text{Ca}^{2+}]_{\text{eq}}$ is the concentration at saturation and when

$$[\text{Ca}^{2+}] \geq 0.2[\text{Ca}^{2+}]_{\text{eq}}.$$

For example, at a P_{CO_2} of 5×10^{-3} atm and a temperature of 10°C , $[\text{Ca}^{2+}]_{\text{eq}}$ has a value of 16.2×10^{-4} mmol cm^{-3} and α , the rate constant, is equal 1.54×10^{-5} cm s^{-1} for a laminar core (diffusion layer) thickness of 0.01 cm. Note also that rates of deposition given in mmol $\text{cm}^{-2} \text{s}^{-1}$ can be converted into a speleothem growth rate given in cm/yr. by multiplying by the factor $1.17 \times 10^6 - \text{cm}^3 \text{s mmol}^{-1} \text{yr}^{-1}$. This assumes that the calcite is deposited in such a way that it is compact (Baker, et. al., 1998).

As an example of a theoretical growth rate calculation of a speleothem, assume the laminar flow conditions listed above and a 400 ppm CaCO_3 solution where we have $[\text{Ca}^{2+}] = 0.004$ mmol cm^{-3} , $\alpha = 1.54 \times 10^{-5}$ cm s^{-1} , and $[\text{Ca}^{2+}]_{\text{eq}} = 16.2 \times 10^{-4}$ mmol cm^{-3} .

With these values the B-D model yields a deposition rate of 3.67×10^{-8} mmol $\text{cm}^{-2} \text{s}^{-1}$ or a 0.0429 cm/yr. growth rate.

Age Dating of Speleothems

While a growth rate of 0.0429 cm/yr. may seem impressive, yielding a two and a half-meter stalactite in 6,000 years, it still falls short of the values for recent cave deposits measured by the relatively new, excess ^{210}Pb technique.

Citing the difficulty in obtaining reliable dates from the ^{14}C method (Williams and Herdtklotz, 1977, p. 198) because of the multiple sources of carbon in speleothems, Baskaran and Iliffe (1993) conducted the first study of short-term (1–100 yr.) growth rates using a relatively short-lived isotope such as ^{210}Pb . ^{210}Pb (half-life = 22.1 yr.)

is produced from its gaseous precursor, ^{222}Rn (half-life = 3.8 d) at a constant rate. Most of the ^{222}Rn in cave air is presumed to have degassed from ground water at the same time that CO_2 is degassed from the water dripping into caves. Drip waters from the ceilings of caves have high concentrations of ^{222}Rn . Baskaran and Illiffe (1993) measured the ^{210}Pb in various sections of a 126-mm soda straw stalactite from Harrel's Cave, Texas. They found that the concentration of ^{210}Pb exhibits an exponential decrease with distance from the bottom of the soda straw. This data yielded a longitudinal growth rate of 1.1 mm/yr. and an age of 115 yr. A 23mm wide icicle shaped stalactite from the same cave, which formed around a soda straw having a central diameter of 5mm, was tested by the same method and yielded a lateral growth rate of 0.031 mm/yr. with an age of 581 yr. Interestingly, an inner core sample of the same icicle stalactite was analyzed by the ^{14}C technique and dated at an age of 7460 yr. The authors believe that their values compare favorably with tradition growth rates such as the 2 mm/yr. rate reported by Moore and Sullivan (Moore, 1978).

A Japanese group (Tanahara, et. al., 1998) using the same excess ^{210}Pb dating method, measured the ^{210}Pb profiles of two soda straw stalactites collected from a natural cave at Tamagusuku, Okinawa Island, Japan. They obtained growth rates of 2.2 and 5.9 mm/yr. respectively. One would expect growth rates of straws to vary even in a single cave, depending on running and dropping rates of water, but a 5.9 mm/yr. rate over 6,000 yr. is capable of producing a stalactite 35 meters long!

Are higher stalactite growth rates than these possible? What factors could be responsible for producing even greater rates of growth? A growth rate of 5.9 mm/yr. corresponds to a $[\text{Ca}^{2+}]$ of 3.4×10^{-2} mmol/cm or 3,400 ppm CaCO_3 using values of, $\alpha = 1.54 \times 10^{-5} \text{ cm s}^{-1}$, and $[\text{Ca}^{2+}]_{eq} = 16.2 \times 10^{-4} \text{ mmol cm}^{-3}$ in the B-D equation. How are such high concentrations obtained? Consider each of the possible factors in turn.

Temperature and Speleothem Growth

Calcite speleothems are found to form in caves beneath icefields (Gascoyne and Nelson, 1983). In temperate and tropical climates the dissolved CO_2 required to dissolve limestone formations is thought to primarily come from gas uptake from decaying organic matter (even to the extent of 16–20 % CO_2 in the soil measured during a monsoon in India) [Adams and Swinnerton, 1937]. See Williams and Herdtklotz, 1977, pp. 192–193 for a discussion of the CO_2 content of water in natural situations. Such a mechanism is not possible in areas devoid of biological activity; although venting of CO_2 from deep within the earth's crust should not be automatically ruled out.

Dreybrodt (1982) proposed a temperature effect mechanism in order to account for the formation of speleothems in caves covered by glaciers or bare karst. Under a glacier there is abundant melt water at 0°C that can penetrate into the fissures of the limestone rock. On the way through the limestone rock to the cave, its temperature is increased by a few degrees and since the solubility of CO_2 decreases with increasing temperature, the solution becomes supersaturated and the deposition of calcite can occur. By this mechanism alone, a solution with a temperature of 2°C entering a cave with the same temperature can be responsible for a growth rate of $1 \times 10^{-3} \text{ cm/yr.}$ all by itself. Depending on the water film thickness, a 5°C differential could easily be responsible for a growth rate of $5 \times 10^{-3} \text{ cm/yr.}$ Williams and Herdtklotz, 1977, pp. 195–197 conducted experiments on the effect of temperature on CaCO_3 solution and deposition. The results are summarized in Tables I and II.

Pressure Difference and Speleothem Growth

It is well known that CO_2 solubility in water not only increases with decreasing temperature but also increases with increasing pressure. Presumably there is some hydrostatic pressure responsible for pushing the ground water through microscopic fissures in the limestone. Unfortunately, a typical pressure gradient from the surface to the cave ceiling would be difficult to quantify. However, it is safe to say that as the water enters the cave, the pressure on the water drops. As the pressure drops, the solubility would also drop and CO_2 would be free to outgas. Several experiments were run in the 1970s employing this concept, and the results are summarized in Tables I and II.

Hydrogen Ion Concentration

The equilibrium pH of the $\text{CaCO}_3 - \text{H}_2\text{O} - \text{CO}_2$ system is well defined for every value of CaCO_3 concentration, CO_2 pressure and temperature (White, 1988. p.131). However, in caves, as opposed to controlled laboratory conditions, the pH is often controlled by other reactions in the system (Garrels, 1965, p.75). For example, pH measurements of cave waters in Indian Echo Cave, PA ranged from 7.67 to 9.91 (Holland et. al., 1962). The 9.91 reading came from a "small pool fed largely by water from a soda straw" and had a concentration of 194 ppm CaCO_3 while the water dripping from the soda straw had an average pH reading of 7.74 and a calcium carbonate concentration of 289 ppm. Water samples taken from Luray Caverns, VA by the same group had a pH range from 7.32 to 8.05. One final example: A small calcite precipitating stream named Westerhofbach located near the village of Westerhof, Germany has been studied more recently (Dreybrodt et al.,

Table I. Test Conditions During Calcium Carbonate Dissolution and Precipitation Experiments

Experiment Designation	Test Time (hours)	Description of Rig	Test Solution	Rock Being Dissolved	Test Temp (°C)
A	700	Ref. 1, p. 212	tap water	Indiana Limestone	25
B	500	Ref. 2, p. 192 (same as A)	+ CO ₂ tap water + CO ₂ + 5% NaCl	(same as A)	(Same as A)
C	NR	Ref. 2, p. 195	tap water + CO ₂ + 1% Acetic acid	Indiana Ls, Beekmantown Dolomite	(same as A)
D	450	(same as C)	demineralized Water + CO ₂	Beekmantown Dolomite	45–50
E	600	(same as C)	(same as D)	(Same as D)	(same as D)
F	500	(same as C)	(same as D)	(same as D)	8–25
G	502	Ref. 3, p. 89	demineralized Water + CO ₂ + NH ₃	(same as D)	25
H	500	Ref. 4, p. 205	demineralized Water + CO ₂	(same as D)	(same as G)
I	1314	(same as H)	(same as H)	(same as D)	(same as G)
J	600	Ref. 4, p. 207	(same as H)	(same as D)	(same as G)
K	600	(same as J)	(same as H)	(same as D)	(same as G)

NR: Not recorded; LS: Limestone

Ref. 1: Williams et al., 1976; Ref. 2: Williams and Herdtklotz, 1977; Ref. 3: Williams and Herdtklotz, 1978; Ref. 4: Williams, House and Herdtklotz, 1981.

Table II. Test Results of Calcium Carbonate Dissolution and Precipitation Experiments.

Experiment Designation	Amount of CaCO ₃ ppt. (grams)	CaCO ₃ ppt. per year (grams)	Amount of Solution Consumed (liters)	Amount of CaCO ₃ ppt. per liter of Water (grams)	Likely Mechanism of CaCO ₃ ppt.
A	1.7962	22.51	NR	NA	Pressure Difference
B	4.4554	78.05	209	0.0213	Temperature and Chemical differences
C	0	0	NR	0	
D	6.4413	125.36	450	0.0143	Temperature and Pressure differences
E	9.4288	137.66	600	0.0157	(same as D)
F	9.9007	173.46	500	0.0198	(same as D)
G	1.0184	7.08	1260	0.0008	Pressure difference
H	2.7036	47.37	118	0.0229	(same as G)
I	3.9386	26.25	1314	0.003	(same as G)
J	10.6556	155.57	472	0.0226	(same as G)
K	12.8434	187.51	191	0.0672	(same as G)

NR: Not recorded; NA: Not available.

1992). Along the 265-m long stream, the pH varied between 7.69 upstream to 8.48 downstream. The greatest deposition rate ($6.50 \times 10^{-8} \text{ mmol cm}^{-2} \text{ s}^{-1}$) was measured at station #7 where coincidentally the pH was 8.48. Qualitative pH measurements were made in a natural cave and quantitative pH measurements were made in laboratory situations. These results were reported in Williams et al., 1976, p. 212; Williams, House and Herdtklotz, 1981.

Carbonates dissolve at a much faster rate in solutions of low pH (Stumm and Morgan, 1996, p. 791). Therefore, it is not unreasonable to suppose that in some cases that limestone is dissolved at a rapid rate by acidic waters close to the surface and becomes increasingly alkaline as the water travels through layers of soil and rock. It would become, as a result, increasingly supersaturated with calcium carbonate before it drips from the cave ceiling. Such a mecha-

nism, though hard to prove, would be more prominent during early stages of a cave's history before the alkalinity has been washed out of the soil and rock.

Flow Velocity and Turbulence

Weyl (1958) discussed the idea that the rate of solution of calcite is proportional to the flow. White and Longyear (1962) were responsible for introducing the concept of "hydraulic jump," a sudden transition in the distance that water will have penetrated into limestone at 90% saturation, as the velocity increases. This penetration distance increase is not a small effect according to White and Longyear. They state (p.163) that "the effectiveness of solution increases by seven orders of magnitude at the jump." Buhmann and Dreybrodt (1985a) confirmed this hydraulic jump by calculating the dissolution rate using the B-D equation for various boundary layer film thicknesses, d , which are inversely related to velocity and turbulence). For $d < 0.003$ cm, d increases nearly linearly with d . This is the region in which the conversion of CO_2 into H_2CO_3 is rate determining. At $d = 0.03$ cm a threshold is reached and above 0.05 cm the dissolution rate decreases. However, in a turbulent system, the rates are determined entirely by surface-controlled processes and the PWP equation holds. Buhmann and Dreybrodt calculated that the rates of dissolution would increase about one order of magnitude for turbulent flow situations. Lauritzen investigated dissolution rates in a phreatic cave conduit by analyzing the chemical composition of the water at the inlet and exit of the conduit (Dreybrodt and Buhmann, 1991). At low flow rates ($1 \text{ m}^3 \text{ s}^{-1}$) the observed dissolution rates were small, but at flow rates above $10 \text{ m}^3 \text{ s}^{-1}$ the dissolution rate increased to maximal value of $1 \times 10^{-7} \text{ mmol cm}^{-2} \text{ s}^{-1}$. Further confirmation of the importance of flow rates has come from rotating disk dissolution experiments (Liu and Dreybrodt, 1997). By rotating a calcite disk in solutions of various temperatures and CO_2 partial pressures and measuring dissolution rates by electrical conductivity measurements, Liu and Dreybrodt were able to confirm the applicability of the B-D model for turbulent solutions. For example, at a rotating speed of 100 rpm (10°C , $P_{\text{CO}_2} = 3 \times 10^{-4} \text{ atm.}$) the measured dissolution rate was $8.0 \times 10^{-8} \text{ mmole cm}^{-2} \text{ s}^{-1}$, but at a rotating speed of 3000 rpm the rate had increased to $28.8 \times 10^{-8} \text{ mmole cm}^{-2} \text{ s}^{-1}$.

The velocity and turbulence of ground water flow through the cracks and fissures in limestone is a complex subject and rates vary from one karst area to another depending on various geometrical, hydraulic and chemical parameters (Dreybrodt, 1996). However, it is safe to say that calcium carbonate supersaturation will increase during times of higher flow rates such as heavy rain storms and floods. Williams and Herdtklotz (1977, pp. 197–198) discussed the possible effect of rapidly-moving, receding

Floodwater through limestone fissures. If the depth of water was 1000 ft. above an opening in the rock, the velocity of flow could be as great as 80 ft s^{-1} .

Drip Rates

The average molecular accumulation rate between two drops falling onto a calcite surface at a time interval T has been shown by Dreybrodt (Baker, et al., 1998) to be

$$R_{acc} = \frac{(c - c_{eq})\delta}{T(1 - \exp(-\frac{T}{\tau}))} \text{ mmol cm}^{-2} \text{ s}$$

where

$$c_{eq} = (-0.01t + 0.72) \cdot 10^{-3} (\text{mol} \cdot \text{l}^{-1}) \text{ and } \tau = \frac{\delta}{\alpha}.$$

where:

R_{acc} is the accumulation rate assuming that $T \geq 0.2\delta/\alpha$.

c is the concentration of Ca in the water film in mmol/cc.

c_{eq} is the equilibrium concentration of Ca, which depends entirely on the temperature t in $^\circ\text{C}$ as shown above.

δ is the thickness of the water film in cm.

T is the interval of time between drops.

τ is the time constant and α is the kinetic constant in cm/s.

It can be seen from the equations above that the maximal growth rates for stalagmites will occur when the drop rate is fast enough to keep the surface covered with a thin film of optimal thickness ($\cong 0.03$ cm) in order to allow the CO_2 to degas. Perhaps this is one reason why stalactites can sometimes appear with a complementary stalagmite and sometimes not. Stalagmite growth appears to be much more dependent on the drip rate dynamics. In a quantitative study of drip rate Williams, House and Herdtklotz (1981, pp. 205–206) found that CaCO_3 deposition increased to a maximum as the drip rate decreased. Then the amount of precipitate decreased upon further lowering of drip rate indicating a possible optimum drip rate for maximum deposition.

Observations and Experimentation on Speleothem Formation

In the 1970s, those working on the problems associated with speleothem formation were limited to using chemical equilibrium calculations as a starting point to predict the rate of speleothem formation. The theoretical models developed since that time, especially the PWP and B-D models now provide an excellent starting point for calculating actual speleothem growth. For example, it used to be thought that models like these were generally valid for

pure substances, but not for natural limestones and dolomites that contain impurities that may have an effect on CaCO_3 dissolution and subsequent precipitation. We now know, in the words of Buhmann and Dreybrodt, that “although foreign ions displace the calcite solution equilibria, by the effect of ion-strength, ion-pairing and the common-ion effect, the kinetics of the dissolution process are hardly changed” from that predicted by the B-D model (Buhmann and Dreybrodt, 1987, p. 89.). In addition to the theoretical advantages offered to workers in the next millennium there are also computer programs on the market that are able to model groundwater behavior in detail. The Van Andel Creation Research Center is in the process of obtaining a software package of this type. The challenge for the experimentalist will be to duplicate the non-equilibrium conditions found in natural settings. For example, natural water laden with CO_2 may travel hundreds of feet through jointed limestone before entering a cave where CO_2 can be released (due to a pressure difference) causing CaCO_3 deposition. Since most test rigs are limited in size, it is almost impossible to achieve a lengthy water travel path that would reflect a natural situation. The only practical solution may be to recycle the test solution thereby increasing the time of exposure to the test rocks as well as increasing the travel length of the fluid in order to effect more calcium carbonate dissolution.

In all of the previous experiments sponsored by the Society, it was found that:

The onset of precipitation...does not occur until a certain “incubation” time...has passed where no apparent precipitation takes place. After this time the precipitate became obvious and growth is visible (Williams, House and Herdtklotz, 1981, p. 207).

Also a pH change accompanied the precipitation “event”—the pH of the water with dissolved carbon dioxide and calcium was 8.27. Upon deposition of CaCO_3 , the pH of the solutions was lowered to 8.15 (Williams, House and Herdtklotz, 1981, pp. 207–208). This is a puzzling result since it appears to be in opposition to the measurements made in Indian Echo Cave and other locations mentioned above where the pH generally increases as the CaCO_3 is deposited.

If it can be determined what factors retard precipitation, then eliminate them, reducing the “incubation” time, it may be possible to speed up the precipitation reaction for speleothem formation and growth. If any of the above conditions can be related to the theoretical models presented previously, then considerable insight into speleothem development processes can be gained. This information in turn could, hopefully, be used to predict the conditions necessary for rapid formation.

The test conditions and results from the experiments conducted in the late 1970s are collected and summarized

in Tables I and II. Hopefully, the data are easier to discern in this format rather than scattered throughout the four reports published from 1976–1981. These reports are referenced and any details needed for further study can be found in them. One of the columns in Table II records the amount of CaCO_3 precipitate obtained per liter of water passing through the test rig. Obviously water flow into a vented cave is necessary for the formation of speleothems and generally the more water seeping into a cavern, the more CaCO_3 precipitation will occur (Williams and Herdtklotz, 1978, p. 88). Considering a Flood model of earth history, the postulated wet conditions (warm ice age) immediately after the Flood would encourage speleothem formation in caverns in the vadose zone.

Conclusion

Many times, actual rapid growth rates of speleothems have been observed in caves—as high as 1 inch per 7.5 days (4 inches/month) (Williams, House and Herdtklotz, 1981, pp. 208, 226). The trend in literature also has been moving toward faster growth rates especially among those who are pioneering the use of the excess ^{210}Pb dating method. Additional experiments need to be performed in order to optimize the various factors that have the potential to increase growth rates by another order of magnitude, temperature, pressure, pH and flow gradients all need to be explored again under controlled conditions before we can obtain a definitive answer to this important question.

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Book Review

Did God Create in Six Days?

Edited by Dr. Joseph A. Pipa, Jr. and Rev. David W. Hall

Southern Presbyterian Press, P.O. Box 690, Taylors, SC 29687. 1999, 339 pages, \$18

There is an ongoing debate over the interpretation of Genesis 1 in the Presbyterian Church in America (PCA). The issue was raised by a number of Presbyteries and individuals in the church following the publication of an annual report from the denominational seminary (Covenant, Saint Louis) noting the latitude of beliefs regarding the Genesis account of creation within the faculty. The seminary administration and faculty rightfully protested that nothing at the seminary has changed in forty years. Their stasis has been overtaken by an awareness in the denomination at large that this issue is important. Those who want to accept both the Bible and modern science reference many post-1800 reformed scholars for their overly-tolerant views of evolution and the supposed great age of the earth, a position unfortunately (but not uniformly) common to the reformed academic elite this century. Too little has been heard of defenders of Genesis such as Dr. Robert L. Dabney and their able sons, such as Dr. D. James Kennedy. Since the issue has been raised to the highest church court, the General Assembly, the governmental structure of the PCA must force a resolution of the issue, in spite of any discomfort. A study committee has been appointed and we should all pray that God would lead the PCA into a more faithful position on these important issues.

Greenville Presbyterian Theological Seminary (GPTS) in South Carolina has responded to the issue by taking a strong theological stand for the sequential, chronological interpretation of Genesis 1 and its corollary of a young earth. In order to clarify arguments from both sides for the study committee, the seminary recently sponsored a disputation, inviting prominent theologians advocating non-literal interpretations to debate the seminary faculty. The proceedings of this symposium have just been published and released by the seminary as the book, *Did God Create in Six Days?* Although scientists of CRS may not all be greatly interested in the wealth of material specific to the Presbyterian tradition in this book, they should enjoy the presentation and critiques of the “day-age” position, the “Framework Hypothesis”, and a new style of interpretation called “Discourse Analysis”. Theological critiques of major non-literal views of Genesis 1 are ably provided by the seminary faculty. The contribution by Dr. Pipa, “From Chaos to Cosmos: A Critique of the Non-Literal Interpretations of Genesis 1:1–2:3” is especially helpful and thor-

ough. Although scientists tend to easily get bogged down in the apparent minutiae of theology, they would be well advised (as would anyone else) to spend a little time in this book. After all, not everyone is a scientist, but everyone is a theologian.

Two other contributions of special note are one by Rev. David Hall of Oak Ridge, Tennessee and another by Dr. Stuart Patterson, former Dean and Chemistry Department Chairman at Furman University. Rev. Hall has researched the position of pre-nineteenth century theologians, and does a masterful job of refuting the false claims of those theistic evolutionists (e.g., Hugh Ross) who seek company with the great theologians of the past. Rev. Hall shows that these giants of the past are often misunderstood and sometimes deliberately misrepresented. The great debate of the 17th century about the time of creation was not millions of years, but millionths of a second! Augustine of Hippo had concluded that God had created instantaneously; seventeenth century theologians opted for a literal interpretation of Genesis 1. This debate obviously had nothing to do with uniformitarianism, a fact lost on those who today see old earth views in the ancient church fathers. Rev. Hall’s conclusions will carry great weight with the PCA, a confessional church that has adopted the theology and polity of the 17th century Westminster standards. Written records from the Westminster divines, available at present, are shown to be unanimous in their support of the 24-hour day, young earth interpretation of Genesis. Finally, for those who can survive the theological tidal wave of the first few hundred pages, Dr. Patterson provides a concise summary of the scientific evidences pertinent to the age of the earth.

Although I freely admit a built-in bias towards this book because of a long association and friendship with both Dr. Patterson and Dr. Pipa, I would encourage the readers of the *Quarterly* to see for themselves how helpful and timely this book is, and to contradict the statement of Rev. Hall who stated that after ministering for some time in a highly scientific community he found “that most (not all, fortunately) practicing scientists were as philosophically sophisticated as most NFL players.” Reading this book would be a good start away from being a “Super Bowl Socrates”.

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Notes from the Panorama of Science

Rock Spires (Pseudo-Hoodoos) on the Lookout Mountain Syncline

An interesting paradox exists with regard to the Lookout Mountain synclinal ridge. Today, the ridge stands over one thousand feet above the adjacent valley floors, but at one time it was the lowest point between two areas of uplift (Figure 1). It extends from just north of Gadsden, Alabama to Chattanooga, Tennessee, a distance of approximately 80 miles. Several young-earth studies have reported on various sections of this geomorphic feature (Akridge, 1998; Froede, 1997a, b, c). Ongoing creationist research continues in this region to interpret the many features within Bible-based Flood stratigraphy and geomorphology.

Geology of the Rock Spires (Pseudo-Hoodoos)

Our exploration of Lookout Mountain near DeSoto Falls and Little River Canyon identified several areas where rock spires (pseudo-hoodoos) are found (Figure 2). Geo-

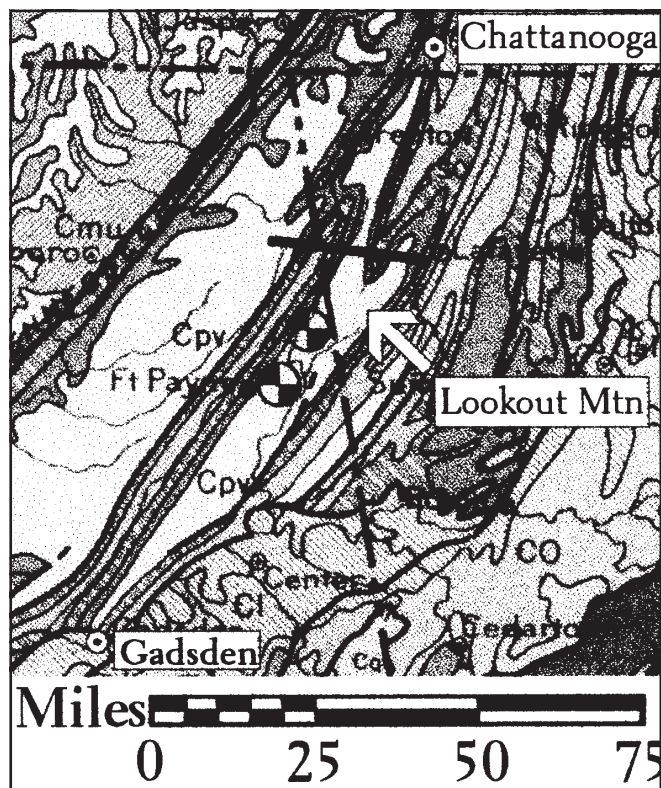


Figure 2. Our area of investigation for the rock spires is from DeSoto Falls to the Little River Canyon (black and white circles). Based on the exploration of this area, we believe that many other areas across the top of this syncline contain similar rock spires in varying degrees of development. Additional field work is needed to confirm or refute our speculations. Base map modified from the United States Geological Survey map of the United States.

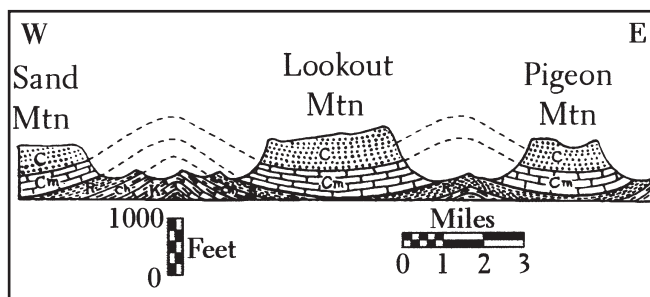


Figure 1. Generalized cross-section through the Lookout Mountain synclinal ridge (see black bar in Figure 2 for location of this section). The ridge was at one time the lowest point between two anticlinal areas of uplift. Erosion removed the uplifted areas and created the elevated synclinal ridge. See Akridge (1998) and Froede (1997c) for a creationist description of the processes believed to be responsible for the formation of this synclinal ridge. Section modified from Spencer, 1893, p. 18, Figure 6.

logically, it appears that they occur within the Pennsylvanian Warren Point Sandstone as identified and delineated in Georgia (Crawford, 1989) and the Pennsylvanian undifferentiated Pottsville Formation in Alabama (Osborne, Szabo, Neathery, and Copeland, 1988). Interestingly, high-angle cross-bedded quartz-pebble channel lag was exposed in the spires. The rock spire stratigraphic unit is described as:

Sandstone, fine-to-course-grained, feldspathic; cross-bedded in sets up to 20 feet thick; ranges from thin- and medium-bedded to massive. Channels tens of feet deep contain massive conglomeratic sandstone and quartz-pebble conglomerate. Siderite-pebble conglomerate at lower contact (Crawford and Brackett, 1989, Plate No. 7).

From our field work we noted a relationship between the siderite (FeCO_3) pebble conglomerate (Figures 3 and 4) and the overlying highly cross-bedded quartz-pebble bearing sandstone. We conjecture that connate water (i.e., water filling the pore spaces between the sand grains) trapped within the massive semi-lithified sandstone moved laterally to points of discharge along newly exposed sidewalls. This occurred as this stratigraphic unit was thrust laterally and warped tectonically during the Flood. Tremendous erosion of the sandstone layer occurred concurrently with this tectonism, and played a significant role in the eventual formation of these rock spires. As the pH and Eh likely changed within the sandstone, iron (i.e., siderite) probably was precipitated from the connate water. It appears that the majority of the iron was precipitated at the base of the sandstone unit where it contacted an impermeable shale unit.

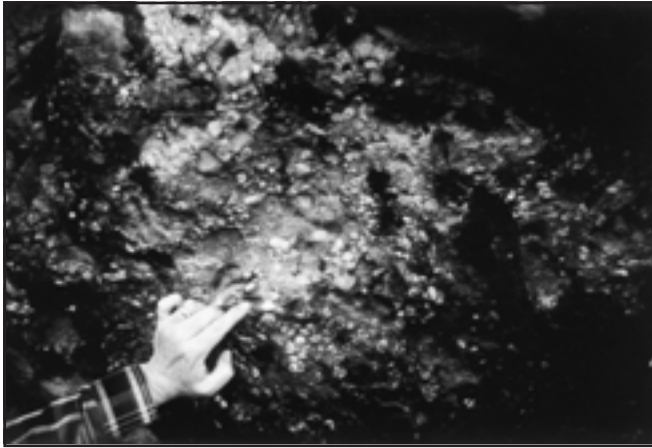


Figure 3. A photograph showing the quartz-pebble conglomerate cemented by silica and a small amount of siderite (FeCO_3). We believe that the differences in cement composition contributed to the formation of the rock spires (pseudo-hoodoos) within this sandstone unit. However, further investigation is needed to substantiate these claims.



Figure 4. A photograph showing a quartz-pebble conglomerate from the bottom-most section of the rock spire layer which was cemented completely by siderite (FeCO_3). This is a weak cement compared to the quartz-cemented sandstones in the upper sections of this layer.



Figure 5. A photograph of an exposed wall of quartz-cemented sandstone in the Citadel Rocks area. Akridge is pointing to a fracture where siderite has precipitated forming an iron-rich lens. These sandstones do not contain high concentrations of siderite cement, but they do reveal substantial levels of iron along joints and fractures.



Figure 6. A photograph showing bedding planes of the sandstones in the Citadel Rocks area. Iron mixed with the sandstones following deposition and precipitated along these bedding features.

According to our observations, the iron was probably not derived from the dewatering of the shales beneath the massive sandstone layer. All the iron precipitation was diagenetic (i.e., post depositional). It filled fractures within the massive sandstone unit and enhanced the joint sets in a manner similar to Liesegang rings (Figures 5 and 6).

We also located areas where rock spires appear to be in the initial stages of formation. These underdeveloped features may hold the key to a better understanding of this area and demonstrate how the rock spires may have formed (Figure 7). From our early reconnaissance of this area, we speculate that cliff-sapping might have played a large role in the formation and development of these inter-

esting features, although further analysis is needed to ascertain this.

Geomorphology of the Rock Spires (Pseudo-Hoodoos)

The rock spires vary considerably in size and shape (Figures 8 and 9). All of the rock spires that we examined had a semi- to impermeable quartz cemented sandstone cap which protects the underlying softer strata (much of which contains iron cement) from weathering (Figure 10). The rock spires tend to occur along the crests of ridges or in topographically high areas. This consistent location supports our speculations about the role that cliff-sapping may have



Figure 7. A photograph showing the beginnings of rock spire formation in the Citadel Rocks area. Individual pedestals of sandstone lie within close proximity to one another. We believe that this setting reflects the massive erosion that this area experienced and the manner by which the rock spires formed.



Figure 8. A rock spire (pseudo-hoodoo) in the Little River Canyon National Preserve. A silica-cemented cap rock protects the underlying siderite-cemented sandstones from erosion.



Figure 9. A smaller rock spire located near the Sallie Howard Memorial Chapel. Not surprisingly, the pseudo-hoodoos vary in size as a function of the characteristics of the individual cap rocks.

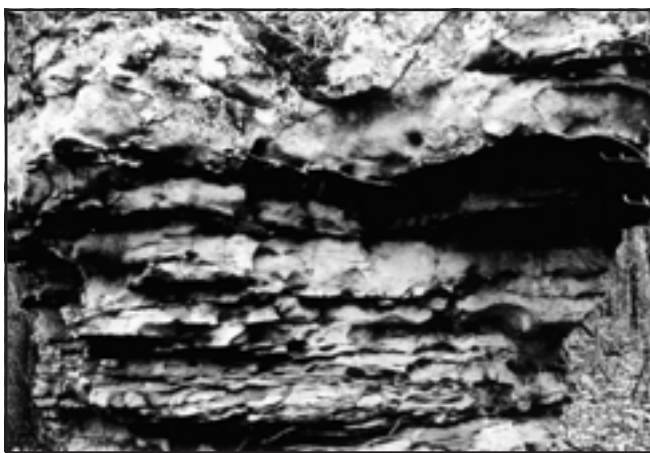


Figure 10. A close-up photograph of Figure 9 showing the massive sandstone cap rock above siderite cemented cross-beds of underlying sandstone. The siderite cement varies in thickness and appears to follow bedding planes. These sedimentary features perhaps reflect preferential connate water flow paths where the siderite precipitated.

had in being a major factor in the formation of these features.¹

The rock spires identified on Lookout Mountain in Georgia, within the Warren Point Sandstone (Froede, 1997a), are identical to those we examined on Lookout Mountain in this area of Alabama. Both occur in similar settings along ridge lines. Weathering appears to be enhanced along joints and fractures, easily identified by the siderite cement and associated iron stain.

¹Discussions regarding how cliff-sapping might possibly be associated with rock spire development can be found in Williams (1995) and Shaver (1999)

Rock Spire at the Sallie Howard Memorial Chapel

The most unique rock spire location that we found occurs at the Sallie Howard Memorial Chapel, a Southern Baptist church located adjacent to DeSoto State Park (Figures 11, 12, and 13). The following is excerpted from the DeKalb Baptist Association church information brochure:

The Chapel was constructed in 1937 under the direction of an ailing Colonel Milford Howard in honor of his deceased wife, Sallie Howard. It is modeled after the Annie Laurie Church in Scotland after Colonel Howard admired a reproduction of that church located in Glendale, California. The Chapel



Figure 11. The Sallie Howard Memorial Chapel. A large rock spire has been incorporated into the front of the church.



Figure 12. Another photograph showing the opposing side of the pseudo-hoodoo which is incorporated into the front of the church.

was dedicated on Sunday afternoon, June 27, 1937. Colonel Howard died in California on December 28, 1937. Colonel Howard's ashes are interred under a bronze marker within the rock spire near the pulpit in the chapel he built on Lookout Mountain.

Conclusions

The rock spires (pseudo-hoodoos) of various shapes and sizes found on top of the Lookout Mountain synclinal ridge, occur in Pennsylvanian age strata, specifically the Warren Point Sandstone and undifferentiated Pottsville Formation. They are consistently found along ridges and elevated areas. It appears that the strata were originally formed under high-energy conditions during the global Flood of Genesis and likely derived from sediments associated with the uplift of the Southern Appalachians (Froede, 1998). Subsequent erosion, occurring during a high-energy portion of the Flood, removed sections of the highly



Figure 13. A photograph looking at the front of the church. Note the bedding planes of the sandstone and the slightly offset jointing of the rock spire.

cross-bedded semi-lithified sandstone. Diagenetic processes served to further lithify the sandstone with silica and iron cements. The iron cement was precipitated mainly along the base of the sandstone unit, although it is also prevalent along fractures and joints within the sandstone. It appears that the iron-cemented sandstone is less resistant to erosion than the silica cemented upper section of the same unit. We believe that this may have aided in the formation of the rock spires through the process of cliff-sapping. Further field work is necessary to confirm these observations.

The rock spires now stand as a silent testimony of powerful erosive forces and processes which occurred during the time of their formation. Because in many places the spires extend as much as 12 to 15 feet above the surrounding land surface, huge volumes of sediment were removed to form them. This approach to defining and understanding these rock spires (pseudo-hoodoos) can best be understood within the constraints of the Young-Earth Flood model.

The uniformitarian depositional paleoenvironment of a prograding delta cannot satisfactorily explain the apparent high-energy conditions which were necessary in the formative process of these sandstone and quartz-pebble conglomerates (Froede, in press). Additionally, the millions of years of uniformitarian-style weathering fail to explain the manner in which the rock spires may have formed. Rather, the high-energy nature of the sedimentary deposits speaks of catastrophic processes which would be expected during the global Flood of Genesis (Froede and Wallace, 1999). The formation of the rock spires through cliff-sapping of the incompletely lithified sandstone indicates that short periods of time elapsed between deposition and erosion, this being consistent with the Young-Earth Flood Model.

Acknowledgments

We thank our wives for allowing us the opportunity to conduct field work within this most interesting and beautiful area of Alabama. We thank our Creator for providing so many apparent evidences of a global Flood and young Earth. Psalms 8:1.

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“Is the goal of science to better understand the physical and life processes present today, or is it to put together dogma concerning the origins of the universe and man? The former is a legitimate use of scientific theory; the later is the use of theories to form a religion, since there is no way to show whether the theories are right. The best that can be done is to prove they are logical.”

This quotation of Jerry Thouson, *Chemical and Engineering News*, October 1984 was used by Frederic B. Jueneman, *Research and Development*, December. 1984, p. 17. Jueneman's source for the quotation was *Chemical and Engineering News*, October 1984, where Jerry Thouson was discussing the inflationary universe theory as described in the May 1984 issue of *The Scientific America* article titled, “The Inflationary Universe.”

Fossil Man

This is a brief note on the present position of the fossil record of man and of the non-human primates that play a part in the overall story of human origins. The skulls of Steinheim and Swanscombe are dated on the evolution scale at about 300,000 years (Gore, 1997, p.105). There are new discoveries in Spain of *Homo sapiens* reckoned to be equally ancient (Arsuaga, Martinez, Gracia, Carretera, and Carbonell, 1993). If we allow a history of about 50,000 years, we come to an overall age of 350,000 years. But at this point we can introduce the oldest spears as dating from 380,000 to 400,000 years ago, which left one author (Denell, 1997) speechless! Those spears can be seen in wonderful color on p.113 in *National Geographic* of July, 1997. The article shows what fine spears they really were. At present, spears are known to accompany remains of *Homo sapiens* only.

Homo erectus in the form of Peking Man is found at 500,000 years (Leakey, 1981, p.123). It can be seen from those dates that the gap between *sapiens* and *erectus* is closing and the shared features of elongated skulls and robust brow ridges could make these types of men the original. Certainly if one were to have the out-of-Africa model correct (i.e. man from one common origin) and if modern man came from *sapiens* with those elongated skulls, then the skulls at 300,000 years and the spears at 400,000 years would have to come out of Africa with *sapiens* around 400,000 to 500,000 years to give them time to travel the distances they did. At these times there is nothing in Africa that is modern enough to give rise to *sapiens*. Therefore, I, for one, dismiss all credibility of such evolutionary arguments.

A skull found in South Africa in Florisbad and dated at 260,000 years, however, has features that are close to modern man (Gore, 1997, p.99). Give this a history of its own and there would be even less time between the skulls at 300,000 years and this one at 260,000 years. Work by Dr. Rosalind Harding of Oxford University has traced back a gene found in Oxfordshire villagers to between 200,000 years and 400,000 years, but claims it originated in Asia. For a *sapiens* to have done this, however, an earlier time in Africa would be needed than the present timetable allows. It would be more akin to the dates mentioned in this paper and the question of who was the original man would still be raised. The date for Dr. Harding's gene is of course not looked at with great favor by those holding to the present timetable, but we must await further discoveries with interest (Connor, 1997, pp. 4–5).

To add another very interesting angle to the above picture, a skull from Petralona in Greece does not yet have an established date to everyone's satisfaction. When Aris Poulanos (after many years of work in that and other areas)

gave it a date of 700,000 years (Poulanos, 1981, pp. 287–288) there was no great support for such a view. The skull may have been seen to be too advanced for this date for the good of the theory of evolution, though of course, not for creation. If we are to view this to be case then to have skulls like Steinheim, Swanscombe, or the skulls from Spain at 700,000 years; or for these skulls even up to 600,000 years would be unwelcome. To discover *sapiens* fossils or their artifacts from 300,000 years to 500,000 years would present insurmountable problems for evolution within this period. Both fossils and their artifacts are up to 400,000 years. With a history, this could very well be brought up to 500,000 years. To discover *sapiens* from 500,000 years to 550,000 years, however, would rule out evolution. In particular if we are to reject the 700,000 year date for the skull from Petralona (which I believe to be a form of *sapiens* anyway from 700,000 years) we would also reject those from Steinheim and Swanscombe from 700,000 years and from 600,000 years. Then evolution would simply have run out of reasonable time within this picture of the fossil record. We await further fossil discoveries with interest.

Homo erectus is dated at 1.8 million years out of Africa (Gore, 1997) and therefore it seems likely that it was dated at least 1.9 million years inside the continent of Africa. That would then place it alongside the time of skulls such as KNMER 1470, which means that no evolution took place within the *erectus* group from about 2 million years. Therefore, we can wonder if any such evolution occurred at all! If *erectus* remains are found at 2.1 or 2.2 million years of age, then that would begin to remove them from any other line such as the less advanced australopithecines. If *erectus* remains were discovered 2.5 million years ago that would deal the final blow because *erectus* would then be fitted in the time frame of the more primitive australopithecines. That would still leave open the question of whether the original men had elongated skulls or heads like our own. Footprints in the Laetolil beds (Leakey and Hay, 1979) dated as being the same time as Lucy could either belong to human beings needing no further evolution or they could belong to australopithecines. The evidence of their ability to walk could have been the result of direct creation or by way of their genetic potential. For further reading of this view see Brown, 1987 and 1996.

In the same item by Aris Poulanos (1981) on p.288 is an amazing discovery. In layers of rock dating between 2,900,000 and 3,300,000 years are both stone and bone tools. These tools had been found in the rib cage of a fossil elephant. There are no records of any remains of *Australopithecus* fossils outside of Africa and so if we take the ages given in the paper and conclude that either *sapiens* or *erectus*

tus used these tools, this would be another devastating blow to the theory of human evolution. These would be at the start of a history for the australopithecines and so the australopithecines would not be able to have given rise to either *sapiens* or *erectus* forms. Even if we moved the dates forward to 2.5 million years or thereabouts, that would still put evolution in trouble because at those dates *sapiens* or *erectus* would be contemporaneous with the best australopithecines. The fact that those most ancient dates have been no longer heard, we can safely conclude that they have been abandoned.

We can only wonder about the large number of times we may have witnessed serious dating problems with the theory of evolution. This is one more demonstration of the fact that evolutionists try to make macroevolution an unfalsifiable theory. I believe it is possible that one day a certain embarrassing fossil will be discovered such that the moving of its age or status will make no significant difference. It will by its very presence prove to be the downfall of the evolutionary theory.

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Book Review

Seduced by Science by Steven Goldberg
 New York University Press, New York. 1999, 230 pages, \$28

Steven Goldberg is a law professor at Georgetown University, Washington D.C. He is also the son of a physicist and he understands the limitations of science. Goldberg's theme is that religion has trivialized itself by seeking scientific credibility. On some topics the author is entirely correct. For example, he challenges the popularity of medical "prayer tests." Several double-blind tests have shown that heart patients who are prayed for have a better rate of recovery than those who are distinctly *not* prayed for. Goldberg suggests that such tests reduce prayer to just another optional form of medicine. Prayer is certainly effective, but limiting it to a comparative scientific test is an affront to God.

Goldberg also discusses creation science, but his bias shows. His main sources include critics Ronald Numbers, Christopher Tourney and Dorothy Nelkin. He takes the discredited position that religion is limited to the *why* questions, not the *how* or *when* questions of history. Goldberg

does not think science or history details should be sought from Scripture (p.26). And this is from a Jewish scholar who surely knows the Old Testament well.

Goldberg discusses genetic engineering, and also the separation of church and state. His comments on prayer in public schools are pertinent: A mandated law could quickly reduce prayer to innocuous words, or to a mere formula (p. 86).

The author's motive is to elevate religion above the shifting sands of scientific knowledge. *CRSQ* readers would agree, but would caution Goldberg not to neglect the book of Genesis, the foundation of all true religion and science.

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Letters to the Editor

Strung Out on String Theory

According to an article in the *Los Angeles Times* (November 16, 1999), string theory would “Reshape fundamental notions of space and time, energy and matter, expanding the number of dimensions to 11” (p. A22). The author of the article, *Times* Science Writer K.C. Cole, quotes Nathan Seiberg of the Institute for Advanced Study in Princeton as saying, “I am almost certain that space and time are illusions” (p. A1). Cole goes on to say,

String theory offers a universe bizarre beyond imagining: Under powerful enough magnification, every known particle in the universe would resemble a complex origami folded out of sheets or strings of the three familiar spatial dimensions, plus one dimension of time, plus seven extra dimensions of space (p. A22).

Cole quotes David Gross, director of the Institute for Theoretical Physics at UC Santa Barbara, who said that the idea that space and time might be illusions “is very disturbing. Where are we? When are we?” (p. A22). To this Cole responds,

The almost unfathomable scenario of a universe without space and time in turn calls into question the very connection between cause and effect. If time can break down, how can one event be placed clearly “before” or “after” another? (p. A22)

This “string theory” could make the whole creation/evolution controversy have no meaning. If space and time are but illusions, then evolutionists could claim infinite time for accomplishing evolution. If creationists were to point to fossils that are out of place or in the wrong time sequence, the evolutionist could merely point to the “string theory” for answers.

What does the creationist physicist say to all this? What can any creationist say?

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String Theory and Nonsense A Reply to Lillo

Clifford Lillo has pointed out the nonsensical journalism which can result when we try to reduce particle physics into newspaper articles. I will try to the best of my ability, and within the constraints of a short letter, to explain the real situation.

Extra dimensions, over and above the usual four spacetime dimensions, entered physics soon after Einstein’s general theory of relativity was introduced. One

who has studied the mathematics of general relativity notices how beautiful the explanation of gravitational phenomena becomes in this theory. Hence, it is desirable to include the mathematics of electricity and magnetism in the same framework. To achieve this goal, Theodor von Kaluza introduced a fifth dimension into Einstein’s theory in the early 1920’s, and his theory was extended by Oskar Klein in 1926. The mathematics of relativity involves something called the metric tensor, a doubly-subscripted quantity with the subscripts running, say, from one to four. Introducing the fifth dimension means the subscripts run from one to five, and the metric tensor has five times five or 25 components instead of 16. These extra components enable electric and magnetic fields to be included besides the usual gravitational fields. A remarkable result of the Kaluza-Klein theory is that the relativity equations for the extra electric and magnetic field components are completely equivalent to the equations of electricity and magnetism developed by James Clerk Maxwell in the 1800’s.

Physics has grown over the years, and we are striving to find a unified theory to explain all the types of force, now including gravitational, electrical, magnetic, weak nuclear, strong nuclear forces under one umbrella. Modern string theory seeks to find the “vacuum” state that corresponds to the real world. Such a state would reproduce the particle spectrum, masses, and coupling constants of standard particle physics. It would also determine the correct “cosmological constant” and explain the expansion of the universe as a function of time. Specialists in modern superstring theory are at present producing new facets of the theory at a very fast pace, and it is hoped that the unified theory will soon be forthcoming. Meanwhile there remain challenges such as explaining whether or not there is a small probability for proton decay, smaller than present experimental limits.

In recent years the conventional wisdom that claimed that the extra dimensions were all “rolled up” to a very small size, smaller than an elementary particle, has been challenged. I attempt to deal with the meaning of the “rolled up” dimensions in a paper which has been submitted to the *Quarterly* for publication. There are at least three different ways in which the extra dimensions might not be small. One idea is that all the extra dimensions are felt by all of the particles and forces of nature. According to this concept the Large Hadron Collider (LHC) being planned for completion in Europe in a few years will display some new physics that was not originally foreseen. The extra dimensions are not compacted as small as thought (Antoniadis and Pioline, 1999). A second idea is that there may be extra dimensions that are felt only by the

gravitational force (Dienes, Dudas, Gherghetta, and Riotto, 1998), with the other types of force constrained to what is called a "brane." A third idea also has the particles and forces other than gravity confined to a four-dimensional subspace, a "3-brane," but the subspace is within a $(4+n)$ -dimensional spacetime (Randall and Sundrum, 1999a, b; Schewe, 1999), thus there is no "compactification."

I was able to obtain a copy of the *Los Angeles Times* article on the internet (Cole, 1999), since the *Times* happened to be offering free access at the time I went to their web page.

The article does quote a physicist as saying that space and time are illusions. However, it is very difficult to state in words what the mathematics is really describing. Also, in my opinion these new discoveries will not negate basic logic. They may not, in my opinion, necessarily lead to problems for the creationist viewpoint. In fact, in my paper which I mentioned, these ideas are used to explain some radioisotope data in a satisfying fashion.

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String Theory Only a Model

It should be remembered that string theory has been developed thus far with zero experimental evidence. It is a *model* of reality, not reality itself. Only God knows whether there are seven dimensions to space, or perhaps seventy times seven.

If subatomic strings are real, they do not alter the history of the earth. A measurable elasticity of time is limited to objects experiencing either relativistic speed or intense gravity. Neither situation exists in our region of space.

For a half-century, relativity theory and experiments have shown that time can be slightly stretched or contracted. This variation is always sufficiently small to not af-

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fect the human passage of time. Although science fiction runs wild with the idea of time travel, the Creator has clearly protected us from macroscopic time variation. In a similar way, we are spared from noticing the stroboscopic, microscopic world of quantum mechanics.

Creationists have a special interest in cosmic string theory. It is yet another possible layer of created complexity, but certainly not the ultimate building block of nature. This side of heaven, in spite of scientific pronouncements, we are not about to correctly determine the *theory of everything*.

Don DeYoung

The Present Position of Birds and Feathered Dinosaurs

In terms of fossil discoveries, China seems certainly the place to be these days. Discoveries of birds and feathered dinosaurs which were dated at 140 myrs and now are dated at 124 myrs are being it seems continually discovered. *Liaoningornis* is a bird that possessed a well developed sternum and a keel which is the oldest known keel found in a true bird. It also had a capacious and strengthened ribcage, all of which implies the existence of air sacs. This creature also had teeth and it is said a primitive jaw (Shipman, 1997). *Con fuciusornis* differed significantly from its con-

temporary *Liaoningornis*. *Con fuciusornis* had no keel, but did have the oldest known bill and it also had feathers and fused tail bones known as the pygostyle and each foot had a backward pointing toe and curved claws for perching (Haihou, Xhou, Martin and Feduccia, 1995).

From about the same age if not older come two other bird fossils with a number of modern features including the ability to fly up from the ground. One is called *Sinornis* (Serenio and Rao, 1992) and the other is called *Cathayornis* (Zhou, Jin, Zhang, 1992). Moving away from

China for a moment to Spain, we have a young bird caught in amber and dated at 135 myrs which *has* modern wings and its bones had microscopic pits like those of modern juvenile birds and is the oldest known nesting bird, which although not mentioned it is likely to have had a keel for flight which if so would go one better than *Liaoningornis* in being the oldest bird to possess a keel (Ackerman, 1998). Also from Spain mentioned by Shipman in the same item is a sparrow-sized bird from Cuenca province dated between 120 myrs to 130 myrs old. *Eolulavis* from Las Hoyas in central Spain is dated at 115 myrs old. This bird had a sternum and keel and many other modern features, but also had claws on its wings. Its size was that of a goldfinch.

In returning to China we now encounter the feathered dinosaurs. Most if not all of these following creatures have feathers but are not in a fit state for flight and have for the most part features that are purely dinosaurian. They are *Protarchaeopteryx* and *Caudipteryx* (see references section for this under N. China Dinos and Brown, 1999). There is an even more recent discovery which it is said shows some avian-like features, but we must wait and see before we make any hurried opinions. The name given to this one is *Archaeoraptor liaoningensis* (Sloan, 1999). As things stand, the overall facts are more in line with what I have called the shared themes model (Brown, 1996). In this view God either created all the features mentioned in these creatures or He created some of them while others came about by way of the organism's genetic potential. The birds mentioned here are so different in their collective features from each other and most certainly from the feathered dinosaurs that any direct connections is just not possible and their ages for the most part are all too close together for comfort to make any sense of their relationship. There is one other thing which many have tried to forget and bury and this is the fossil of what some have called *Protoavis*. This fossil was dated at 225 myrs old. This is some 78 myrs before *Archaeopteryx* and before all or most of the dinosaurs favored by paleontologists of going into *Archaeopteryx*. This creature has been said by some to possess a

number of advanced avian features one of which is a keel which implies it could fly (Brown, 1987). If this fossil proves true it would spell much trouble if not the end of the dinosaur-bird connection. We await further discoveries from China and elsewhere, but at the moment, the way things stand, the shared themes model stands in good stead.

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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.